

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. AND SAMSUNG ELECTRONICS
AMERICA, INC.,
Petitioner,

v.

GENGHISCOMM HOLDINGS LLC,
Patent Owner

Case: IPR2025-00780
U.S. Patent No. 9,768,842

**DECLARATION OF HARRY V. BIMS, PH.D. IN SUPPORT
OF PETITION FOR *INTER PARTES* REVIEW**

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TABLE OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 9,768,842 (“’842 Patent”)
1002	Declaration of Harry Bims, Ph.D.
1003	Angela Doufexi, et al., <i>Design Considerations and Initial Physical Layer Performance Results for a Space Time Coded OFDM 4G Cellular Network</i> , In The 13th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (Vol. 1, pp. 192-196). IEEE (Sept. 18, 2002) (“Doufexi”).
1004	Dirk Galda & Hermann Rohling, <i>A Low Complexity Transmitter Structure for OFDM-FDMA Uplink Systems</i> , Vehicular Technology Conference. IEEE 55 th Vehicular Technology Conference, vol. 4, pp.1737-1741 (May 6, 2002) (“Galda”).
1005	Stefan Kaiser, <i>Multi-Carrier CDMA Mobile Radio Systems – Analysis and Optimization of Detection, Decoding, and Channel Estimation</i> , VDI-Verlag, Dusseldorf, Germany (Jan. 1998) (ISBN 3-18-353110-0) (“Kaiser”)
1006	Lucent Technologies, <i>Proposed Baseline OFDM Systems for Study</i> , 3GPP TSG-RAN1 #28 bis, R1-02-01246 (Oct. 8-9, 2002) (“Lucent”).
1007	Andres Bury & Jurgen Linder, <i>Comparison of Amplitude Distributions for Hadamard Spreading and Fourier Spreading in Multi-Carrier Code Division Multiplexing</i> , Globecom ’00-IEEE. Global Telecommunications Conference, Vol. 2, pp.857-860 (Nov. 27, 2000) (“Bury”)
1008	Kwang-Cheng Chen, et al., <i>A Programmable Architecture for OFDM-CDMA</i> , IEEE Communications Magazine, pp.76-82 (Nov. 1999) (“Chen”)
1009	José Francia, <i>Proposal for an OFDM-based 802.16.3 Air Interface Physical Layer</i> , IEEE 802.16.3c-00/44 (Oct. 30, 2000)

Exhibit No.	Description
1010	John Langley, <i>PHY Layer System Proposal for Sub 11 GHz BWA Having SC-FDE and OFDM Modules</i> , IEEE802.16.3c-01/31r2 (Mar. 12, 2001).
1011	U.S. Patent Application Publication No. 2003/0081538 to Walton et al.
1012	Declaration of Sylvia Hall-Ellis, Ph.D.
1013	Hermann Rohling, et al., <i>Broad-Band OFDM Radio Transmission for Multimedia Applications</i> , Proceedings of the IEEE, Vol. 87, No. 10, Oct. 1999 (“Rohling”)
1014	Stephen B. Weinstein, <i>The History of Orthogonal Frequency-Division Multiplexing</i> , IEEE Communications Magazine, pp.26-35 (Nov. 2009).
1015	Richard van Nee & Ramjee Prasad, <i>OFDM for Wireless Multimedia Communications</i> (Artech House 2000).
1016	Karsten Bruninghaus & Herman Rohling, <i>Multi-carrier spread spectrum and its relationship to single-carrier transmission</i> , Vehicular Technology Conference. IEEE 48 th Vehicular Technology Conference, vol. 3, pp.2329-2332 (May 18-21, 1998) (“Brüninghaus”)
1017	RESERVED
1018	File History of U.S. Patent Application No. 15/283,881 as obtained from Patent Center (excerpts)
1019	File History of U.S. Patent Application No. 14/967,633 as obtained from Patent Center (excerpts)
1020	File History of U.S. Patent Application No. 14/168,466 as obtained from Patent Center.
1021	File History of U.S. Patent Application No. 11/187,107 as obtained from Patent Center (excerpts)
1022	File History of Provisional No. 60/589,187

Exhibit No.	Description
1023	File History of U.S. Patent Application No. 10/145,854 as obtained from Patent Center (excerpts)
1024	RESERVED
1025	RESERVED
1026	RESERVED
1027	RESERVED
1028	RESERVED
1029	RESERVED
1030	RESERVED
1031	RESERVED
1032	RESERVED
1033	RESERVED
1034	RESERVED
1035	3GPP TS 36.306 V8.0.0 (2007-12) (Release 8)
1036	RESERVED
1037	RESERVED
1038	3GPP TS 36.211 V8.8.0 (2009-09) 3 rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 8)
1039	Exhibit 1 to Plaintiff's P.R. 3-1(c) Infringement Contentions (U.S. Pat. No. 9,768,842)
1040	Marco Breiling, et al., <i>Peak-Power Reduction in OFDM without Explicit Side Information</i> , 5 th Int'l OFDM-Workshop 2000 (Hamburg/Germany), Sept. 2000, pp.28-1 to 28-4.
1041	EP 0 734 132 A2 to Kabushiki Taisha Toshiba ("Toshiba")
1042	U.S. Patent No. 6,597,745 to Dowling

Exhibit No.	Description
1043	Gerhard P. Fettweis, et al., <i>A Time Domain View to Multi-Carrier Spread Spectrum</i> , IEEE 6 th Int'l Symposium on Spread-Spectrum & Applications (ISSSTA 2000), (Sept. 6-8, 2000) (pre-print)
1044	Armin Dekorsy & Volker Kuehn, <i>Exploiting Time and Frequency Diversity by Iterative Decoding in OFDM-CDMA Systems</i> , Seamless Interconnection for Universal Services, Global Telecommunications Conference. GLOBECOM'99, Vol. 5, pp.2576-2580 (Dec. 5, 1999)
1045	Volker Kuehn, et al., <i>Channel Coding Aspects in an OFDM-CDMA System</i> , ITG FACHBRICHT, pp.31-36 (Jan. 2000)
1046	Docket Control Order, <i>Genghiscomm Holdings, LLC v. Samsung Elecs., Am., Inc.</i> , No. 2:24-cv-0242-RWS-RSP, Dkt. 25 (Sept. 24, 2024)
1047	Complaint, <i>Genghiscomm Holdings, LLC v. Samsung Elecs., Am., Inc.</i> , No. 2:24-cv-0242-RWS-RSP, Dkt. 1 (Apr. 12, 2024).
1048	RESERVED
1049	RESERVED
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1051	RESERVED
1052	RESERVED
1053	RESERVED
1054	RESERVED
1055	RESERVED
1056	RESERVED
1057	RESERVED
1058	RESERVED
1059	Declaration of Gary Swatzell including Exhibits A-D

Exhibit No.	Description
1060	Guidance on USPTO's rescission of "Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation" (Mar. 24, 2025).
1061	Docket Control Order, <i>Slyde Analytics LLC v. Apple Inc.</i> , No. 2:24-cv-00331-RWS-RSP, Dkt. 46 (E.D. Tex. Sept. 23, 2025)
1062	Docket Control Order, <i>Innomemory, LLC v. Truis Financial Corp.</i> , No. 2:24-cv-00146-RWS-RSP, Dkt. 38 (E.D. Tex. Sept. 24, 2025)
1063	Docket Control Order, <i>Husky Injection Molding Systems Ltd. V. Ningbo Ao Sheng Mold Co., Ltd. D/B/A Aosimi</i> , No. 2:24-cv-00348-RWS-RSP, Dkt. 46 (E.D. Tex. Oct. 21, 2025)
1064	Docket Sheet for <i>Partec Ag, et al v. Microsoft Corporation</i> , No. 2:24-cv-00433 (downloaded Mar. 26, 2024)
1065	Combined asserted patents in <i>Genghiscomm Holdings, LLC v. Samsung Elecs., Am., Inc.</i> , No. 2:24-cv-0242-RWS-RSP, Dkt. 25 (Sept. 24, 2024)
1066	RESERVED
1067	RESERVED
1068	RESERVED
1069	RESERVED
1070	Results of Docket Navigator Search for '842 Patent
1071	The title page, page V, page 14, pages 32-24, pages 130-137, page 140, and page 150 of Kaiser, Stefan. <i>Multi-Carrier CDMA Mobile Radio Systems - Analysis and Optimization of Detection, Decoding, and Channel Estimation</i> . Doctoral Dissertation. Department of Computer Science and Engineering, Technische Universität München. Dusseldorf, Germany: Verein Deutscher Ingenieure (VDI) Verlag, ©1998. Obtained from the University of Mannheim Library in Mannheim Germany.

I, Harry V. Bims, Ph.D., declare as follows:

I. Introduction

1. I am over the age of 21 and am competent to make this declaration.
2. I have been retained on behalf of Petitioner Samsung Electronics Co., Ltd. (“Samsung”) to provide my opinions regarding the validity of certain claims of U.S. Patent No. 9,768,842 (Ex-1001, the “’842 patent”). I submit this declaration based on my personal knowledge and in support of Samsung’s *inter partes* review Petition (the “Petition”) against the ’842 patent.
3. I have been asked to provide my independent analysis of the ’842 patent in light of the materials cited below and my knowledge and experience in this field during the relevant period. I have been asked to consider whether the references cited in the Petition render obvious the invention described by claims 1-4, 7-9, 11, 17-18, 22, 25-26, 28.
4. I am being compensated at my normal hourly rate for my time. My compensation is not contingent in any way on the content of my analysis or the outcome of this proceeding. I am not and never have been an employee or agent of Samsung.
5. My opinions are based on my study, experience, and background discussed below, informed by my extensive experience regarding the subject matter of the ’842 patent and the related prior art. For more than 30 years, since

approximately 1981, I have studied, designed, and worked in the field of telecommunications, including wireless communications. During this period, I have designed and implemented various products involving cellular communication technology.

II. Qualifications

6. My findings are also based on my education as an electrical engineer. I received a B.S. in Computer and Systems Engineering from Rensselaer Polytechnic Institute in 1985.

7. I received an M.S. in Electrical Engineering in 1988 and a Ph.D. in Electrical Engineering in 1993, both from Stanford University. As a graduate student, I studied the principle of Digital Communications theory, including data modulation and demodulation, signal constellations and lattices, channel estimation, equalization, filtering, precoding, synchronization, and trellis coding.

8. My Ph.D. thesis addressed the application of trellis coding and precoding to a digital modulation system, and was titled “Trellis Coding for Multi-Level, Partial Response Continuous Phase Modulation with Precoding.”

9. After receiving my Ph.D. in 1993, I worked for Glenayre Technologies – Wireless Access Group, where I worked on applications for wireless communication, including inventing, designing, and building a patented two-way pager test system and co-developing a wireless application protocol.

10. In January of 1999, I launched a technology consulting company, Protocomm Systems Inc., which focuses on the development of advanced wireless communications protocols and related software implementations for wireless product companies.

11. From 1999 to 2001, I was also the Director of Software Architecture for Symmetry Communications System. In this position, I was responsible for the software architecture for core SGSN (Serving GPRS Support Node) and GGSN (Gateway GPRS Support Node) products for the GPRS (Generic Packet Radio Services) market. I also held management responsibility for the Firmware, Hardware, Performance, and Systems Engineering Groups.

12. In 2001, I developed a business plan for building network infrastructure for Institute of Electrical and Electronics Engineers (“IEEE”) 802.11 standard (“Wi-Fi”) enterprise networks, and then later that year founded AirFlow Networks, Inc. where I invented and received eleven patents on a distributed antenna system design for wireless networks, based on the 802.11 wireless local area network specification.

13. I am currently the President of Protocomm Systems, LLC and Bims Laboratories, LLC, both of which I founded. As the President of Bims Laboratories, I perform technical research in wireless technology standards, such as UMTS, LTE/4G, 5G, Wi-Fi, Bluetooth, and other network communication protocols. I am named as an inventor of twenty-three telecommunications related patents.

14. In addition, I am a named Technical Expert and former Vice-Chair and Secretary of the IEEE 802.16 Working Group, which develops technical standards for the wireless protocol commonly known as WiMax. I am also a voting member of the IEEE 802.11 Working Group (which develops technical standards for WiFi), and the IEEE 802.15 Working Group (which develops standards for a variety of specialty wireless networks). Within the IEEE 802.15 Working Group, I am the technical editor for IEEE 802.16t, an amendment to the WiMAX standard that supports long-range wireless networks for the railroad industry. Within the IEEE 802.11 Working Group, I routinely participate and vote on discussions relating to the design of wireless communications, including packet prioritization, transmission, acknowledgment, and retransmission.

15. Attached as Appendix A is my curriculum vitae, which includes a more detailed statement of my professional qualifications, including education, publications, honors and awards, professional activities, consulting engagements, and other relevant experience.

III. Materials Considered

16. As described in more detail below, based on my experiences, I understand and know the capabilities of a person of ordinary skill in the art of the '842 patent in 2002, when the application to which the '842 patent claims priority was filed. I have relevant personal knowledge and experience, in addition to working

directly with many such persons in these fields during that time frame.

17. I have also relied on my review and analysis of the prior art cited in the Petition, information provided to me in connection with this case, and information I have independently reviewed.

18. In forming my opinions, I have been asked to review the '842 patent including the specification and claims 1-4, 7-9, 11, 17-18, 22, 25-26, 28 (the "Challenged Claims"). I have also considered the materials cited herein, including those itemized in the Table of Exhibits that precedes this declaration.

19. My opinions are based on the materials I reviewed and my knowledge and professional judgment. My opinions have also been guided by my understanding of how a person of ordinary skill in the art would have understood the claims of the '842 patent in the relevant time frame.

20. I also understand from counsel that the prior art references cited herein qualify as prior art under U.S. law.

21. In my analysis below, emphasis in my citations has been added unless otherwise noted. Likewise, annotations to images and figures (typically highlighting of various colors) has been added unless otherwise noted.

22. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

IV. Legal Standards

23. I am not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioner, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. In preparing this declaration, I have tried to faithfully apply these legal standards to the challenged claims.

24. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can “anticipate” a claim. Second, I have been informed that the prior art can render a claim “obvious” to a person of ordinary skill in the art. I understand that a claim is patentable if it was not anticipated and would not have been obvious by the prior art at the effective filing date of the patent. In this declaration, I only address obviousness.

25. I have been informed that a dependent claim is a patent claim that refers back to another patent claim. I have been informed that a dependent claim includes all of the limitations of the claim to which it refers.

26. I have been asked to provide my opinions as to whether the cited prior art renders obvious claims 1-4, 7-9, 11, 17-18, 22, 25-26, 28 of the '842 patent from the perspective of a person of ordinary skill in the art at the '842 patent's earliest

possible effective filing date in 2002, as described in more detail below.

27. I have been informed that in *inter partes* review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means “more likely than not.”

28. For purposes of this declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions.

A. Level of Ordinary Skill

29. I understand that my assessment of the claims of the '842 patent must be undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the '842 patent on its priority date and in light of the specification and file history of the '842 patent. I will refer to such a person as a “POSITA.”

30. I understand that my analysis and opinions expressed in this declaration must be rendered based on the perspective of a POSITA as of the priority date of the '842 patent. I also understand that a POSITA is a hypothetical person who is presumed to know the relevant art at the time of the alleged invention claimed in the '842 patent.

31. I further understand that in determining the level of ordinary skill in the

art, I am to consider factors including:

- the type of problems encountered in the art or field of invention,
- prior art solutions to those problems,
- the rapidity with which innovations are made,
- sophistication of the technology, and
- the educational level of active workers in the field.

32. I have been instructed to assume a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

33. I understand that a POSITA is a person of ordinary creativity, but not an automaton, and that a POSITA can often fit multiple patents or prior art references together like pieces of a puzzle as a result of this ordinary creativity. I also understand that I may consider the inferences and creative steps that a POSITA would employ. In addition, I understand that a POSITA would necessarily have been capable of understanding the scientific and engineering principles applicable to the pertinent art. I also understand that when I consider what would have been obvious to a POSITA, I am not considering what would have been obvious to me at the time, nor to the inventors, judges, laymen, those skilled in other arts, or to geniuses in the art.

B. Prior Art

34. I have been advised and understand that the information used to

evaluate whether an invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes patents and printed publications that existed before the earliest claimed priority date or the earliest filing date of the patent (which I have been informed is also called the “effective filing date”).

35. I have been informed and understand that a patent or published patent application is prior art if it was filed before the effective filing date of the claimed invention.

36. I have also been informed and understand that a printed publication is prior art if it was publicly available before the earliest filing date and could be located by a POSITA exercising reasonable diligence.

C. Anticipation

37. I understand that a patent is invalid as anticipated if each and every feature of the claim is found, expressly or inherently, in a single item of prior art. I understand that anticipation by inherent disclosure is appropriate only when a prior art reference necessarily includes or discloses the unstated claim element. I also understand that the discovery of a new or previously unreported or unappreciated property of a prior art composition, or of a scientific explanation for how a prior art composition operates, does not make the prior art composition patentably new to the entity or person that discovered the new property or mode of operation. I further

understand that there is no requirement that a POSITA would have recognized the inherent disclosure at the time of the invention.

38. For anticipation by a prior art publication or document, I understand that the reference's description must enable a POSITA to practice the claimed invention without undue experimentation.

D. Obviousness

39. I understand that a claim may be invalid if the subject matter described by the claim as a whole would have been obvious to a POSITA in view of a prior art reference, or in view of a combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a POSITA, and that the asserted claims of the patent should be read from the point of view of such a person at the time the claimed invention was made. I further understand that a POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit and all analogous prior art. I understand that obviousness in an *inter partes* review proceeding is evaluated using a preponderance of the evidence standard, which means that the claims must be more likely obvious than nonobvious.

40. I also understand that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the

level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole. I understand that in considering whether an invention for a claimed combination would have been obvious, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a POSITA. I also understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a POSITA can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a POSITA would have recognized 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;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;

- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a POSITA will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A POSITA is also a person of ordinary creativity, not an automaton;
- A patent claim can be proved obvious by showing that the claimed combination of elements was "obvious to try," particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a POSITA would have had good reason to pursue the known options within his or her technical grasp; and
- One should be cautious of using hindsight in evaluating whether a claimed invention would have been obvious.

41. I have been informed that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention. For my obviousness analysis, counsel for Petitioner instructed me to assume that the effective filing date is in 2002, and that I should assume this is the date of invention for the Challenged Claims. My opinions would not change if I assumed a later date of invention.

V. Claim Construction

42. I understand that claim terms in an IPR are generally interpreted according to their ordinary and customary meaning. I further understand that the

claims are read in light of the patent's specification and that claims themselves often provide significant guidance as to the meaning of a particular term. I also understand that extrinsic evidence may be helpful when construing a claim term, but that it is less relevant than the intrinsic evidence and is often unreliable.

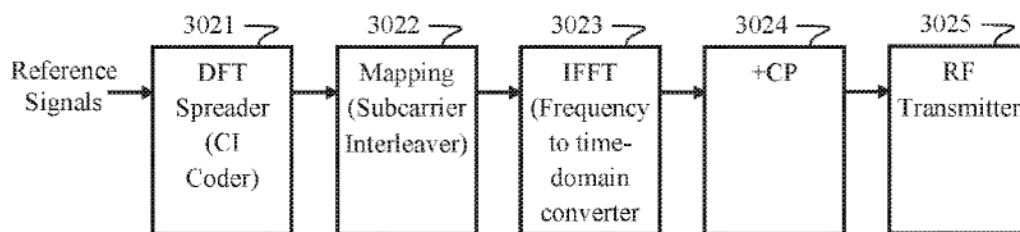
43. The prior art discussed herein would disclose the Challenged Claims under any reasonable constructions, and thus, I believe no formal claim constructions are required.

VI. The '842 Patent

A. General Overview and Background Concepts

44. The Challenged Claims addressed herein relate to an OFDM transmitter. The transmitter has a Discrete Fourier Transform ("DFT") spreader, a mapper for mapping DFT-spread symbols to OFDM subcarriers, and an OFDM modulator to modulate the DFT-spread data symbols onto the OFDM subcarriers. EX1001, Abstract, 8:57-9:1, 70:56-63, 77:7-18, FIG. 30A.

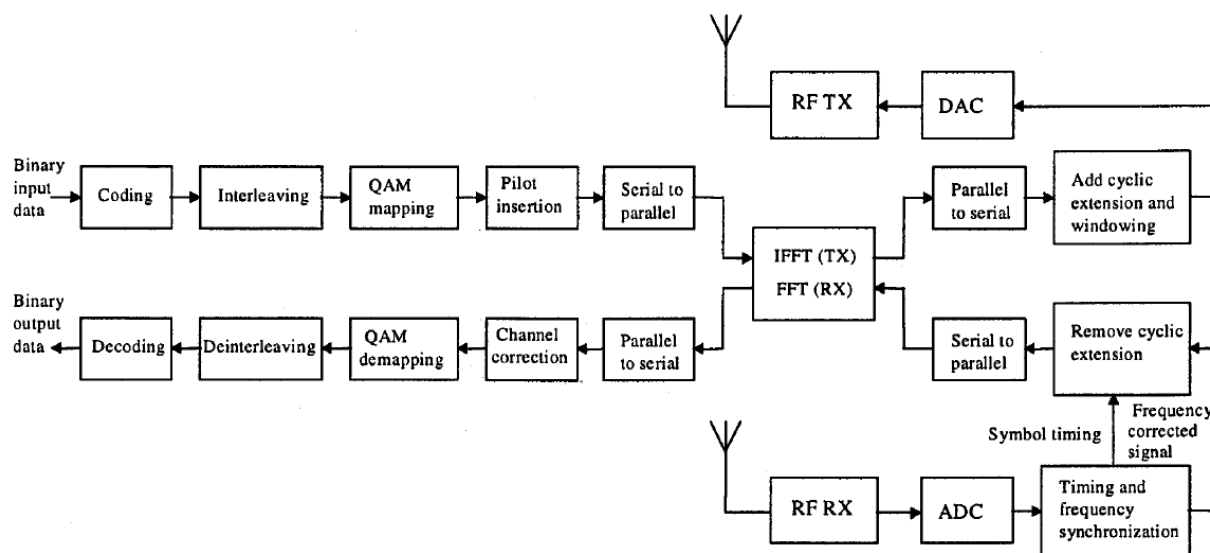
45. FIG. 30 of the '842 patent provides a block diagram example of an OFDM transmitter:



EX1001, FIG. 30A.

46. The '842 patent and the claims at issue herein relate to systems and methods that implement conventional DFT spreading and OFDM modulation in wireless communications. "OFDM" refers to "orthogonal frequency division multiplexing" in wireless communications, which has been well known to skilled artisans for more than 50 years. *See, e.g.,* EX1014-Weinstein, 26-28; EX1015-Prasad, 20-24.

47. For example, EX1015 is a 2000 textbook that provides an example OFDM transceiver block diagram below:



EX1015-Prasad, 48.

48. As shown above, an OFDM signal is formed at the transmitter using an inverse discrete Fourier transform (often abbreviated "IDFT" in the art), which is typically implemented as an inverse fast Fourier transform ("IFFT"). EX1015-Prasad, 42, 47-48.

49. The transceiver above also illustrates the addition of a guard interval including a cyclic prefix, which is a conventional technique used to minimize inter-symbol interference (“ISI”) and inter-carrier interference (“ICI”). EX1015-Prasad, 39-40.

50. It was also well known that OFDM systems can suffer from high peak-to-average power ratios (“PAPR” or “PAR”). EX1013-Rohling, 1780; EX1014-Weinstein, 31-32. The ’842 patent purports to reduce PAPR in OFDM systems by spreading input data using complex-valued codes obtained from a discrete Fourier transform (“DFT”). EX1001, Abstract, 8:64-9:1.

51. This, too, was conventional. Specifically, it was well known to persons of ordinary skill in that art (“POSITAs”) that OFDM systems exhibited high PAPR, and techniques for reducing that high PAPR were known in the technical literature, including some of the references relied on herein. Indeed, various publications described using DFT spreading codes to reduce PAPR in OFDM systems years before the earliest claimed effective filing date of the ’842 patent (as discussed below, that date is May 14, 2002).

52. For example, in 1998, Brüninghaus (EX1016) observed that when an “FFT matrix” is used “as a spreading matrix for OFDM-CDM” signals, this “leads to a single-carrier system with guard interval.” EX1016-Bruninghaus, 2332.

53. Similarly, in 2000, Bury (EX1007) explains that “Fourier spreading”

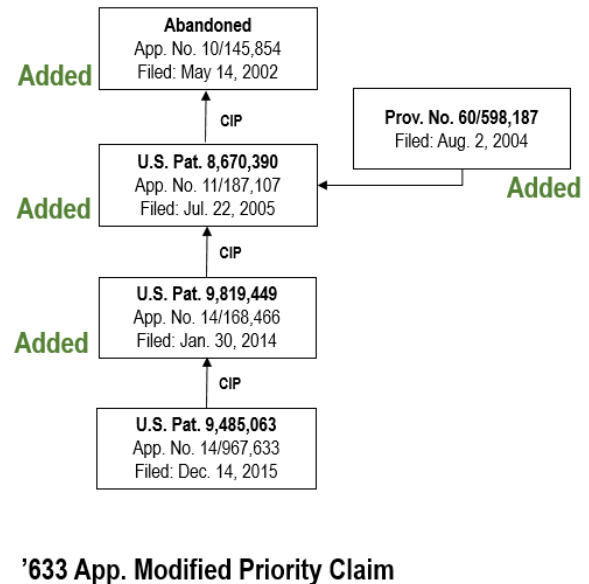
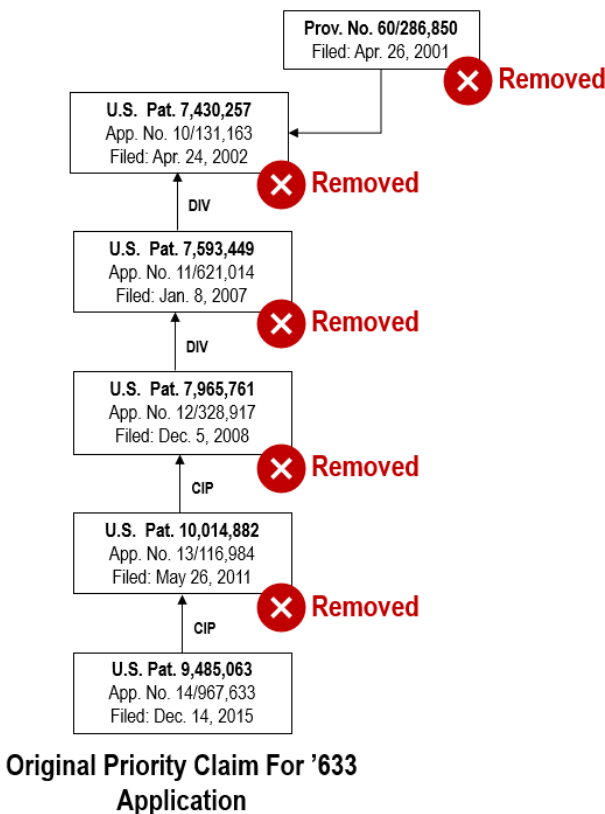
can be “implemented by a discrete Fourier transform (DFT) operation” and the resulting transmission can have a “much lower” PAPR. EX1007-Bury, 857.

54. And by 2002, Galda (EX1004) had built on Bruninghaus’s work to show “how an OFDM-FDMA uplink system can be combined with a user data spreading technique based on the DFT spreading matrix to reduce the PAR of the uplink signal without increasing the computational complexity of the transmitter.” EX1004-Galda, 1738; *id.* at 1741 (identifying reference [3] as the Bruninghaus reference, EX016 herein).

B. Prosecution History and Effective Filing Date

55. I understand that Petitioner contends the ’842 patent is not entitled to an effective filing date before December 14, 2015. I provide a very brief background on the prosecution history below, as it relates to this issue.

56. First, I note that the application for the ’842 patent was filed on October 17, 2016. EX1001, cover. That application claims priority to the ’633 Application, which originally claimed priority to one chain of applications and was amended to claim priority to another set of applications, as shown below:



EX1019, 31, 38-39, 202-03.

57. I understand that the '854 Application describes “wireless transceivers that implement Carrier Interferometry (CI) and/or CI-based coding.” EX1023, 227. However, the '107 Application (which claims priority directly to the '854 Application) describes different subject matter that relates to “providing cooperative signal processing between a plurality of wireless terminal devices ... to improve network access.” EX1021, 99. The '107 Application further “relates generally to antenna-array processing and ad-hoc networking.” EX1021, 1. These are different inventions. The use of different spreading codes for multiplexing and multiple access (which is not an antenna technology as described in the '854 Application) is different

technology than the use of multiple antennas for beam-forming and ad-hoc networking (which is an antenna technology as described in the '107 Application).

58. To be entitled to the effective filing date of the '854 Application, I understand that each application in the chain must disclose the subject matter of the invention. Here, the '107 Application does not do so. In addition, the '107 Application also fails to describe the subject matter claimed in the '842 patent.

59. For example, claim 1 of the '842 patent requires a transmitter with a “spreader,” “a mapper,” and “an OFDM modulator,” which perform specific claimed functions. EX1001, 77:6-18, 77:52-65, 78:33-53. The “spreader” spreads “a plurality of data symbols with Fourier coefficients,” while the “mapper” maps “the DFT-spread data signal to a plurality of OFDM subcarriers.” EX1001, 77:7-11. Method claim 11 requires distinct steps similar to the functions performed by the elements of claim 1: “multiplying a plurality of data symbols by a discrete Fourier Transform (DFT) spreading matrix,” “mapping the plurality of DFT-spread symbols to a plurality of OFDM subcarriers,” and so on. *Id.*, 77:53-57. Claim 22 requires “a set of instructions” that are executable by a computer to perform similar steps yet again: “perform an N-point discrete Fourier transform (DFT) spreading,” “map the N DFT-spread data symbols to at least N subcarriers of a plurality of M of Orthogonal Frequency Division Multiplexing (OFDM) subcarriers,” and so on. *Id.*, 78:35-45. None of these features are described in the '107 Application. Indeed, the

'107 Application never describes a spreader or a mapper for mapping DFT-spread symbols to subcarriers.

60. The '107 Application relates to materially different subject matter than what is claimed in the '842 patent. In fact, the application only includes two references to DFT-spreading, and no disclosure of using a spreader and mapper (or spreading and mapping) together.

61. The '107 Application instead refers to multicarrier spreading codes (e.g., orthogonal DFT or CI codes) and states:

Preferred embodiment of the invention may employ Spread-OFDM, which involves multiplying each data block $s(n)$ by a spreading matrix A:

$$U(n)=As(n)$$

In the case where CI spreading codes are employed, $A_{nm}=exp(-j2\pi nm/N)$. This maps the data symbols to pulse waveforms positioned orthogonally in time. This choice of spreading codes also gives the appearance of reducing the IFFT. However, the resulting set of pulse waveforms is a block, rather than a sequence, wherein each waveform represents a cyclic shift within the block duration T_s , such as described in U.S. Pat. Appl. Pubs. 20030147655 and 20040086027, which are both incorporated by reference.

EX1021, 34, 49.

62. The excerpt above addresses matrix multiplication of spreading codes including the term $exp(-j2\pi nm/N)$, but it does not describe the structure of a spreader

63. The application also says that the multiplication performs the mapping (i.e., “[t]his [multiplying by spreading matrix] maps the data symbols to pulse waveforms”), but no structure is discussed at all.

64. Moreover, the ’107 Application is titled “Cooperative Beam-Forming in Wireless Networks.” EX1021, 7. Its field is “providing cooperative signal processing between a plurality of wireless devices.” EX1021, 7. The Abstract describes “a cooperative array of wireless terminals,” EX1021, 82. And its claims all require “multiple wireless terminals.” EX1021, 76-77.

65. The ’107 Application purports to address a problem that “power, cost, and size constraints typically make the implementation of antenna arrays on mobile wireless terminals ... impractical.” EX1021, 9, 16-17. The alleged invention coordinated among multiple wireless terminals to make them operate as if they were a single antenna array. EX1021, 16. The embodiments are consistent with that idea, in that they utilize multiple wireless terminals operating together to transmit or receive signals. The claims of the ’842 patent differ significantly from that concept, and relate to a transmitter that does not depend on other transmitters. Therefore, they are directed to different subject matter than the ’107 Application.

C. The Challenged Claims

66. The Challenged Claims are claims 1-4, 7-9, 11, 17-18, 22, 25-26, and

28. Claims 1, 11, and 22 are independent.

D. Person of Ordinary Skill in the Art (“POSITA”)

67. A POSITA as of May 14, 2002 (the earliest claimed effective filing date of the ’842 patent) would have had either a Master’s degree in electrical engineering or a related field, or a Bachelor’s degree in electrical engineering or a related field with three years of experience in wireless communication systems, signal processing, and related technologies. A POSITA would have been familiar with the use of Orthogonal Frequency Division Multiplexing (OFDM) and Orthogonal Frequency Division Multiple Access (OFDMA) in evolving wireless communication standards and 3GPP standards. Techniques including discrete Fourier transform (“DFT”) spreading, modulation comprising the use of inverse discrete Fourier transforms (“IDFT”), and cyclic prefix/guard interval insertion would have been well known to a POSITA.

68. A POSITA would have recognized that DFT-spreading was used to reduce peak-to-average power ratio, including as compared to other spreading codes like Walsh-Hadamard codes, as detailed further with respect to the prior art discussed herein.

69. Additional techniques and tools understood by a POSITA are discussed in this Declaration.

70. I also understand and have been informed that Petitioner may contend

that the '842 patent is not entitled to its earliest-claimed effective filing date, and instead has an effective filing date of December 14, 2015. I have been asked for my opinion of whether the level of ordinary skill in the art would be lower or higher as of that date and whether any difference would be material. I believe the education and experience levels of persons having ordinary skill would remain the same, though naturally more prior art would become available, familiar, and known to a POSITA with the passage of time. I do not think that a difference in the filing date would materially impact my opinions as follows unless otherwise noted.

VII. Overview of the Prior Art

71. I understand that the Petition addresses the following grounds:

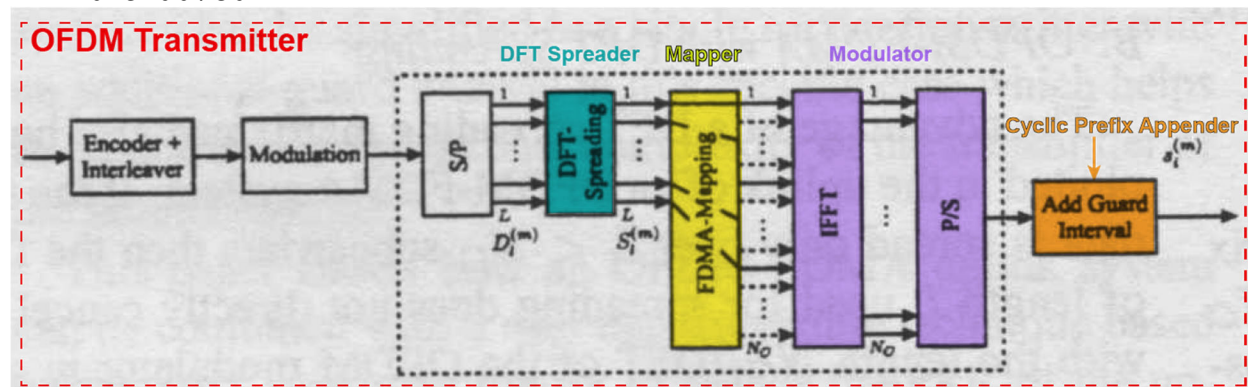
Ground	'842 Patent Claim	Basis
Grounds 1-2	1-3, 7-8, 11, 17-18	Galda
Ground 3	4, 9	Galda in view of Toshiba
Ground 4	22, 25-26, 28	Galda in view of Dowling
Ground 5	1-3, 7-8, 11, 17-18	Kaiser in view of Bury
Ground 6	4, 9	Kaiser in view of Bury and Dowling
Ground 7	22, 25-26, 28	Kaiser in view of Bury and Dowling

72. I provide a brief overview of the prior art references identified in Petitioner's grounds below.

A. Galda (EX1004)

73. Galda is an article published in proceedings for the IEEE's 55th Vehicular Technology Conference. The papers published in these proceedings were available by at least May 6, 2002, as well as during the conference (between May 6 and 9, 2002) for review and purchase. EX1059. In particular, I understand from counsel that the conference proceeding papers were distributed to attendees at the conference, the conference was open to the public, there were no confidentiality restrictions, and the papers were available for review and purchase there as well. I understand this means that Galda qualifies as prior art. I also understand that the Galda reference itself was available in engineering libraries by at least June 26, 2002, as well as available from the IEEE website by at least August 7, 2002. I also understand that Galda was cataloged and categorized by subject matter, including "mobile communication systems." This categorization would have enabled a POSITA interested in wireless communication systems, signal processing, and related technologies to find Galda through reasonably diligent search efforts.

74. Galda discloses an OFDM transmitter that reduces PAPR (PAR) using "OFDM-FDMA multiple access ... combined with a data spreading technique based on a Discrete Fourier Transform spreading matrix using only the user specific subcarriers." EX1004-Galda, 1737. Galda's transmitter is illustrated below.



EX1004-Galda, 1740 (annotated).

75. Galda relates to applying complex-valued codes or “polyphase” codes, which may be “derived from at least one invertible function, such as a Fourier transform” to OFDM signals to reduce PAPR. EX1004, 1737. Thus, Galda is analogous art as compared to the ’842 patent for at least this reason. *See, e.g.*, EX1001, 7:65-8:3, 72:42-43.

76. Galda is also analogous art for the additional reason that the authors were faced with the problem of reducing PAPR in OFDM communications. EX1004-Galda, 1737; *see* EX1001, 8:64-9:1 (OFDM modulator modulates DFT-spread symbols to produce OFDM signal “which can have low peak to average power ratio (PAPR)”); *id.* at 70:9-11, 72:59-66.

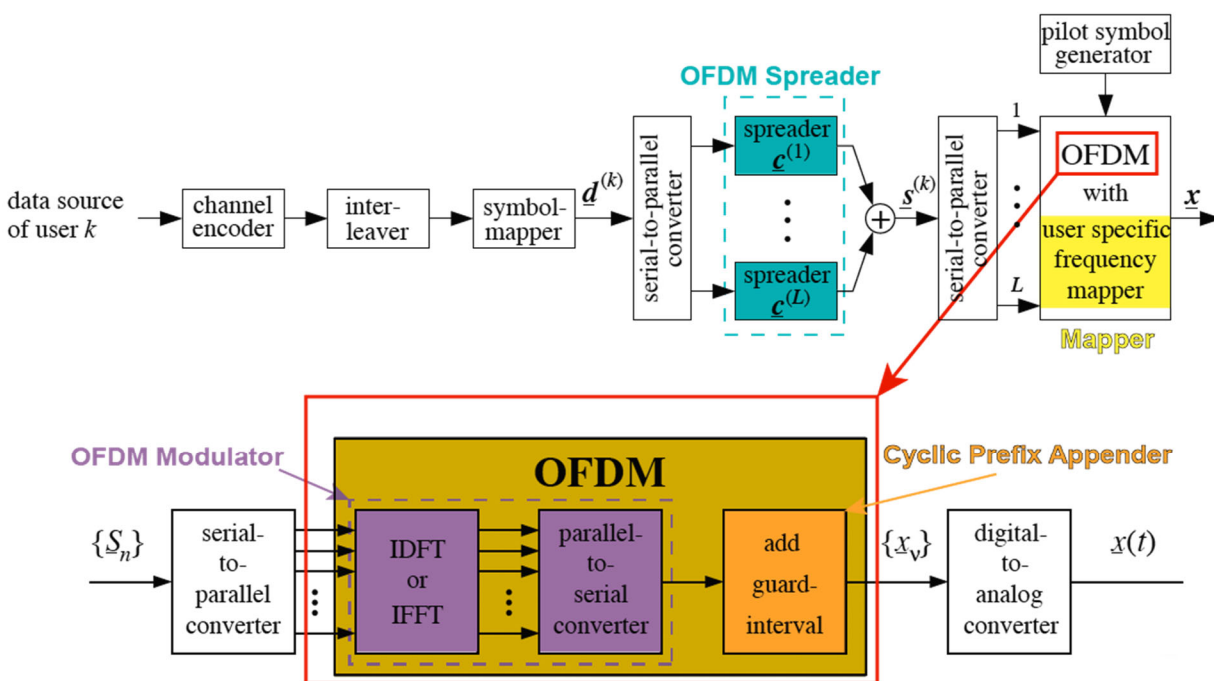
B. Kaiser (EX1005)

77. Kaiser is a Ph.D. thesis authored by Stefan Kaiser titled “*Multi-Carrier CDMA Mobile Radio Systems – Analysis and Optimization of Detection, Decoding, and Channel Estimation,*” issued by the Department of Computer Science and

Engineering at the Technische Universität München (Dusseldorf, Germany), and published by VDI-Verlag, with a January 1998 publication date and publication number ISBN 3-18-353110-0.

78. Kaiser was also cataloged in 1998 by the Bavarian Library Network in its online catalog by at least April 15, 1998 and into the Bibliothèque Scientifique Nationale / National Research Council Library (Ottawa, Ontario, Canada) by at least July 6, 1998. I understand that Kaiser was cataloged by subject matter using terms that a POSITA would have reasonably used to locate Kaiser, including “Bandspreiztechnik”, “CDMA,” “Frequenzdemodulation”, “Mobilfunk”, and “Trägerfrequenztechnik.” I have been informed that these terms are translated from German to English as follows: ““Bandspreiztechnik” means “Band Spreading Technology”, “Frequenzdemodulation” means “Frequency Demodulation”, “Mobilfunk” means “Mobile Radio”, and “Trägerfrequenztechnik” means “Carrier Frequency Technology.” These categorization terms would have enabled a POSITA interested in wireless communication systems, signal processing, and related technologies to find Kaiser through reasonably diligent search efforts. Kaiser was also frequently cited in related literature, which shows that people working in the field at the time located and referred to Kaiser in their related works. EX1043, 4 (reference [14]), EX1044, 6 (reference [2]), EX1045, 6 (reference [4]). I understand from counsel that Kaiser qualifies as prior art.

79. Kaiser discloses an OFDM transmitter comprising an OFDM spreader element (highlighted teal), user-specific frequency mapper (yellow), and OFDM transmission elements including an IDFT/IFFT modulator and parallel to serial converter (both purple), as well as a guard-interval appender (orange):



EX1005-Kaiser, Figs. B.2, 3.2 (annotated).

80. I note that the figure above combines two figures from Kaiser. Figure B-2 discloses an SS-MC-MA transmitter that includes an “OFDM” element, and Figure 3.2 from Chapter 3, §3.1.1 that expands the details of the OFDM element. EX1005-Kaiser, 132 & 34. The figures are depicted together above because Kaiser teaches that the OFDM steps would be applied in the SS-MC-MA transmitter in the

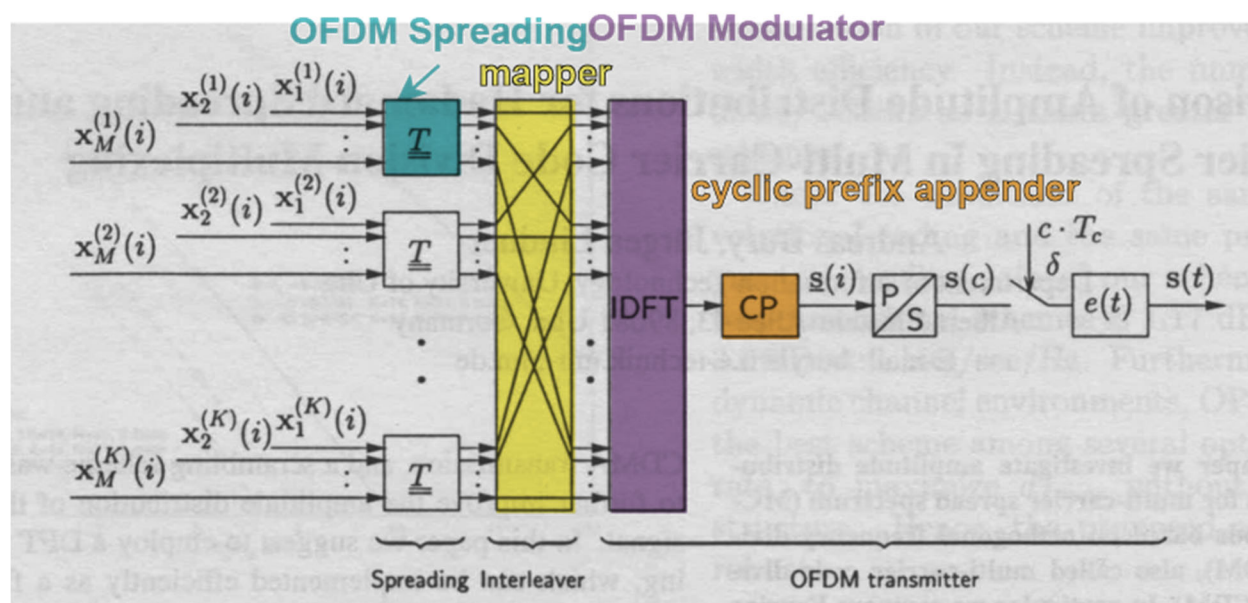
same manner discussed in §3.1.1. EX1005-Kaiser, 133. A POSITA would have been motivated to combine these embodiments and interpret them together as Kaiser further teaches that “OFDM with guard interval is applied in SS-MC-MA systems.” EX1005-Kaiser, 133.

81. Kaiser is analogous art relative to the '842 patent for at least the reason that both references disclose OFDM transmitters that spread, map, modulate, and add guard intervals to symbols for transmissions. EX1005-Kaiser, Fig. B.2, Fig. 3.2, 132-34; EX1001, 1:26-29 (describing the “Field” as relating to spread OFDM wireless communication networks); *see id.*, claim 1.

C. Bury (EX1007)

82. Bury is a paper authored by Andreas Bury et al. titled “*Comparison of Amplitude Distributions for Hadamard Spreading and Fourier Spreading in Multi-Carrier Code Division Multiplexing*,” published by IEEE in 2000 and entered into the Linda Hall Library’s catalog by at least January 12, 2001. I understand that Bury was cataloged by subject matter categories, including telecommunications, data transmission systems, computer networks, and broadband communication systems. These categorizations would have enabled a POSITA interested in wireless communication systems, signal processing, and related technologies to find Bury through reasonably diligent search efforts. Thus, I understand Bury qualifies as prior art.

83. Bury discloses an OFDM transmitter in Figure 1. As shown below, that figure discloses elements for spreading (highlighted teal), mapping (yellow), modulating (purple “IDFT” element), and a cyclic prefix element (orange) for adding a cyclic prefix/guard interval:



EX1007-Bury, 858 (Fig. 1(a) (annotated)).

84. Bury also teaches that DFT-spreading codes/matrices should be used instead of conventional Walsh-Hadamard codes in order to improve overall performance by reducing “peak-to-average power ratio” (i.e., “PAPR”). EX1007-Bury, 857, 860.

85. Bury is analogous art to the '842 patent because the authors were also faced with solving the same problem of reducing PAPR in OFDM communications. EX1007-Bury, 857, 860 (solving that problem by using DFT-spreading); *see*

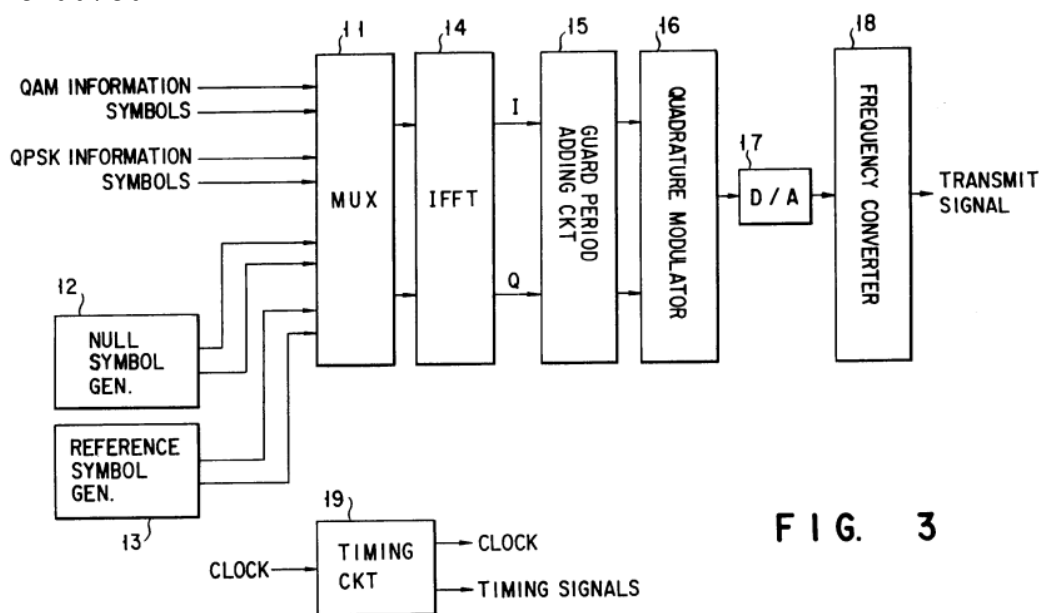
EX1001, 8:64-9:1 (OFDM modulator modulates DFT-spread symbols to produce OFDM signal “which can have low peak to average power ratio (PAPR)”; *id.* at 70:9-11, 72:59-66.

D. Toshiba (EX1041)

86. Toshiba is EP 0 734 132 A2, which published on September 25, 1996. EX1041-Toshiba, cover. I understand that Toshiba qualifies as prior art.

87. Toshiba discloses an OFDM transmission system in which high data rates are enabled using QAM modulation, while also reducing the amount of reference signal data that needs to be transmitted to properly decode the multi-level QAM modulated data. EX1041-Toshiba, 1:38-2:13.

88. Toshiba multiplexes four types of symbols together: QAM information symbols, QPSK information symbols, null symbols, and reference symbols. This multiplexing occurs before modulating the symbols with an IFFT, as shown in the figure below:



EX1041-Toshiba, FIG. 3, 7:46-58, 8:25-38, 9:19-56.

89. The null symbols are “used in the receiver as a reference symbol for timing synchronization.” *Id.*, 8:27-29. The reference symbols have known phase and amplitude and are used “as a synchronization reference symbol adapted to recognize the frame and as demodulation reference signals for demodulating the phase and amplitude of each carrier.” *Id.*, 8:29-36.

90. Toshiba is also in the same field of endeavor as the '842 patent: OFDM wireless transmission systems. EX1041-Toshiba, 1:3-8 (invention relates to “radiocommunication system employing” OFDM); *see* EX1001, 1:27-29. Toshiba relates directly to the problem to be solved in the '842 patent, because both the '842 patent and Toshiba address increasing data transmission efficiency. EX1041-Toshiba, 2:5-13 (explaining how invention increases “data transmission

efficiency”); EX1001, 2:19-3:3 (describing issues with “spectral efficiency” and “declining data rates per user”).

E. Dowling (EX1042)

91. Dowling is U.S. Patent No. 6,597,745 which was filed on April 6, 1999 and issued July 22, 2003. EX1042-Toshiba, cover. I understand Dowling qualifies as prior art.

92. Dowling discloses multicarrier modulation and OFDM systems that may be implemented as software modules. Such modules execute on programmable processor architectures; in other words, transmitters, receivers, and precoders may be implemented in either hardware or software. EX1042-Dowling, 3:46-50, 5:66-6:1.

93. Dowling is analogous art with respect to the '842 patent at least because it is in the same field of endeavor—namely wireless communications including OFDM communications. EX1042-Dowling, 1:6-12 (“field” relates to “data transmission” and more specifically to a “precoder” technique for multicarrier systems, including OFDM systems), 21:62-64 (“[T]he present invention may be readily applied to other FFT based multicarrier modulation and OFDM systems besides DMT.”); EX1001, 1:28-30 (“field” relates to “wireless communication networks ... more specifically” spread OFDM).

VIII. GROUND 1-2: Claims 1-3, 7-8, 11, and 17-18 are (Ground 1) anticipated by and (Ground 2) obvious over Galda

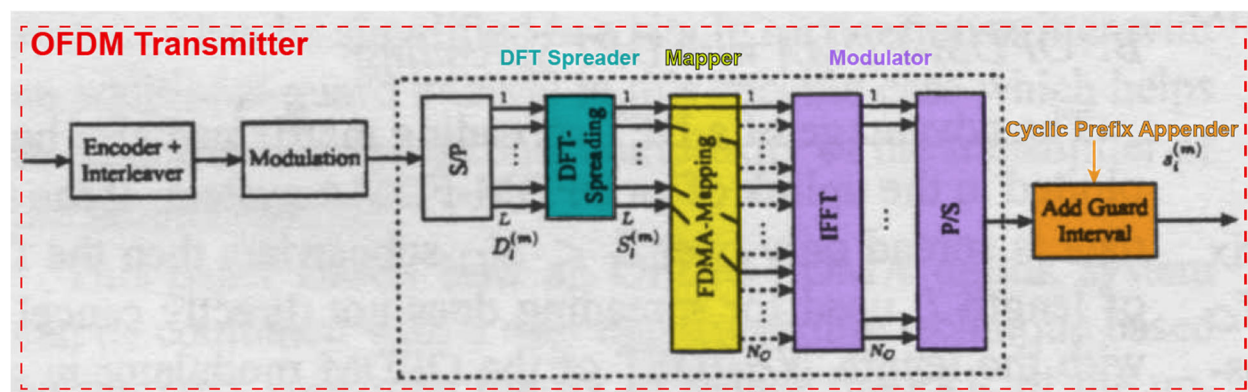
A. Challenged Claims

1. Independent Claim 1

[1Pre] “An OFDM transmitter, comprising:”

94. Galda teaches the preamble.

95. Galda discloses an OFDM transmitter:



EX1004-Galda, Fig. 6(a) (“OFDM-FDMA transmitter”); *id.*, Abstract, 1737-38.

96. Here I note that I am relying on Galda’s more flexible transmitter embodiment in which the channel spacings are not required to be equidistant for each user. EX1004-Galda, 1738 (“[I]n principle, the set of subcarrier[s] assigned to each user can be composed of any L out of N_C subcarrier that have not been assigned to another user.” (emphasis added); *see id.*, 1739 (“If the user data is spread over only $L < N_C$ subcarriers then the DFT of length L does not directly cancel out with the length N_C IDFT of the OFDM modulator in general.”). Although Galda discusses the option of using a simplified transmitter (EX1004-Galda, 1738-39, Fig. 6(b)), a

POSITA would have understood that allowing flexible subcarrier allocation and channel spacings depending on channel conditions, deployment scenarios, and the payload to be transmitted on the uplink would have improved system flexibility. *See, e.g.,* EX1003-Doufexi, §§III-IV (disclosing variable subcarrier spacings and the need for flexibility when implementing multi-carrier, multi-rate transmission); EX1006-Lucent, Table 4 (disclosing various subcarrier spacing options). A system that can flexibly adjust its subcarrier allocation can increase its system capacity by reducing its subcarrier spacings when channel conditions improve (for example when mobile devices stop moving). In frequency selective channels, the wireless channel conditions experienced by the communications network causes a varying delay spread during each symbol period. The longer the symbol period, the less negative effect a particular Doppler amount and a particular delay spread amount have on the ability of a receiver to properly receive the transmitted symbol, thereby improving the performance of the network and reducing the interference it experiences. The negative effects of Doppler and delay spread include frequency offset, phase noise, and inter-symbol interference (ISI). In addition, the longer the symbol period, the larger the amount of time in the symbol period can be dedicated to a guard interval, in which the latter portion of a transmitted symbol is repeated. This guard interval is designed to create a buffer zone within which the delay spread can be contained, thereby further reducing its negative effect on the ability of a

receiver to properly receive the transmitted symbol. One method for achieving a longer symbol period within a fixed bandwidth is to reduce the sub-carrier spacing parameter of OFDM transmissions. When the sub-carrier spacing is reduced, the symbol period of the OFDM transmission is necessarily longer, in order to preserve orthogonality between the subcarriers. However, a longer symbol period not only increases implementation complexity and sensitivity, it also reduces the rate at which symbols can be transmitted, which reduces the data rate capacity of the communication system. Thus, an OFDM communication system must optimally adjust its sub-carrier spacing parameter in order to balance the need to mitigate the negative effects of delay spread against the need to maximize the symbol rate as the delay spread amount of the frequency-selective channel dynamically changes. For example, Doufexi is a prior art reference that “identifies and describes the key link parameters of OFDM for a potential 4G cellular standard.” EX1003-Doufexi, 1. Doufexi explains that “a fixed set of parameters is not capable of achieving high performance in all cases. A system capable of dynamically adapting one or more of the above parameters may offer superior performance.” EX1003-Doufexi, 1. Subcarrier spacing was one of the key candidate parameters considered by Doufexi in its study of the effect of dynamic adjusting the OFDM parameters in a communication system. In particular, Table 2 in Doufexi shows two columns of parameters that were compared in its study; the Value 1 column, and the Value 2

column. The operating frequency parameter and the bandwidth parameter are the same. However, because the subcarrier spacing parameter in the Value 2 column is half that of the subcarrier spacing parameter in the Value 1 column, the remaining parameters in Value 2 column, including the FFT size, are twice the value of the same parameters in the Value 1 column. As a result, the set of parameter values in the Value 2 column can withstand greater delay spread and interference caused by the communication channel than the set of parameter values in the Value 1 column. “A FFT size of $N=512$ is also under consideration, since it will improve guard interval efficiency and can handle more ISI.” EX1003-Doufexi, 2. Lucent is another prior art example discussing flexible subcarrier spacing. The Lucent reference is a document submitted to the 3GPP TSG-RAN1 working group for discussion, titled “Proposed Baseline OFDM Systems for Study. EX1006-Lucent, 1. Multiple configurations of parameters such as sub-carrier spacing were considered in the OFDM system studied in Lucent. “We have suggested an OFDM system with multiple configurations that can be deployed in different environments.” EX1006-Lucent, 7. In this Lucent reference, it is stated that “In order to design the OFDM system properly, the symbol duration should be less than the coherence time and the sub-carrier spacing should be less than the coherence bandwidth.” EX1006-Lucent, 1. However, Lucent explains that there must be a balance in selecting the sub-carrier spacing. “The sub-carrier spacing should be large enough to provide robustness

against frequency offset and phase noise, but it also has to be small enough such that the sub-carrier experiences flat fading.” EX1006-Lucent, 1. However, the assumed delay spread for the channel varies depending on the channel conditions, which causes the optimal sub-carrier spacing to change. “We suggest that a maximum delay spread of 10 usec be considered for the design of the OFDM system . . . Note that it is observed that in a simulcast environment, the signal coming from the other cell is most likely the dominant multi-path which has longer delay than the non-simulcast signal. Therefore, larger delay spread should be considered if multicast and simulcast services are of interest.” EX1006-Lucent, 2. “The optimal value of sub-carrier spacing can be determined later after the adjacent channel emission requirement has been agreed.” EX1006-Lucent, 3. This determination will differ as the delay spread (also called multipath) amount of the channel changes. “To allow shorter symbol durations when the multipath is less severe, this would result in a wider sub-carrier spacing which would make the system more immune to frequency offset.” EX1006-Lucent, 5. This is because the stationarity of the channel model makes it easier to equalize the channel. Alternatively, increasing the cyclic prefix length when channel conditions deteriorate (for example when the delay spread increases), reduces the negative impact of inter-symbol interference on receiver reliability. When subcarrier spacing and cyclic prefix length cannot be changed in the system, a one-size-fits-all system design, such as Galda, would be suboptimal

for most of the system operation, despite the flexible sharing of sets of subcarriers between users.

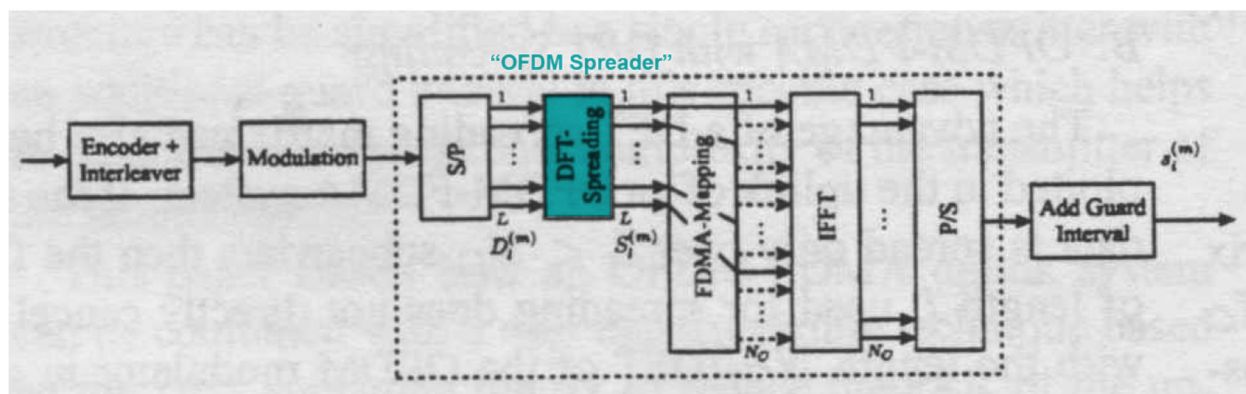
97. Importantly, Galda still achieves the PAPR/PAR improvements using the transmitter illustrated in Galda's Fig. 6(a), because the PAPR-related improvements result from using DFT spreading as long as the minimum separation between subcarriers used by the spreading technique exceeds the coherence bandwidth, as this causes the spreading to occur over an AWGN channel, and not a flat-fading channel. EX1004-Galda, 1737-38.

98. Thus, Galda teaches the preamble.

[1A] "an OFDM spreader configured to spread a plurality of data symbols with Fourier coefficients to generate a discrete Fourier Transform (DFT)-spread data signal;"

99. Galda teaches this limitation.

100. Specifically, Galda discloses a DFT-spreading element (blue):



EX1004-Galda, Fig. 6(a) (annotated).

101. Galda's DFT-spreading element is an OFDM spreader that spreads data

symbols “ $D_l^{(m)}$ ” with Fourier coefficients to generate a DFT-spread data signal comprising a plurality of spread data symbols “ $S_l^{(m)}$ ”:

The input data stream for each mobile user $m, m = 0, \dots, M - 1$, is convolutionally encoded in a first step. The bit sequence is then mapped onto L complex modulation symbols $D_l^{(m)}, l = 0, \dots, L - 1$, of a coherent, higher-level modulation scheme. The L modulation symbols are spread over the L user specifically allocated subcarrier with an unitary spreading matrix $[C]$ resulting in L complex transmit symbols $S_l^{(m)}$.

EX1004-Galda, 1738.

102. Galda’s “unitary spreading matrix $[C]$ ” spreads data symbols (“ D_l ” symbols) to generate spread symbols (the “ S_l ” symbols). The “unitary spreading matrix $[C]$ ” includes Fourier coefficients, as Galda discloses that “[t]he discrete Fourier matrix is also unitary but has an influence on the PAR of an OFDM transmit signal.” EX1004-Galda, 1739.

103. The use of the DFT’s Fourier coefficients results in improved peak-to-average power ratios:

[T]he peak-to-average ratio (PAR) of the uplink OFDM transmit signal can be greatly reduced if this OFDM-FDMA multiple access scheme is additionally combined with a data spreading technique based on a Discrete Fourier Transform (DFT) spreading matrix using only the user specific subcarriers.

EX1004-Galda, Abstract; *see id.*, 1739 (“The advantage of a DFT spreading matrix can also be exploited in the uplink of an OFDM-FDMA system.”).

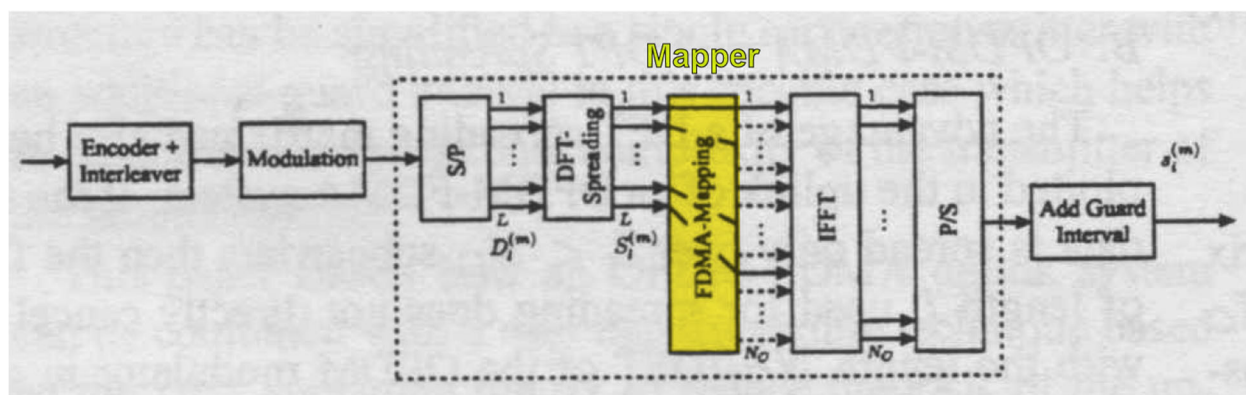
104. Spreading with Galda’s DFT spreading matrix produces a discrete Fourier Transform (DFT)-spread data signal including the set of symbols S_l .

105. Thus, Galda teaches this limitation.

[1B] “a mapper configured to map the DFT-spread data signal to a plurality of OFDM subcarriers; and”

106. Galda teaches this limitation.

107. Figure 6(a) illustrates a FDMA-Mapping element (yellow):



EX1004-Galda, Fig. 6(a).

108. The “FDMA-Mapping” block maps the DFT-spread data signal’s L transmit symbols $S_l^{(m)}$ onto a plurality L of the system’s available N_C subcarriers:

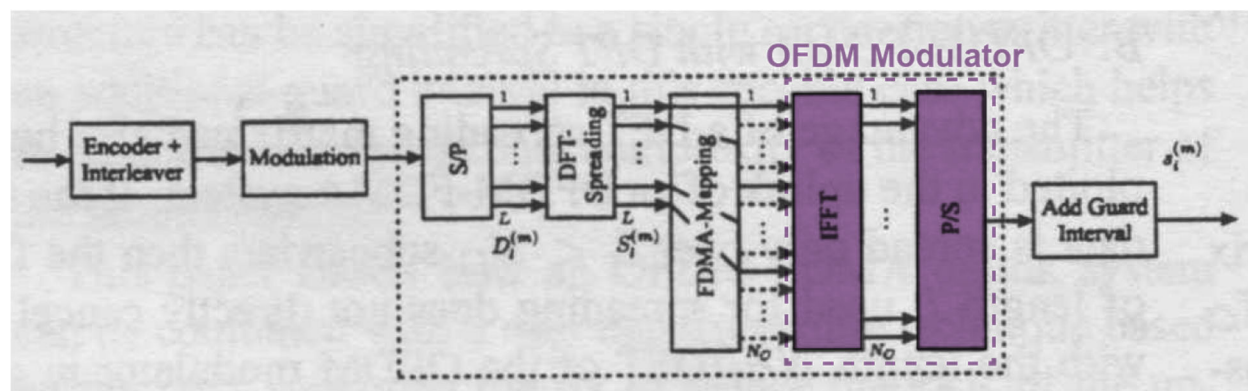
The transmit symbols $S_l^{(m)}$ are then mapped onto L of the available N_C subcarrier which are exclusively allocated to user m . In principle, the set of subcarrier assigned to each user can be composed of any L out of N_C subcarrier that have not been assigned to another user.

109. Thus, Galda teaches this limitation.

[1C] “an OFDM modulator configured to modulate the DFT-spread data signal onto the plurality of OFDM subcarriers to produce an OFDM transmission signal comprising a superposition of the OFDM subcarriers,”

110. Galda teaches this limitation.

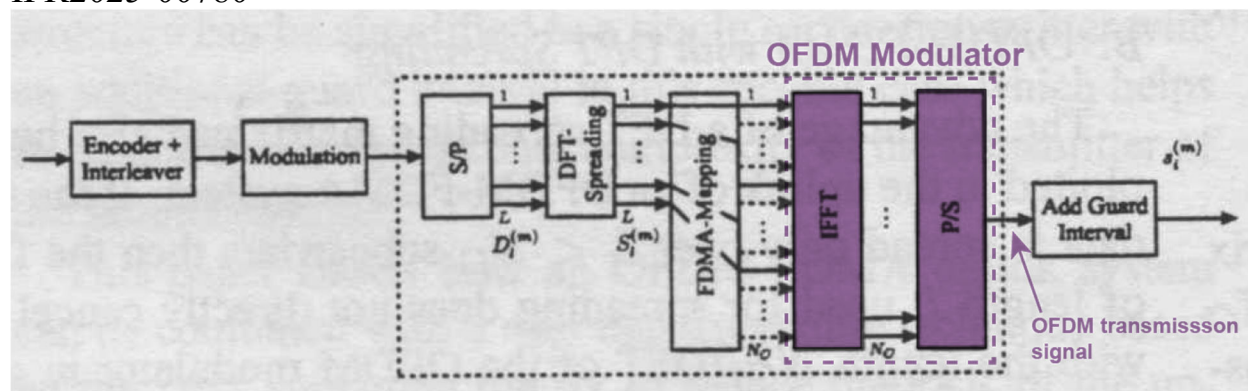
111. Specifically, Galda discloses an OFDM modulator, shown below as Galda’s IFFT and P/S elements (purple):



EX1004-Galda, Fig. 6(a).

112. Consistent with dependent claim 3, the '842 patent explains that “the OFDM modulator comprises an M-point inverse Fast Fourier Transform,” which corresponds to Galda’s IFFT block. EX1001, claim 3.

113. The '842 patent further states that “[t]he output of the IFFT is parallel-to-serial converted to produce a CI-OFDM signal having N frequency components.” EX1001, 69:43-45. This corresponds to Galda’s teaching that the “P/S” element generates the OFDM transmission signal (labeled below).



EX1004-Galda, Fig. 6(a).

114. Galda's resulting OFDM transmission signal comprises a superposition of the OFDM subcarriers. First, I understand that Patent Owner admits that a POSITA "at the time of the invention would understand that an OFDM signal is a superposition of subcarriers" and is "a sum (i.e., a superposition) of the subcarrier frequencies modulated with their corresponding symbols." EX1038, 10.

115. Second, Galda confirms that its OFDM transmission signal comprises a "superposition of a large number of independent symbols." EX1004-Galda, 1737 ("[T]he OFDM transmit signal results from the superposition of a large number of independent symbols."), 1740. A POSITA would have recognized that this superposition of subcarriers is in the context of the transmitter design above, wherein the transmission signal is the result of summing the subcarriers that were modulated with their corresponding symbols in the IFFT block and then parallel to serial converted, resulting in the transmission signal.

116. Thus, Galda teaches this limitation.

[1D] “wherein the OFDM spreader is configured to provide the superposition with a reduced peak-to-average power ratio.”

117. Galda teaches this limitation.

118. Specifically, Galda explains that an OFDM transmit signal “has in general a large peak-to-average ratio (PAR).” EX1004-Galda, 1737. The term PAR is also defined in Galda and refers to a peak-to-average power ratio:

$$PAR = 10 \log_{10} \left(\frac{\max(|s(t)|^2)}{\sigma_s^2} \right) [dB], \text{ where } \sigma_s^2 \text{ denotes the average}$$

transmit power.

EX1004-Galda, 1740.

119. Accordingly, PAR is a peak-to-average power ratio, because $\max(|s(t)|^2)$ represents the peak (“max”) transmit power of a given signal and σ_s^2 is defined as the average transmit power. A POSITA would have recognized this to be the case because typical peak-to-average power ratios are expressed as a ratio of the square of the maximum amplitude of a waveform over the square of the average amplitude of the waveform.

120. Galda further discloses that its OFDM spreader provides the resulting superposition with a reduced PAPR:

[T]he PAR of the transmit signal envelope which employs an OFDM-FDMA multiple access scheme can significantly be reduced if additional spreading techniques are applied which spread the user data over the allocated subcarrier only. In this case an appropriate

spreading technique must be designed reducing the PAR to a minimum value. It will be shown in this paper that using the Discrete Fourier Transform (DFT) matrix as an orthogonal spreading technique will reduce the PAR significantly [sic].

EX1004-Galda, 1737-38.

121. Accordingly, Galda discloses to a POSITA that the use of a “Discrete Fourier Transform (DFT) matrix” for spread data over the allocated subcarriers results in a transmit signal envelope that has a reduced peak-to-average power ratio.

122. Thus, Galda teaches this limitation and renders obvious claim 1.

2. Independent Claim 11

[Claim 11, 11Pre] “A method, comprising:”

123. This is a generic preamble, the steps of which are addressed below.

[11A] “multiplying a plurality of data symbols by a discrete Fourier Transform (DFT) spreading matrix to produce a plurality of DFT-spread symbols;”

124. Galda teaches this limitation.

125. This limitation is similar to limitation 1A and is disclosed for the same reasons discussed above, as both require DFT spreading. The limitations are compared below:

[11A] multiplying a plurality of data symbols by a discrete Fourier Transform (DFT) spreading matrix to produce a plurality of DFT-spread symbols;	[1A] an OFDM spreader configured to spread a plurality of data symbols with Fourier coefficients to generate a discrete Fourier Transform (DFT)-spread data signal;
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126. Limitation 11A differs in that it refers to multiplying by a DFT

spreading matrix rather than to Fourier coefficients, and to “DFT-spread symbols” rather than a DFT-spread data signal.

127. Galda teaches this additional aspect of limitation 11A because Galda teaches multiplying data symbols by a DFT spreading matrix [C] to produce DFT-spread symbols:

The spreading operation can be denoted mathematically by the following simple matrix multiplication

$$\vec{S}^{(m)} = [C]\vec{D}^{(m)}[.]$$

EX1004-Galda, 1738 (explaining spread symbols $S_l^{(m)}$ result from the spreading operation.); *see id.*, Abstract, 1738-39, Fig. 6(a).

128. This expression shows that Galda multiplies a “spreading matrix [C]” by a vector of data symbols for user m (i.e., $\vec{D}^{(m)}$). EX1004-Galda, 1739 (describing advantages associated with using a “DFT spreading matrix” (matrix [C]) in the “uplink of an OFDM-FDMA system.”).

129. Thus, Galda teaches this limitation.

[11B] “mapping the plurality of DFT-spread symbols to a plurality of OFDM subcarriers; and”

130. Galda teaches this limitation.

131. This limitation is similar to limitation 1B and is disclosed for the same reasons. The limitations are compared below:

[11B] mapping the plurality of DFT-	[1B] a mapper configured to map the
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spread symbols to a plurality of OFDM subcarriers; and	DFT-spread data signal to a plurality of OFDM subcarriers; and
--	--

132. Limitation 11B further refers to DFT-spread symbols rather than a DFT-spread data signal. Galda's DFT-spread signal comprises DFT-spread symbols $S_l^{(m)}$, which are mapped onto subcarriers. EX1004-Galda, 1738-1739 (spread "transmit symbols $S_l^{(m)}$ are then mapped onto L of the available N_C subcarrier[s]").

133. Thus, Galda teaches this limitation.

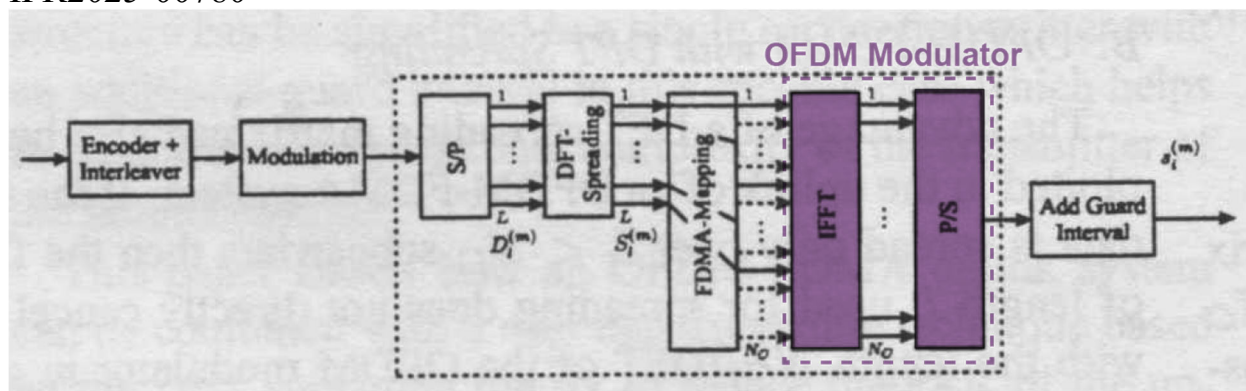
[11C] "modulating the plurality of DFT-spread symbols onto a plurality of OFDM subcarriers to produce a DFT-spread OFDM signal to be transmitted into a wireless channel, wherein the DFT-spread OFDM signal comprises a superposition of the OFDM subcarriers, and"

134. Galda teaches this limitation.

135. Limitation 11C is similar to limitation 1C and is disclosed for the same reasons. The limitations are compared below:

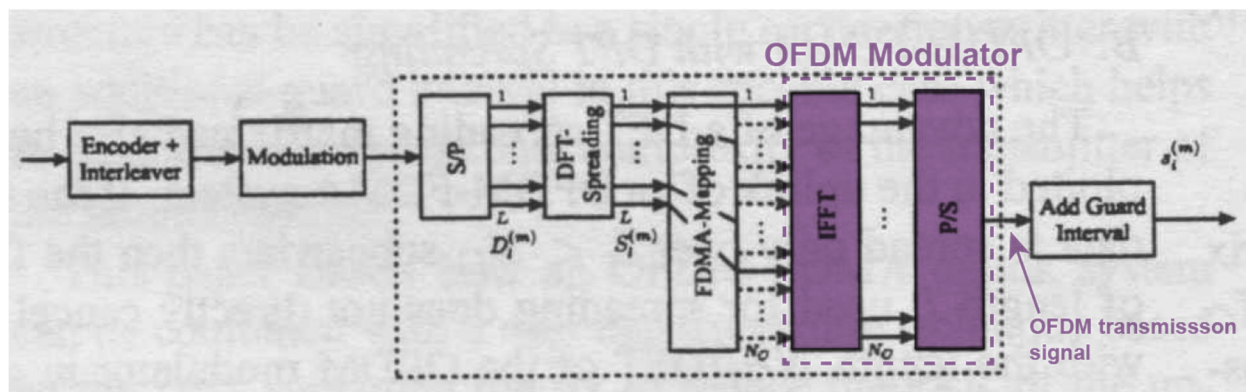
[11C] modulating the plurality of DFT-spread symbols onto a plurality of OFDM subcarriers to produce a DFT-spread OFDM signal to be transmitted into a wireless channel, wherein the DFT-spread OFDM signal comprises a superposition of the OFDM subcarriers,	[1C] an OFDM modulator configured to modulate the DFT-spread data signal onto the plurality of OFDM subcarriers to produce an OFDM transmission signal comprising a superposition of the OFDM subcarriers,
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136. Limitation 11C additionally refers to DFT-spread symbols (rather than a DFT-spread data signal) and to a wireless channel. As discussed above regarding limitation 1C, Galda's OFDM modulator modulates DFT-spread symbols $S_l^{(m)}$ onto OFDM subcarriers, as shown in Fig. 6(a):



EX1004-Galda, Fig.6(a).

137. The DFT-spread OFDM signal is shown at the output of the parallel-to-serial converter as shown below:



EX1004-Galda, Fig.6(a).

138. The signal is “DFT-spread” because the symbols modulated on the signal undergo “DFT Spreading” in Galda’s DFT-Spreading block, as I explain above.

139. Galda’s DFT-spread OFDM transmission signal is also transmitted into a radio channel (i.e., a wireless channel). This was clear to a POSITA because Galda explains that the OFDM “transmission technique” can “deal with ... multi-path

propagation in the broadband radio channel.” EX1004-Galda, Abstract; *see id.*, 1737

(describing OFDM in mobile communications and broadband radio channels).

140. Thus, Galda teaches this limitation.

[11D] “wherein the DFT spreading matrix is configured to provide the superposition with a reduced peak-to-average power ratio (PAPR).”

141. Galda teaches this limitation.

142. Limitation 11D is similar to limitation 1D and is disclosed for the same reasons. The limitations are compared below:

[11D] and wherein the DFT spreading matrix is configured to provide the superposition with a reduced peak-to-average power ratio (PAPR).	[1D] wherein the OFDM spreader is configured to provide the superposition with a reduced peak-to-average power ratio.
---	--

143. As shown above, limitation 11D differs through its reference to a “DFT spreading matrix,” which I address in relation to limitation 11A above.

144. Thus, Galda teaches this limitation and renders obvious claim 11.

3. Dependent Claims

[Claim 2] “The OFDM transmitter recited in claim 1, wherein the OFDM spreader comprises an N-point DFT and the OFDM modulator comprises an M-point inverse discrete Fourier Transform, wherein $M > N$.”

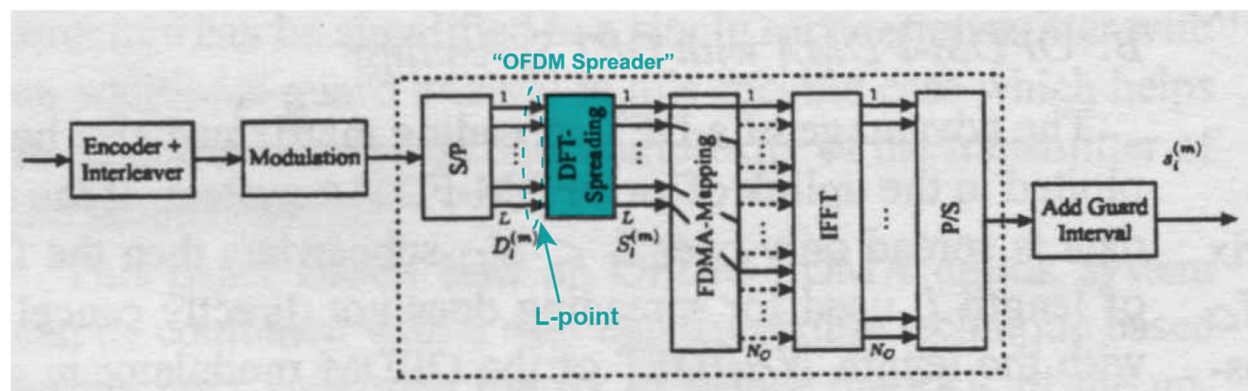
[Claim 18] “The method recited in claim 11, wherein the DFT spreading matrix comprises an N-point DFT, and the modulating comprises employing an M-point inverse-DFT, and wherein $N < M$.”

145. Galda teaches claims 2 and 18. These limitations include the same requirements:

[Claim 2] The OFDM transmitter	[Claim 18] The method recited in claim
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recited in claim 1, wherein the OFDM spreader comprises an N-point DFT and the OFDM modulator comprises an M-point inverse discrete Fourier Transform, wherein $M > N$.	11, wherein the DFT spreading matrix comprises an N-point DFT, and the modulating comprises employing an M-point inverse-DFT, and wherein $N < M$.
--	---

146. Galda teaches these limitations. In particular, Galda's DFT-spreading element and corresponding spreading matrix (green) comprise an L -point DFT:

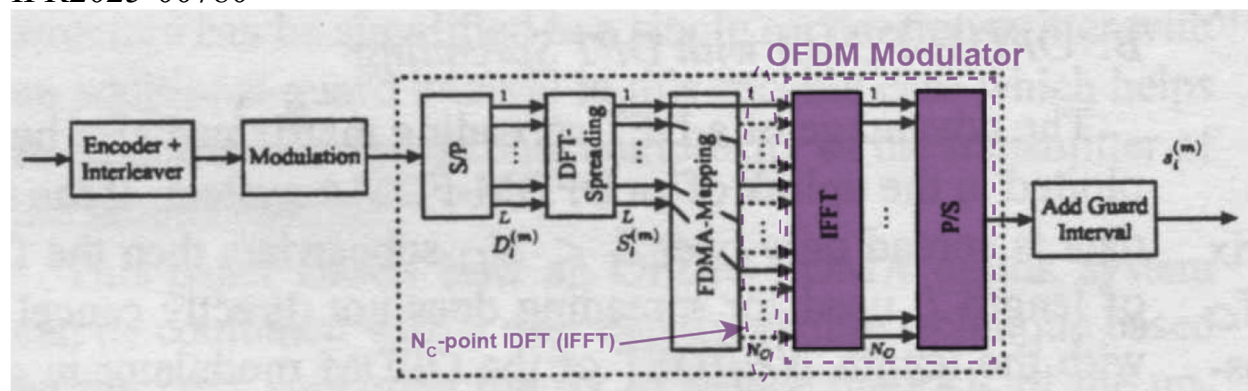


EX1004, Fig. 6(a); *see* limitations 1A, 11A.

147. Galda Fig. 6(a) shows using an N_C -point IFFT. *See* limitations 1C, 11C.

148. An IFFT is a conventional type of inverse-Discrete Fourier Transform (IDFT). *See, e.g.,* EX1001, FIG. 33 (item 3305), 72:48-52 (“an M-point inverse discrete Fourier transform, such as an inverse fast Fourier transform (IFFT)”), 78:60-61 (“[T]he IDFT comprises an inverse fast Fourier transform.”).

149. Galda's N_C point IDFT is shown below:



EX1004-Galda, Fig. 6(a).

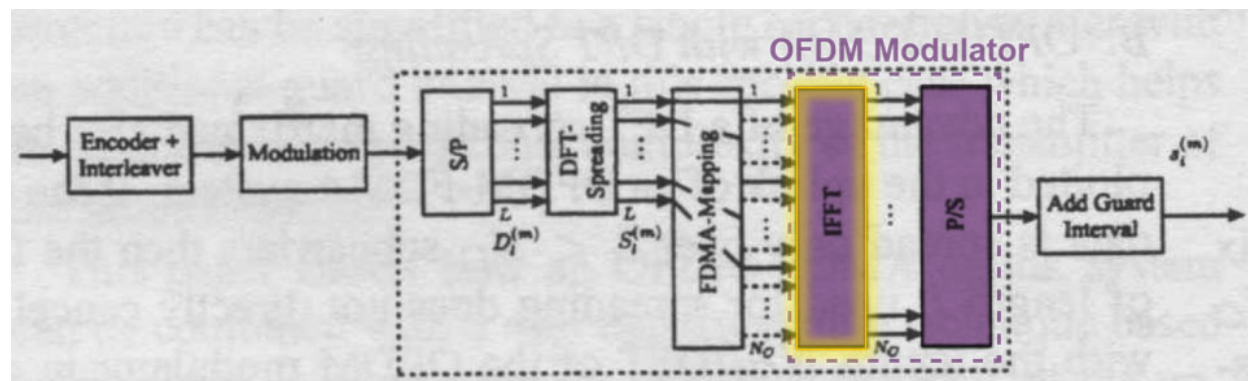
150. Galda's use of L and N_C correspond to the variables N and M respectively because they describe the inputs into the DFT and IDFT respectively. Because Galda's DFT has fewer inputs than the IDFT (IFFT), leaving some of the inputs to be unused for a particular user (shown by dashed lines in Fig. 6(a)), Galda discloses the inequalities " $M > N$ " [Claim 2] and " $N < M$ " [Claim 18]) as required by both dependent claims 2 and 18. EX1004-Galda, 1739 (describing example where $L < N_C$ and user only is using some subset of the system subcarriers).

151. Thus, Galda renders obvious claims 2 and 18.

[Claim 3] "The OFDM transmitter recited in claim 1, wherein the OFDM modulator comprises an inverse fast Fourier transform."

152. Galda teaches this limitation.

153. As I explain above regarding claims 1-2, 11, and 18, Galda's OFDM modulator comprises an IFFT block. This block is depicted in Fig. 6(a) (highlighted yellow below) and labeled "IFFT," which is short for "inverse fast Fourier



154. Thus, Galda renders obvious claim 3.

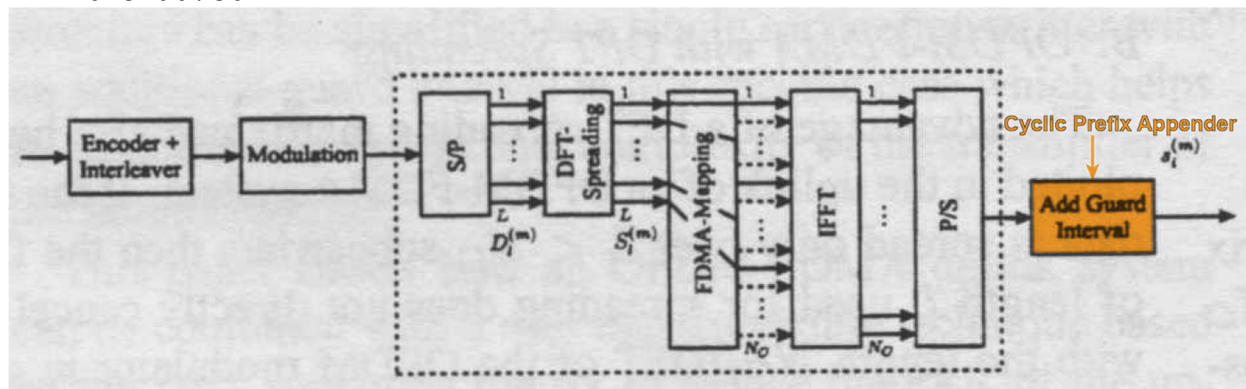
[Claim 7] “The OFDM transmitter recited in claim 1, further comprising a cyclic prefix appender configured to append at least one of a cyclic prefix, a postfix, and a guard interval to the OFDM transmission signal.”

[Claim 17] “The method recited in claim 11, further comprising appending at least one of a cyclic prefix, a postfix, and a guard interval onto the DFT-spread OFDM signal.”

155. Galda teaches claims 7 and 17. These claims are similar, as shown below:

[Claim 7] The OFDM transmitter recited in claim 1, further comprising a cyclic prefix appender configured to append at least one of a cyclic prefix, a postfix, and a guard interval to the OFDM transmission signal.	[Claim 17] The method recited in claim 11, further comprising appending at least one of a cyclic prefix, a postfix, and a guard interval onto the DFT-spread OFDM signal.
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156. Galda’s Fig. 6(a) illustrates a cyclic prefix appender (highlighted orange) that adds at least “a guard interval as a cyclic prefix” to the OFDM transmission signal:



EX1004-Galda, Fig. 6(a); *see id.* at 1739-40 (describing “an added guard interval as cyclic prefix, shown in Fig. 5.”), 1737 (noting that interferences can be avoided by “by introducing an additional guard interval into the OFDM symbol”), 1739 (“a guard interval is added in the time domain as a cyclic prefix”).

157. Thus, Galda renders obvious claims 7 and 17.

[Claim 8] “The OFDM transmitter recited in claim 1, wherein the OFDM spreader is configured to provide channel precoding.”

158. Galda teaches this limitation.

159. In particular, the ’842 patent indicates that spreading with a CI matrix is an example of precoding: “CI-OFDM is distinctly different from prior-art OFDMA, for example, because of the DFT pre-coding (e.g., spreading) of the symbols in the transmitter....” EX1001, 72:55-58; *see id.*, 65:1-5 (“CI spreading” can use “spreading matrix ... comprising DFT coefficients”), 65:59-61 (“CI spreading matrix can comprise channel precoding”), 70:32-34 (“CI spreading 2901 can comprise precoding”), FIG. 29A.

160. Galda's DFT-spreader discloses the claimed DFT spreading when it teaches a DFT spreading matrix [C] prior to mapping and modulation, as previously discussed. Thus, Galda discloses providing channel precoding (via DFT spreading) in the same way disclosed by the '842 patent, as discussed above relative to limitations 1A and 11A.

161. Thus, Galda renders obvious claim 8.

IX. GROUND 3: Claims 4 and 9 are obvious over Galda in view of Toshiba

A. Reasons for Combining Prior Art

162. As discussed above, Galda discloses and renders obvious each limitation of claim 1, from which claims 4 and 9 depend. However, Galda does not describe "data symbols" that comprise "reference-signal symbols" (claim 4) or data symbols that are multiplexed (e.g., time-multiplexed) with "reference-signal symbols" (claim 9). These features were obvious over Galda in view of Toshiba.

163. Galda does not discuss reference-signal symbols. A POSITA, however, would have understood that reference-signal symbols were commonly used for necessary functions in OFDM systems like Galda's, including timing synchronization, frequency offset correction, channel estimation, and demodulation.

164. Toshiba discloses using reference signal symbols including "null symbol data" and "reference symbol data" for these purposes in an OFDM wireless transmission system. EX1041-Toshiba, 8:13-42.

165. Toshiba's null symbols are "used in the receiver as a reference symbol for timing synchronization." *Id.* at 8:27-29.

166. Likewise, Toshiba's "reference OFDM symbol[s]" have known phase and amplitude and are "used in the receiver as a synchronization reference symbol adapted to recognize the frame and as demodulation reference signals for demodulating the phase and amplitude of each carrier." *Id.* at 8:29-36.

167. Toshiba discloses multiplexing its reference-signal symbols with other symbols in the "MUX" block before OFDM modulation (the purple-highlighted IFFT block):

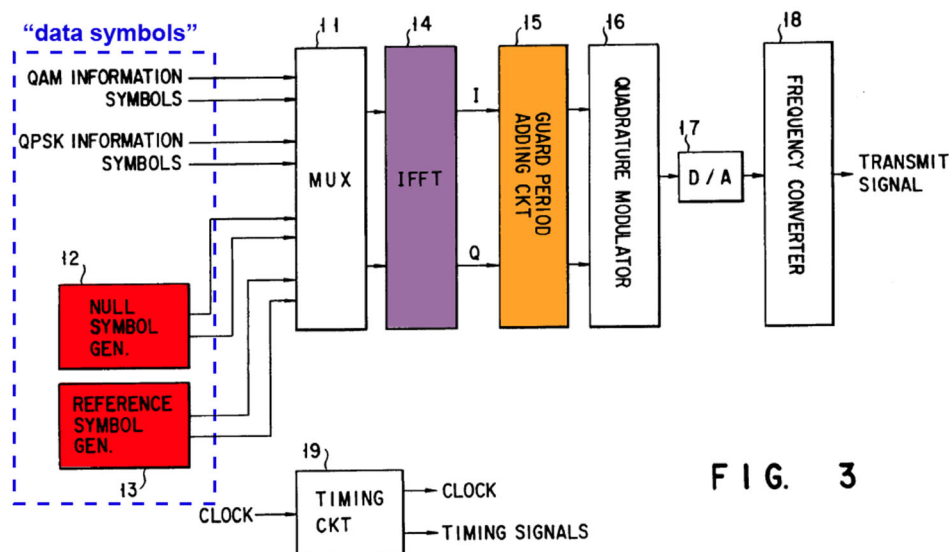
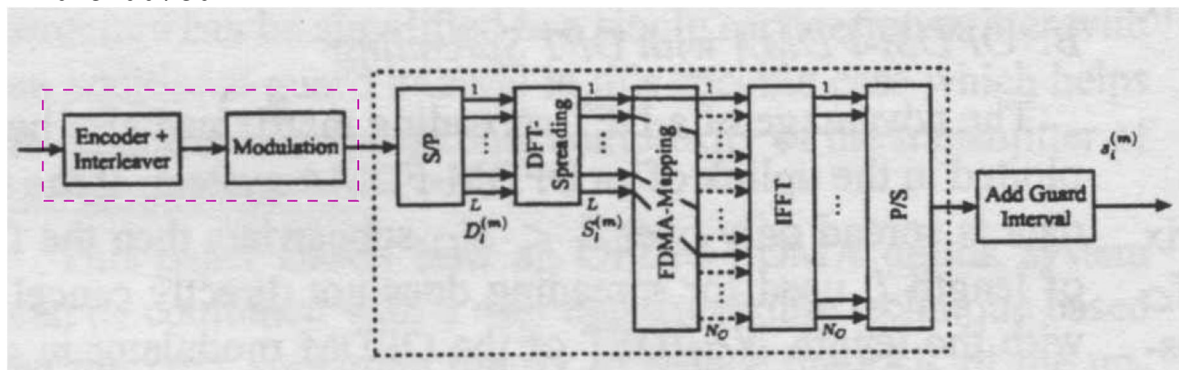


FIG. 3

EX1041-Toshiba, FIG. 3 (annotated), 9:33-10:2.

168. While Galda indicates that the data symbols to be spread are encoded and modulated (see annotated figure below), Galda does not provide the details of the modulation.



EX1004-Galda, 1740 (Fig. 6(a)). Thus, a POSITA would have sought out (1) proper modulation schemes for data transmission and (2) time synchronization techniques to implement with Galda's system.

169. This would have led a POSITA to Toshiba, which teaches solutions for both issues. Toshiba teaches a QAM modulation technique that minimizes the overhead of reference symbols, thus improving data efficiency. *See* EX1041-Toshiba, 1:38-52 (explaining that digital television “needs a high transmission rate” and thus uses “multi-valued QAM” to modulate data for each carrier). Modifying Galda to perform QAM modulation would have allowed Galda to improve data rates.

170. A POSITA also would have known that QAM modulation is improved by using amplitude and phase information derived from channel estimation. EX1041-Toshiba, 1:53-58. This information is determined in Toshiba using reference symbols (i.e., synchronization symbols) and time synchronization reference signals called “null symbols” for these purposes. EX1041-Toshiba, 1:53-56, 8:25-38.

171. A POSITA also would have known that Galda's system needed to be time-synchronized. EX1004-Galda, 1739 ("For a perfectly time and carrier synchronized system the received symbols are not influenced by ISI and ICI at all.") Galda does not disclose a mechanism for achieving this required synchronization.

172. However, Toshiba discloses a known technique for providing this type of synchronization using reference-signal symbols. In particular, Toshiba discloses reference-signal symbols called "null symbols" and "reference symbols," which Toshiba discloses multiplexing with information data before OFDM modulation to facilitate synchronization. EX1041-Toshiba, 8:25-29.

173. A POSITA also would have understood that Toshiba time-multiplexes the reference-signal symbols with the information symbols. As Toshiba details, the reference signal symbols occupy the first two time slots in the OFDM frame and the information signals follow thereafter. EX1041-Toshiba, FIG. 2, 8:13-45.

174. By placing reference signal symbols in the first two timeslots across subcarriers, Toshiba facilitates time synchronization and frame synchronization in the receiver, and allows the rest of the frame to be demodulated. EX1041-Toshiba, 8:25-56.

175. A POSITA would have found it obvious in view of the teachings of Galda and Toshiba to provide data symbols that comprise reference-signal symbols including known training symbols (Toshiba's null symbols) and synchronization

symbols (Toshiba's reference symbols), which are time multiplexed to Galda's DFT spreader, mapper, OFDM modulator, and guard interval appender.

176. A POSITA would have found it obvious to do so because Galda explicitly contemplates achieving time synchronization, but leaves it up to the skilled artisan to consider methods known in the art for actually achieving such synchronization. EX1004-Galda, 1739.

177. A POSITA would have been motivated to incorporate the reference-signals taught by Toshiba in Galda to time multiplex reference signals and information signals before spreading and OFDM modulation. For instance, Toshiba discloses a known use of null symbols multiplexed with other data symbols to achieve the timing synchronization needed by Galda. EX1004-Galda, 1739.

178. Thus, a POSITA would have applied Toshiba's known technique to Galda's OFDM transmitter, resulting in a simple combination of prior art elements (various types of data symbols including reference-signal symbols) according to known methods (to time multiplex them before inputting them into Galda's spreader) to achieve the predictable result of being able to use null symbols embedded in the OFDM signal to achieve timing synchronization as taught by Toshiba.

179. A POSITA would also have used Toshiba's reference symbols to allow for the demodulation of QAM modulation schemes, thus providing the benefit of

higher data rates to Galda as taught in Toshiba. Additionally, a POSITA would have understood that to achieve high data throughput modulation using QAM modulation would have been preferred, but Galda does not describe what type of modulation is used. EX1004-Galda, 1739; EX1041-Toshiba, 8:25-38.

180. A POSITA also would have understood that improved demodulation of QAM modulated signals at a receiver requires using reference symbols to provide phase and amplitude information to the receiver. EX1041-Toshiba, 1:53-59. This would have further led a POSITA to multiplex various types of data symbols together including reference symbols, null symbols, and information symbols, as taught by Toshiba, before undertaking Galda's steps of spreading, mapping, and OFDM modulating those signals. Indeed, a POSITA would have understood that spreading the reference signals would have enabled them to be less susceptible to frequency-dependent channel effects like fading, thereby improving their recovery at the receiver. At the very least, doing so would have been obvious to try because there are only two ways to implement reference-signal symbols in Galda (spread them or not).

181. Combining Galda and Toshiba was also obvious because the combination merely required applying Toshiba's known technique of multiplexing information and reference-signal symbols prior to OFDM modulation to Galda's known OFDM transmitter, which was ready for improvement in the form of

increased data rates and timing synchronization techniques. The combination would have predictably resulted in a system that had reference signal symbols embedded in the OFDM signal received at a receiver, thereby allowing for timing synchronization and demodulation of QAM modulated information symbols.

182. A POSITA also would have reasonably expected to succeed in implementing Toshiba's reference signal symbols in Galda's system because Toshiba teaches a conventional way to use reference-signal symbols time synchronization, thereby allowing QAM-modulated data symbols to be demodulated successful, thereby improving data rates.

183. A POSITA would have had no difficulty multiplexing various symbols together before applying Galda's spreading and modulation because the symbols vary only in whether they represent data or not. These symbols would all be operated on the same way mathematically as they are DFT spread, mapped to subcarriers, and processed by an IFFT to OFDM modulate the output signal. These steps were understood by a POSITA, and merely changing the data content and use of the symbols would have been viewed as a simple modification to Galda in view of Toshiba.

B. Challenged Claims

[Claim 4] “The OFDM transmitter recited in claim 1, wherein the data symbols comprise reference-signal symbols, which comprise at least one of known training symbols and synchronization symbols.”

184. Galda in view of Toshiba teaches this limitation.

185. Galda discloses data symbols, but is silent with respect to “reference-signal symbols, which comprise at least one of known training symbols and synchronization symbols.”

186. Toshiba discloses such reference signal symbols, as shown below in

FIG. 3:

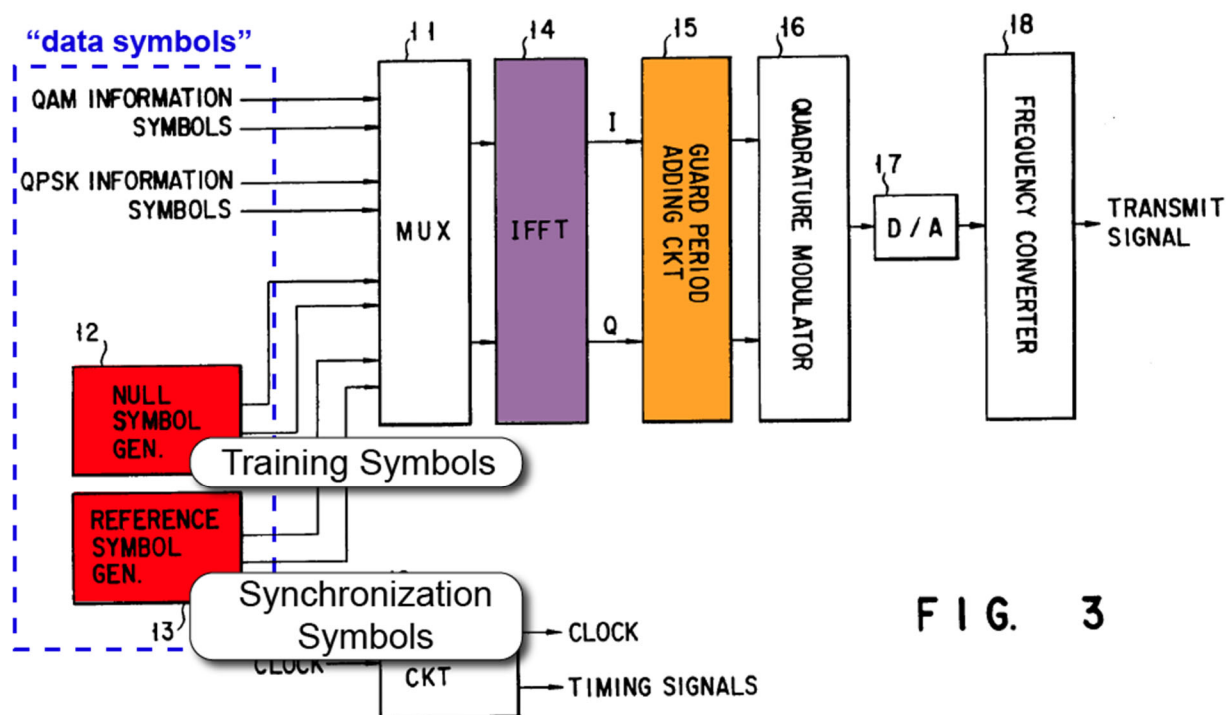


FIG. 3

EX1041-Toshiba, FIG. 3 (annotations and labels added).

187. Toshiba’s null symbols are training symbols, because they are used for

synchronization. EX1041-Toshiba, 8:27-29 (null symbols are “used in the receiver as a reference symbol for timing synchronization”). In the ’842 patent, training symbols also include symbols used for synchronization. EX1001, 41:22-25.

188. Similarly, Toshiba’s reference symbols are also synchronization symbols because they “are used in the receiver as a synchronization reference symbol adapted to recognize the frame and as demodulation reference signals for demodulating the phase and amplitude of each carrier.” EX1041-Toshiba, 8:32-36.

189. Thus, Galda in view of Toshiba renders obvious claim 4.

[Claim 9] “The OFDM transmitter recited in claim 1, wherein the plurality of data symbols are at least one of time-multiplexed with reference-signal symbols, frequency-multiplexed with reference-signal symbols, and code-multiplexed with reference-signal symbols.”

190. Galda in view of Toshiba teaches this limitation.

191. As detailed above regarding the combination of Galda and Toshiba, Toshiba discloses multiplexing data symbols (e.g., modulated “information symbols”) with reference-signal symbols (null symbols and “reference symbols”).

192. Toshiba’s FIG. 2 shows this in more detail:

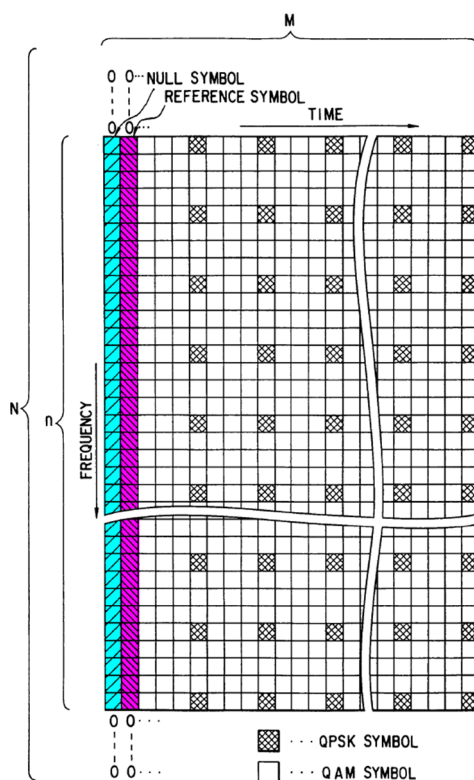


FIG. 2

EX1041-Toshiba, FIG. 2.

193. As FIG. 2 shows, each OFDM frame includes null symbols (first column), then reference symbols (second column), followed by modulated information signals in subsequent time slots. Thus, Toshiba discloses multiplexing (performed by multiplexer 11, FIG. 3) synchronization symbols with data symbols.

EX1041-Toshiba, FIG. 3 (item 11).

194. Thus, Galda in view of Toshiba renders obvious claim 9.

X. GROUND 4: Claims 22, 25-26, 28 are obvious over Galda in view of Dowling

A. Reasons for Combining Prior Art

195. Ground 4 relies on Galda in view of Dowling and addresses claims 22, 25-26, and 28.

196. Claim 25-26 and 28 depend from claim 22, so all of these claims require a processor (limitation 22A) and “a non-transitory memory coupled to the processor, the non-transitory memory including a set of instructions stored therein and executable by the processor” to perform subsequent steps (limitation 22B). Otherwise, these claims correspond to claims 1-3, 7, 11, and 17-18.

197. Galda does not explicitly state whether its OFDM transmitter is implemented in hardware or a combination of hardware and software. Nevertheless, a POSITA would have understood that Galda would have needed to be implemented using at least one of these technologies. A POSITA would have found it obvious to implement Galda in software stored in memory coupled to a processor such that the software is executed by the processor.

198. More specifically, a POSITA would have understood that transmitters could be implemented in hardware or software. The Dowling reference (EX1042-Dowling) provides one example by disclosing that its OFDM transmitter including its modulation techniques “may be implemented as software modules which execute

on a programmable processor architecture.” EX1042-Dowling, 3:46-50; *see id.* at 5:66-6:1 (disclosing that the transmitter, receiver, and precoder may be implemented in hardware or software”); 21:62-64 (disclosing that the “present invention” is applicable to FFT based multicarrier modulation and OFDM systems).

199. In a software implementation, software is stored in memory, and is provided from memory to a processor for execution as was well known to a POSITA. Indeed, those skilled in the art were aware of “software radios” that used code in memory and processors to execute that code to provide flexibility in design and updating, as opposed to hardware which was significantly more difficult to upgrade because it is fixed in silicon. EX1008-Chen (describing OFDM-CDMA software radio); EX1011-Walton, 0124-25 (explaining that modulation “and other techniques” can be implemented in “hardware, software, or a combination thereof” and that “[t]he software codes may be stored in a memory unit...and executed by a processor”). These disclosures echo the disclosures in the ’842 patent, which simply states that various aspects “may be implemented in hardware or special purpose circuits, software....” EX1001, 76:37-43.

200. A POSITA would have been motivated and found it obvious to implement Galda’s spreading, mapping, modulation, and cyclic prefix appending functions (among others) in a software radio (including code in memory and a processor coupled to memory to execute the code) rather than in specialized

hardware. In particular, the use of software and corresponding memory would have resulted in a more flexible system that could be modified and redesigned more easily.

201. Moreover, implementing Galda's OFDM transmitter using software and corresponding memory merely represented a simple substitution of one known element (a software-based transmitter) for another (hardware implementation of same) to obtain predictable results (the same functionality performed in software rather than hardware). Likewise, implementing Galda using software and memory merely required a predictable use of prior art elements (software-based transmitter components) according to their established functions (i.e., performing the same functions taught by Galda), and merely required applying a known technique (software implementation) to a known device (Galda's transmitter) ready for improvement (e.g., in the form of increased flexibility) to yield predictable results (a transmitter performing Galda's operations in software).

202. A POSITA also would have expected to succeed in making this combination. As I explain above, Galda discloses an OFDM transmitter and defines the various mathematical operations for each of the components. Implementing these mathematical operations in software would have required only routine knowledge because software is especially well-suited for performing mathematical operations. Because ordinary artisans working in the field were aware that various transmitter functions may be implemented in either hardware or software (both well-known

alternatives) a POSITA would have reasonably expected in achieving a software implementation using instructions stored on a memory for execution by a processor.

B. Challenged Claims

1. Independent Claim 22

[Claim 22, 22Pre] An apparatus comprising:

203. Galda in view of Dowling teaches the preamble.

204. As explained above, Galda discloses an OFDM transmitter apparatus as discussed regarding Grounds 1-2, and Dowling discloses implementing an OFDM transmitter, receiver, and precoder as a hardware or software-based apparatus. EX1042-Dowling, 3:46-50; *see id.* at 5:66-6:1 (disclosing that the transmitter, receiver, and precoder may be implemented in hardware or software”); 21:62-64 (disclosing that the “present invention” is applicable to FFT based multicarrier modulation and OFDM systems).

205. Thus, Galda in view of Dowling teaches the preamble.

[22A] “a processor; and”

[22B] “a non-transitory memory coupled to the processor, the non-transitory memory including a set of instructions stored therein and executable by the processor to:”

206. Galda in view of Dowling teaches these limitations.

207. Specifically, Dowling discloses that various aspects of an OFDM transmitter including its modulation techniques “may be implemented as software modules which execute on a programmable processor architecture.” EX1042-

Dowling, 3:46-50; *see id.* at 5:66-6:1 (disclosing that the transmitter, receiver, and precoder may be implemented in hardware or software”); 21:62-64 (disclosing that the “present invention” is applicable to FFT based multicarrier modulation and OFDM systems).

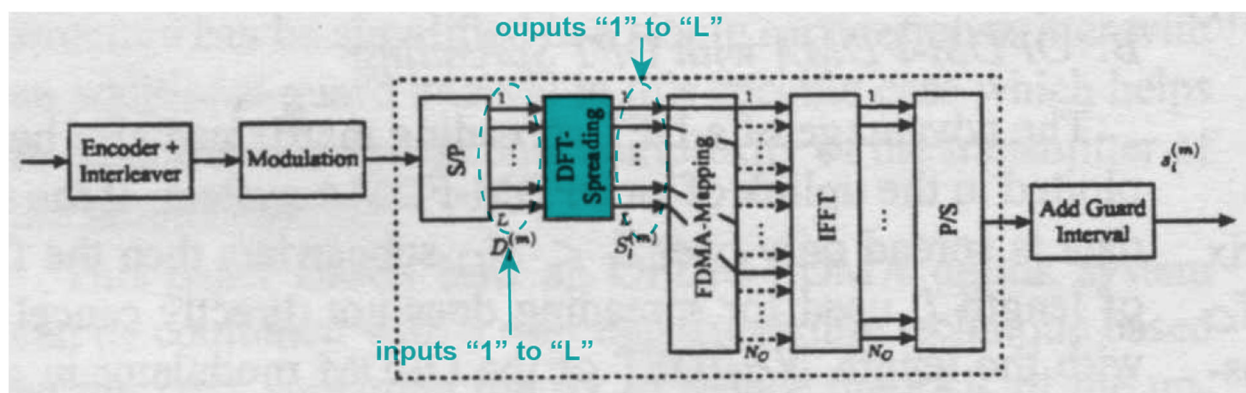
208. In a software implementation, software is stored in memory, and is provided from memory to a processor for execution. A POSITA would have known that “software radios” were implemented by a processor executing code stored in memory, and that doing so provided desirable flexibility in design and the ability to update features of the radio as compared to hardware-only implementations that were more difficult to upgrade because they are fixed in silicon. EX1008-Chen (describing OFDM-CDMA software radio); EX1011-Walton, 0124-25 (explaining that modulation “and other techniques” can be implemented in “hardware, software, or a combination thereof” and that “[t]he software codes may be stored in a memory unit...and executed by a processor”). As I explained above, a POSITA would have found it obvious to implement Galda in software stored on memory for execution by a processor coupled to the memory as recited in claim 22.

209. Thus, Galda in view of Dowling teaches this limitation.

[22Bi] “for a set of data symbols, perform an N-point discrete Fourier transform (DFT) spreading on the set of data symbols to generate a plurality N of DFT-spread data symbols;”

210. Galda teaches this limitation for the reasons previously explained

regarding limitations 1A, 11A, and claim 2. This is illustrated, for example, in the annotated figure below, which shows that Galda's N-point DFT takes "L" symbols ($D_l^{(m)}$) as inputs and spread them to generate "L" spread data symbols ($S_l^{(m)}$) as outputs:



EX1004-Galda, 1740 (Fig. 6(a)).

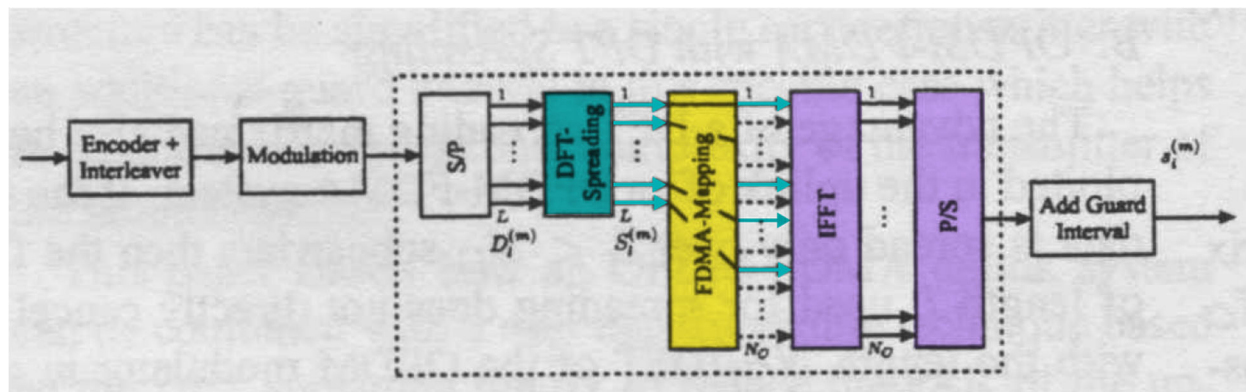
211. Thus, Galda teaches this limitation.

[22Bii] “map the N DFT-spread data symbols to at least N subcarriers of a plurality M of Orthogonal Frequency Division Multiplexing (OFDM) subcarriers to generate a set of complex subcarrier amplitudes; and”

212. Galda teaches this limitation for the reasons previously explained regarding limitations 1B, 11B, and claim 2.

213. More particularly, Galda discloses the claimed mapping because Galda maps N DFT-spread data symbols ($S_l^{(m)}$) to at least N subcarriers—specifically, to N subcarriers between 1 to N_C as shown by the solid and dashed lines in Galda's Fig. 6(a) below. The figure below illustrates that there are a total of N_C available subcarriers. In the annotated figure below, the blue lines have been added to more

clearly show the lines from the spreader that are mapped by the mapper to specific inputs to the IFFT in the ellipses between the subcarriers partially shown in Galda Fig. 6(a).



214. Galda's mapping also generates complex subcarrier amplitudes because DFT-spread (i.e., complex-valued) symbols are applied to N subcarriers. The result is that N subcarriers (L in Galda's nomenclature) to which the spread symbols are applied have a non-zero complex amplitude.

215. Thus, Galda teaches this limitation.

[22Biii] "perform an M -point inverse discrete Fourier transform (IDFT) on the set of complex subcarrier amplitudes to generate a time-domain sequence to be transmitted into a wireless channel, the time-domain sequence comprising a superposition of the OFDM subcarriers,"

216. Galda teaches this limitation for the reasons previously explained regarding limitation 1C and claim 2.

217. More particularly, Galda discloses performing an M -point IDFT on the complex subcarrier amplitudes discussed above, because Galda's IFFT is a well-

known type of IDFT that converts complex subcarrier amplitudes from the frequency domain to the time domain, resulting in a time-domain sequence that comprises a superposition of OFDM subcarriers for transmission into a wireless channel, as previously explained.

218. Thus, Galda teaches this limitation.

[22Biv] “wherein the N-point DFT spreading is configured to provide the superposition with a reduced peak-to-average power ratio.”

219. Galda teaches this limitation for the reasons previously explained regarding limitation 1D. Indeed, Galda discloses that an N-point DFT spreading step substantially reduces PAPR. EX1004-Galda, 1737, 1739-41.

220. Thus, Galda teaches this limitation, and Galda in view of Dowling renders obvious claim 22.

2. Dependent Claims

[Claim 25] “The apparatus recited in claim 22, wherein $M > N$.”

221. Galda teaches this limitation for the reasons explained above regarding claim 2. Specifically, Galda discloses $M > N$ because $N_C > L$.

222. Thus, Galda teaches this limitation and Galda in view of Dowling renders obvious claim 25.

[Claim 26] “The apparatus recited in claim 22, wherein the IDFT comprises an inverse fast Fourier transform.”

223. Galda teaches this limitation for the reasons explained above regarding

claim 3. Specifically, Galda's IDFT is an IFFT.

224. Thus, Galda teaches this limitation and Galda in view of Dowling renders obvious claim 26.

[Claim 28] “The apparatus recited in claim 22, wherein the non-transitory memory further comprises instructions to append at least one of a cyclic prefix, a postfix, and a guard interval to the time-domain sequence.”

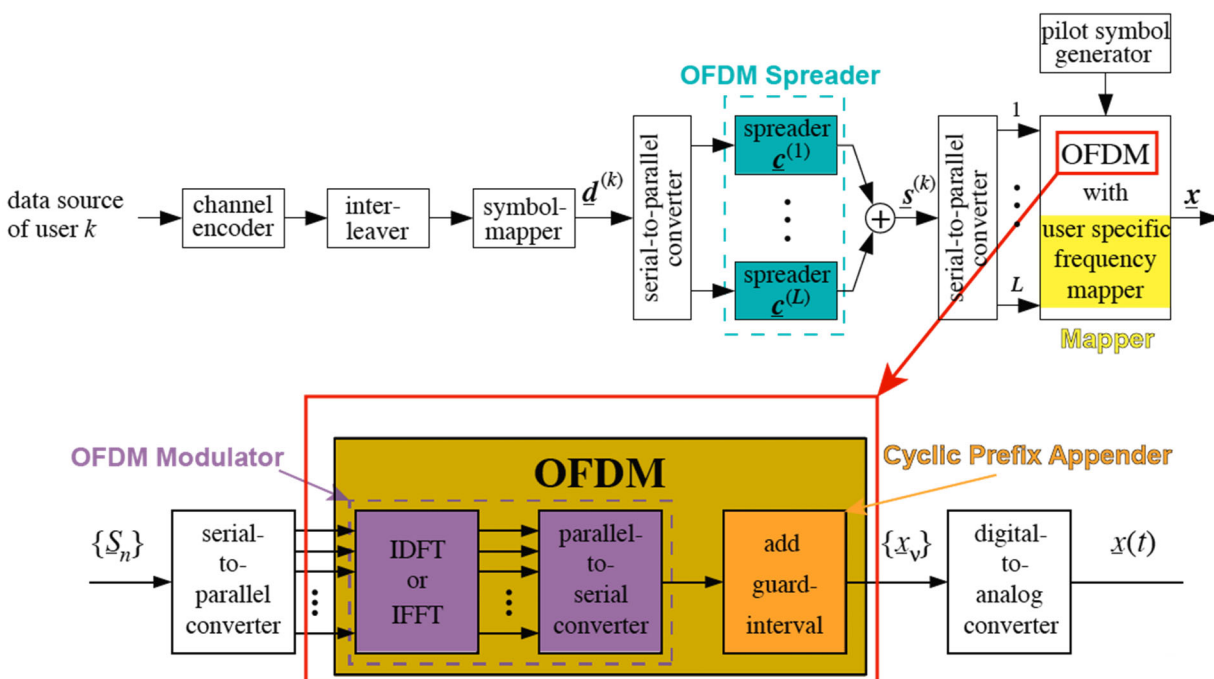
225. Galda teaches this limitation for the reasons explained above regarding claim 7.

226. Thus, Galda teaches this limitation and Galda in view of Dowling renders obvious claim 28.

XI. GROUND 5: Claims 1-3, 7-8, 11, and 17-18 are obvious over Kaiser in view of Bury

A. Reasons for Combining Prior Art

227. Kaiser discloses most limitations of the Challenged Claims. Below, the combined, annotated, and labeled figure illustrates Kaiser's OFDM transmitter (“SS-MC-MA transmitter” shown in Kaiser's Figure B.2), OFDM spreader, mapper (i.e., “user specific frequency mapper”), and OFDM modulator (including an IDFT or IFFT) for generating an OFDM transmission signal, and a cyclic prefix appender:



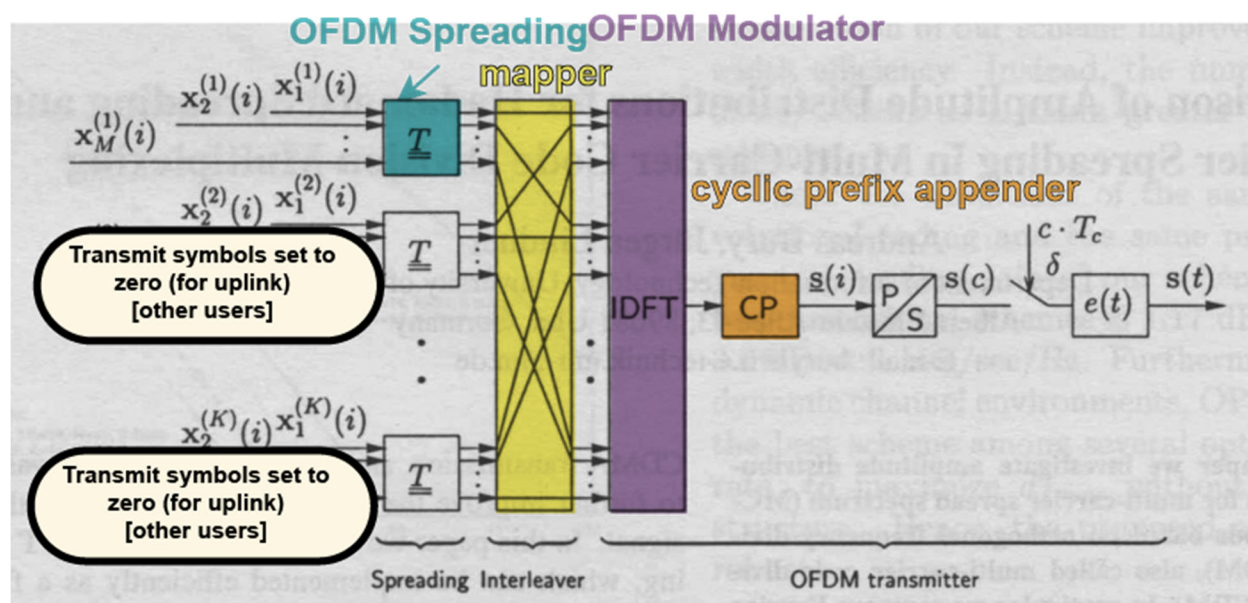
EX1005-Kaiser, 34, 132 (Figures B.2 & 3.2 (combined, annotated)).

228. Kaiser teaches that “OFDM with guard interval is applied in SS-MC-MA systems”—like that shown in Kaiser Figure B.2—“in the same way as in MC-CDMA systems, cf. Section 3.1.1.” EX1005-Kaiser, 133. Thus, a POSITA would have understood that the “OFDM” block Kaiser Figure B.2 has the functional blocks shown in §3.1.1, Figure 3.2.

229. Kaiser discloses an OFDM transmitter, but it discloses using Walsh-Hadamard spreading rather than DFT spreading. EX1005-Kaiser, 135 (“[A] block of 8 serial data symbols is parallel converted and spread with orthogonal Walsh Hadamard codes of length L ...”); 134 (Table B.1, “spreading code”: “Walsh Hadamard code”).

230. Bury discloses a multi-carrier code division multiplexing (MC-CDM) transmitter that is “valid for both[] MC-CDMA and MC-FDMA” (which is called MC-SS-MA by Kaiser). EX1007-Bury, 857, 858.

231. Bury’s Fig. 1 discloses an uplink and downlink transmitter, and for the uplink only one user “K” has non-zero symbol values—the other transmit symbols are set to zero “thereby omitting the corresponding signal paths,” as shown below:



EX1007-Bury, 858 (Fig. 1(a) (annotated)).

232. As shown above, Bury’s transmitter has the same features as Kaiser’s including a spreader, mapper, OFDM modulator, and cyclic prefix appender.

233. Bury also recognizes that “Walsh-Hadamard spreading” was “commonly used” in MC-CDMA systems. EX1007-Bury, 857. However, Bury teaches that the use of “Fourier spreading” using a “discrete Fourier transform (DFT)

operation” materially improved PAPR performance as compared to Walsh-Hadamard codes.

234. For instance, using Kaiser’s MC-SS-MA (i.e., MC-FDMA) technique, “the PAPR remains nearly constant at a low level for all spreading factors.” EX1007-Bury, 860; *see id.* (“in the uplink Fourier spreading outperforms Hadamard spreading in most cases.”), (“For both up- and down-link Fourier spreading delivers a lower or equal PAPR. This superiority increases significantly for larger spreading factors. In the uplink, MC-FDMA (Kaiser’s MC-SS-MA) delivers lower PAPRs than MC-CDMA.”) Accordingly, Bury discloses that Fourier spreading is “the best choice” combined with MC-FDMA in the uplink. *Id.*

235. A POSITA would have been motivated and found it obvious to apply Bury’s teachings to Kaiser in order to improve PAPR. This merely required applying DFT-spreading (Fourier spreading “implemented by” a DFT, EX1007-Bury, 857) instead of Kaiser’s Walsh-Hadamard codes in Kaiser’s spreader for uplink OFDM transmissions.

236. This would have been a simple modification. Kaiser and Bury discuss the same types of OFDM transmission systems (called MC-FDMA in Bury and MC-SS-MA in Kaiser, EX1007-Bury, 857), and Bury studied which spreading codes were better: the ones used by Kaiser or the DFT spreading codes recited in the claims and concluded that “the best choice” for uplink communications was to use Kaiser’s

transmission technique in combination with DFT (Fourier) spreading codes.

237. Thus, Bury provides an explicit motivation to combine Kaiser and Bury. Combining Kaiser and Bury merely required applying Bury's known Fourier spreading techniques to improve Kaiser's MC-SS-MA uplink transmitter by substituting Bury's Fourier spreading codes for Kaiser's Walsh-Hadamard codes, thereby improving Kaiser's uplink transmitter in the same way that it improved Bury's MC-FDMA transmitter.

238. A POSITA would have reasonably expected to succeed in using Bury's spreading codes in Kaiser's system because Bury explicitly says to use such spreading codes in the context of a system like Kaiser's and a POSITA would have understood that implementing DFT spreading codes would have merely required the use of a known mathematical technique to define the spreading codes to use (i.e., a DFT).

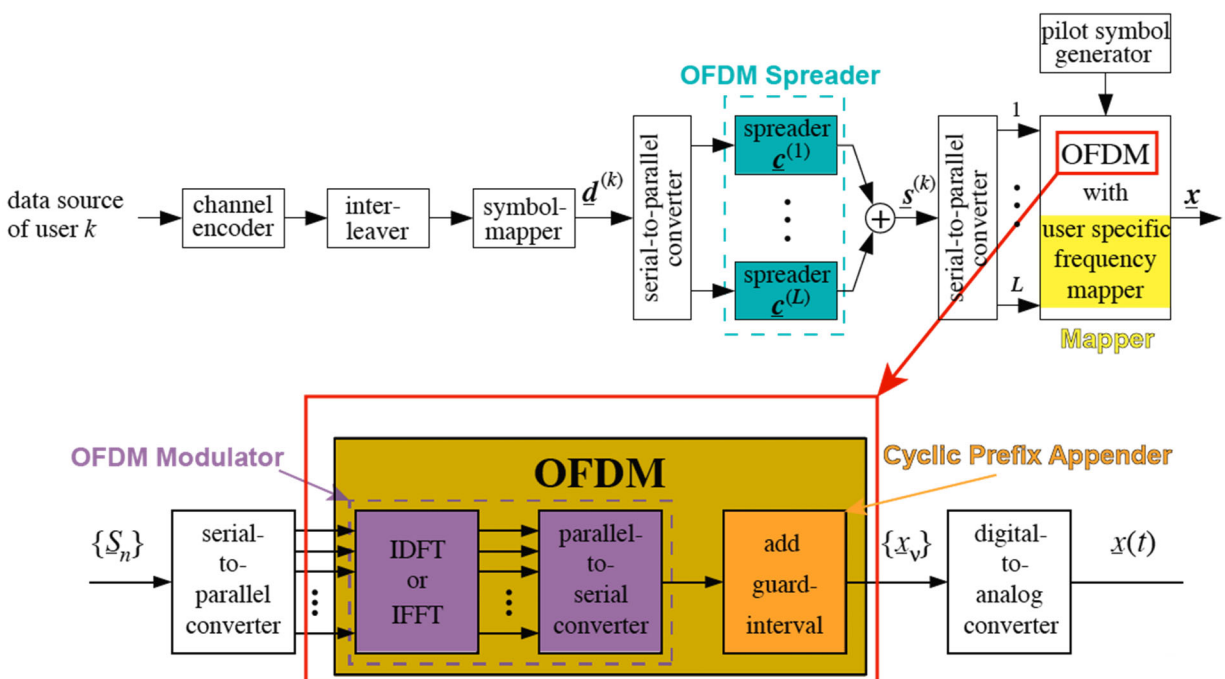
B. Challenged Claims

1. Independent Claim 1

[1Pre] "An OFDM transmitter, comprising:"

239. Kaiser in view of Bury teaches the preamble.

240. Kaiser discloses an OFDM transmitter:



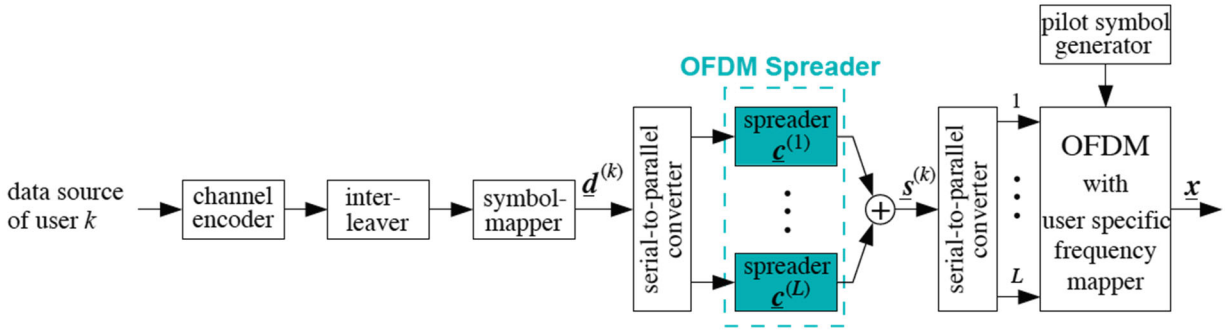
EX1005-Kaiser, Figs. B.2 & 3.2 (annotated). The figure above shows an “SS-MC-MA transmitter of the k th user for the uplink.” EX1005-Kaiser, 132.

241. Thus, Kaiser in view of Bury teaches the preamble.

[1A] “an OFDM spreader configured to spread a plurality of data symbols with Fourier coefficients to generate a discrete Fourier Transform (DFT)-spread data signal;”

242. Kaiser in view of Bury teaches this limitation.

243. Kaiser discloses an OFDM spreader, as shown below:



EX1005-Kaiser, 132.

244. Kaiser's OFDM spreader spreads data symbols using a spreading matrix to produce a spread signal:

In SS-MC-MA systems, L subsequent complex-valued data symbols $\underline{d}_l^{(k)}, l = 1 \dots L$, of user k are serial-to-parallel converted. The vector

$$\underline{d}^{(k)} = (\underline{d}_1^{(k)}, \underline{d}_2^{(k)}, \dots, \underline{d}_L^{(k)})^T \quad (B.1)$$

represents one block of L parallel converted data symbols of the k th user. Each of the L data symbols is multiplied with another orthogonal spreading code of length L . The $L \times L$ matrix

$$\underline{C} = (\underline{c}_1 \ \underline{c}_2 \ \dots \ \underline{c}_L) = \begin{pmatrix} \underline{C}_{1,1} & \underline{C}_{2,1} & \dots & \underline{C}_{L,1} \\ \underline{C}_{1,2} & \underline{C}_{2,2} & \dots & \underline{C}_{L,2} \\ \vdots & \ddots & \dots & \vdots \\ \underline{C}_{1,L} & \underline{C}_{2,L} & \dots & \underline{C}_{L,L} \end{pmatrix} \quad (B.2)$$

represents the L different spreading codes $\underline{c}_l, l = 1, \dots, L$, used by user k . The matrix $\underline{C}$ is the same for all users. The modulated spreading codes are data symbol and, thus, chip synchronously added, resulting in the transmission vector

$$\underline{s}^{(k)} = \underline{C} \underline{d}^{(k)} = (\underline{s}_1^{(k)}, \underline{s}_2^{(k)}, \dots, \underline{s}_L^{(k)})^T \quad (B.3)$$

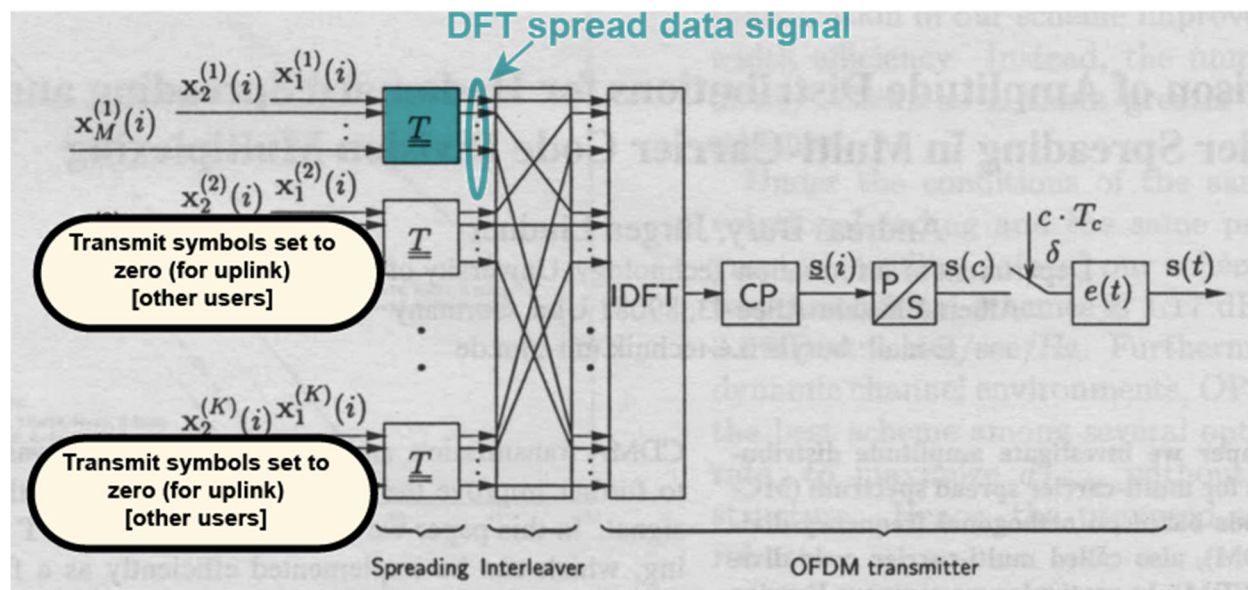
consisting of L components.

EX1005-Kaiser, 131-32; *see id.*, 130-31, 133-35, Fig. B.2.

245. The resulting signal is a spread signal $\underline{s}^{(k)}$.

246. As discussed above, Kaiser's spreading matrix uses Walsh-Hadamard codes. EX1005-Kaiser, 134. Thus, Kaiser does not describe spreading the data symbols with Fourier coefficients to generate a discrete Fourier Transform (DFT)-spread data signal.

247. However, as also discussed above, Bury teaches spreading data symbols with Fourier coefficients. EX1007-Bury, 857 (describing "Fourier spreading [3], which can be implemented by a discrete Fourier transform (DFT) operation"), 858 (explaining matrix $\underline{T}$ can be "a DFT"). Thus, Bury discloses generating a DFT spread data signal at the output of the spreader, as shown in the annotated version of Bury's Fig. 1 below:



EX1007-Bury, 858.

248. As Bury explains “[s]preading is done by transforming a vector of M symbols through a matrix $\underline{T}$,” where the matrix is orthogonal. EX1007-Bury, 857-58.

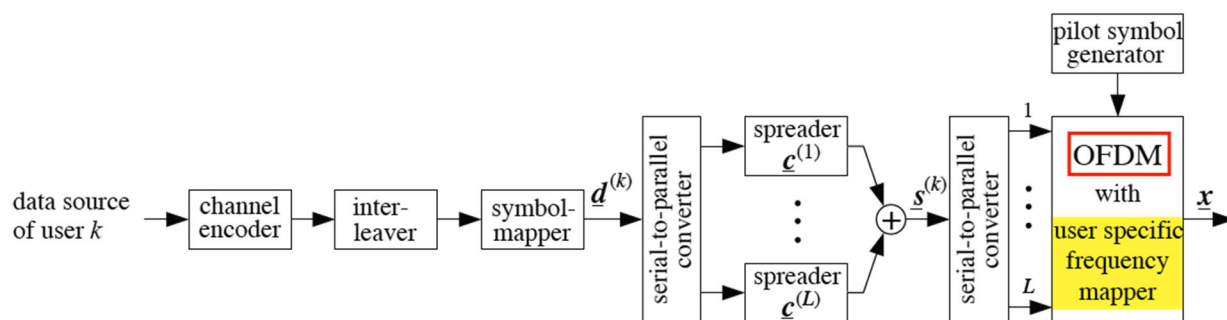
249. It was obvious to a POSITA to use Bury’s Fourier coefficients instead of Kaiser’s Walsh-Hadamard codes to generate a discrete Fourier Transform (DFT)-spread data signal because, among other reasons, Bury says this was “the best choice” for Kaiser’s uplink transmitter. EX1007-Bury, 860.

250. Thus, Kaiser in view of Bury teaches this limitation.

[1B] “a mapper configured to map the DFT-spread data signal to a plurality of OFDM subcarriers; and”

251. Kaiser in view of Bury teaches this limitation.

252. Kaiser discloses a mapper (yellow):



EX1005-Kaiser, 132, Fig. B.2.

253. Kaiser further explains that the user-specific frequency mapping element maps spread data signal ($s^{(k)}$) to a plurality of OFDM subcarriers:

Comparable to the frequency interleaving in MC-CDMA systems, the SS-MC-MA transmitter performs a user specific frequency mapping [KaF97b] such that subsequent components of $\underline{s}^{(k)}$ are interleaved and mapped to subcarriers with maximum distance. The subcarriers of the different subsystems are chosen such that each subsystem exploits the whole transmission bandwidth. The user specific frequency mapping assigns each subsystem and, hence, each user exclusively its L subcarriers, avoiding MAI.

EX1005-Kaiser, 132.

254. As one example, Kaiser discloses mapping spread symbols of a user's data signals to $L=8$ subcarriers (out of an available $N_C=256$ total subcarriers).

EX1005-Kaiser, 134-135. Figure B.4 illustrates “3 of the 8 subcarriers used by the k th user:”

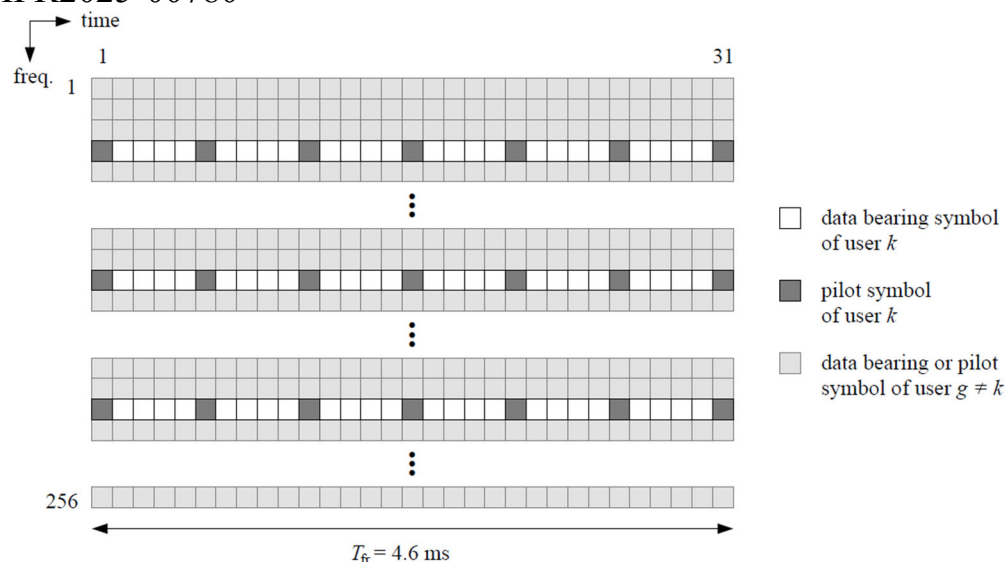


Figure B.4: OFDM frame of the proposed SS-MC-MA mobile radio system; $N_c = 256$; $N_s = 31$; $N_t = 5$; $N_{grid} = 1792$

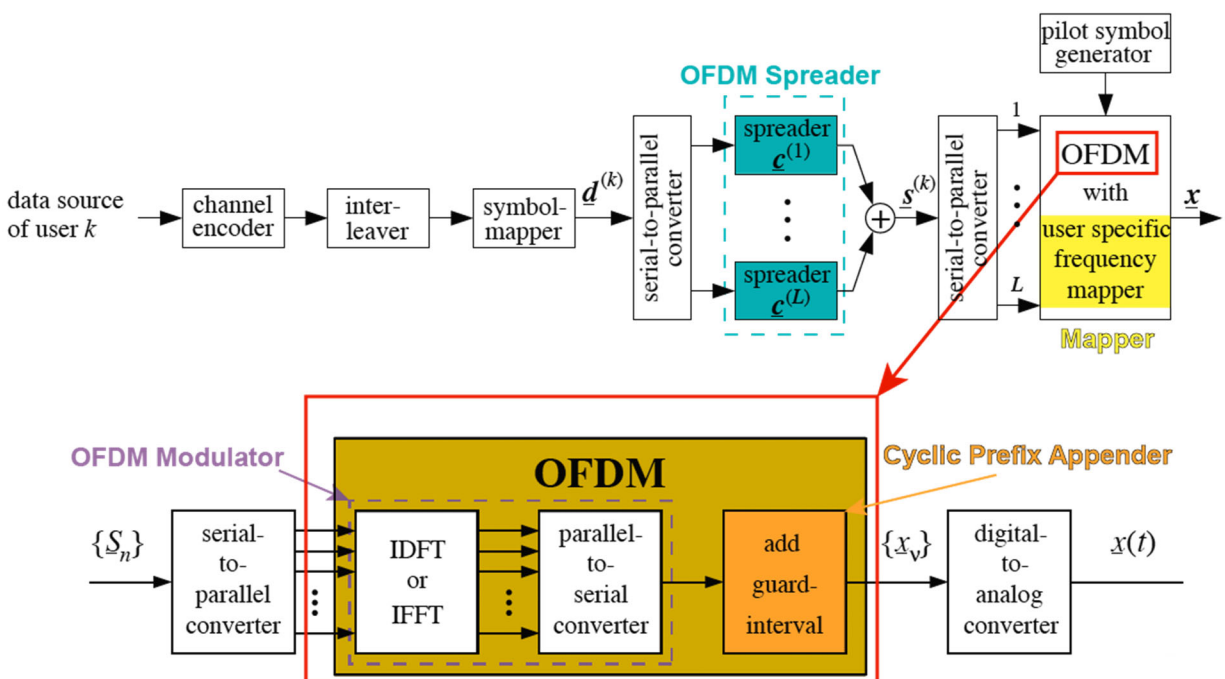
EX1005-Kaiser, 135 (Figure B.4).

255. Thus, Kaiser in view of Bury teaches this limitation.

[1C] “an OFDM modulator configured to modulate the DFT-spread data signal onto the plurality of OFDM subcarriers to produce an OFDM transmission signal comprising a superposition of the OFDM subcarriers,”

256. Kaiser in view of Bury teaches this limitation.

257. Specifically, Kaiser depicts an OFDM modulator in the figure below:



EX1005, 34, 132 (Figs. 3.2 & B.2 (annotated)).

258. The OFDM modulator depicted above includes the IDFT/IDFT and parallel-to-serial converter. As I previously noted, Kaiser’s “OFDM” block in Fig. B.2 uses the OFDM modulation techniques described in the earlier section 3.1.1 (as thus illustrated in Fig. 3.2). EX1005-Kaiser, 133.

259. Kaiser’s OFDM modulator modulates a spread data signal (parallelized signal $\underline{s}^{(k)}$) onto the plurality of OFDM subcarriers to produce an OFDM transmission signal comprising a superposition of the OFDM subcarriers which is reflected by transmission signal labeled “ $\underline{x}$ ” in Kaiser’s Fig. B.2.

260. Kaiser’s OFDM modulator also produces an OFDM transmission signal comprising a superposition of the OFDM subcarrier at the output of the

parallel-to-serial converter. Kaiser explains:

[a] key advantage of using OFDM is that the MC [(multi-carrier)] modulation can be implemented in the discrete domain using an IDFT, or a more computationally efficient IFFT. [] When sampling the complex envelope $x(t)$ of an OFDM symbol at time instances t equal to $(v=1, \dots, N_C)$, the samples are

$$\underline{x}_v = \frac{1}{\sqrt{N_C}} \sum_{n=1}^{N_C} \underline{s}_n e^{j2\pi(n-1)(v-1)/N_C}, v = 1, \dots, N_C \quad (3.6)$$

and the sampling rate is N_C/T_s . The important result is that the sampled sequence $\{\underline{x}_v\}$, $v = 1, \dots, N_C$, is the IDFT of the source symbol sequence $\{\underline{s}_n\}$, $n = 1, \dots, N_C$.

EX1005-Kaiser, 32.

261. Here, I note that there appears to be no dispute that an OFDM signal is a superposition of subcarriers. EX1039, 10 (“A person of ordinary skill in the art at the time of the invention would understand that an OFDM signal is a superposition of subcarriers.”), (“If multiple symbols are input to the IFFT at the same time, the output discrete-time signal is a sum (i.e., a superposition) of the subcarriers modulated with their corresponding symbols. In short, superposition is the sum of the subcarrier frequencies at a given time.”)

262. Thus, Kaiser’s disclosure of inputting multiple (spread) symbols $\{\underline{s}_n\}$ into an IFFT (see EX1005-Kaiser, 34 (Fig. 3.2)) results in an output of a discrete time signal $\{\underline{x}_v\}$ that is a superposition of the subcarriers modulated with their

corresponding symbols. EX1005-Kaiser, 32, 34, 132-133.

263. Thus, Kaiser in view of Bury teaches this limitation.

[1D] “wherein the OFDM spreader is configured to provide the superposition with a reduced peak-to-average power ratio.”

264. Kaiser in view of Bury teaches this limitation.

265. As I explained above, Bury discloses DFT-spreading that significantly reduces PAPR in multi-carrier FDMA uplink transmissions as compared to Walsh-Hadamard spreading. EX1007-Bury, 860 (“For Fourier spreading ... the PAPR remains nearly constant at a low level for all spreading factors.... [I]n the uplink Fourier spreading outperforms Hadamard spreading in most cases.”), *id.* (“For both up- and downlink Fourier spreading delivers a lower or equal PAPR” with a “superiority” that “increases significantly for larger spreading factors.”)

266. Thus, Kaiser in view of Bury teaches this limitation and renders obvious claim 1.

2. Independent Claim 11

[Claim 11, 11Pre] “A method, comprising:”

267. Kaiser in view of Bury teaches a method, as discussed with respect to the limitations below.

[11A] “multiplying a plurality of data symbols by a discrete Fourier Transform (DFT) spreading matrix to produce a plurality of DFT-spread symbols;”

268. Kaiser in view of Bury teaches this limitation for the reasons explained

269. More particularly, Bury discloses that “[s]preading is done by transforming a vector of M symbols through a matrix $\underline{T}$,” and indicates that the matrix $\underline{T}$ can be “a DFT,” thereby disclosing a DFT spreading matrix. EX1007-Bury, 857-858. Spreading Kaiser’s data symbols $\underline{d}^{(k)}$ in view of Bury would have resulted in DFT-spread symbols (as opposed to Walsh-Hadamard spread data symbols $\underline{s}^{(k)}$). EX1005-Kaiser, 132.

270. Thus, Kaiser in view of Bury teaches this limitation.

[11B] “mapping the plurality of DFT-spread symbols to a plurality of OFDM subcarriers; and”

271. Kaiser in view of Bury teaches this limitation for the reasons explained above regarding limitation 1B. More particularly and as discussed above, Kaiser in view of Bury discloses spreading Kaiser’s signal $\underline{s}^{(k)}$ by Bury’s DFT matrix instead of Kaiser’s Walsh-Hadamard codes, which signal $\underline{s}^{(k)}$ includes DFT-spread symbols $\underline{s}_1^{(k)}, \underline{s}_2^{(k)}, \dots, \underline{s}_L^{(k)}$. EX1005-Kaiser, 132.

272. Thus, Kaiser in view of Bury teaches this limitation.

[11C] “modulating the plurality of DFT-spread symbols onto a plurality of OFDM subcarriers to produce a DFT-spread OFDM signal to be transmitted into a wireless channel, wherein the DFT-spread OFDM signal comprises a superposition of the OFDM subcarriers, and”

273. Kaiser in view of Bury teaches this limitation for the reasons explained above regarding limitation 1C. More particularly, Kaiser in view of Bury discloses

a DFT-spread OFDM signal because it includes Kaiser's data symbols spread by DFT-spreading codes (as in Bury) which are modulated using an IFFT. EX1005-Kaiser, 41, 132.

274. Kaiser in view of Bury also discloses a DFT-spread OFDM signal for transmission into a wireless channel because Kaiser discusses "an SS-MC-MA mobile radio system," and a POSITA would have understood that mobile radio systems transmit and receive signals over wireless channels. EX1005-Kaiser, 130, 133.

275. Thus, Kaiser in view of Bury teaches this limitation.

[11D] "wherein the DFT spreading matrix is configured to provide the superposition with a reduced peak-to-average power ratio (PAPR)."

276. Kaiser in view of Bury teaches this limitation for the reasons explained above regarding limitation 1D.

277. Thus, Kaiser in view of Bury teaches this limitation and renders obvious claim 11.

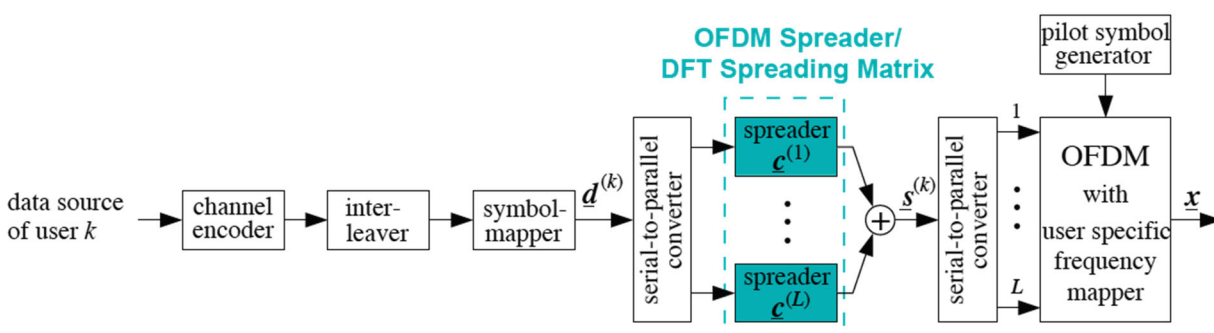
3. Dependent Claims

[Claim 2] "The OFDM transmitter recited in claim 1, wherein the OFDM spreader comprises an N-point DFT and the OFDM modulator comprises an M-point inverse discrete Fourier Transform, wherein $M > N$."

[Claim 18] "The method recited in claim 11, wherein the DFT spreading matrix comprises an N-point DFT, and the modulating comprises employing an M-point inverse-DFT, and wherein $N < M$."

278. Kaiser in view of Bury teaches claims 2 and 18.

279. Specifically, Kaiser describes an L -point spreader, and Kaiser in view of Bury's DFT receives vector $\underline{d}^{(k)} = \underline{d}_1^{(k)}, \underline{d}_2^{(k)}, \dots, \underline{d}_L^{(k)}$, which “represents one block of L parallel converted data symbols of the k th user.”



EX1005-Kaiser, 132, Fig. B.2 (annotated).

280. Kaiser's spreading matrix is a $L \times L$ matrix, and “is the same for all users.” EX1005-Kaiser, 132. Bury describes a DFT matrix with “ M ” inputs because it explains that “a vector of M symbols” is input into transform $\underline{T}$, and illustrates inputs 1 to M . EX1007-Bury, 857-858 (Fig. 1).

281. Thus, a POSITA would have understood that Kaiser in view of Bury discloses an OFDM spreader/DFT spreading matrix that uses an N -point DFT, where in Kaiser, the variable N (reflecting the total inputs into the spreader) is specified as L and in Bury, the variable N is specified by M .¹

¹ In Bury N is specified as “ M ” because M defines the number of symbols in a spreading group. EX1007-Bury, 858.

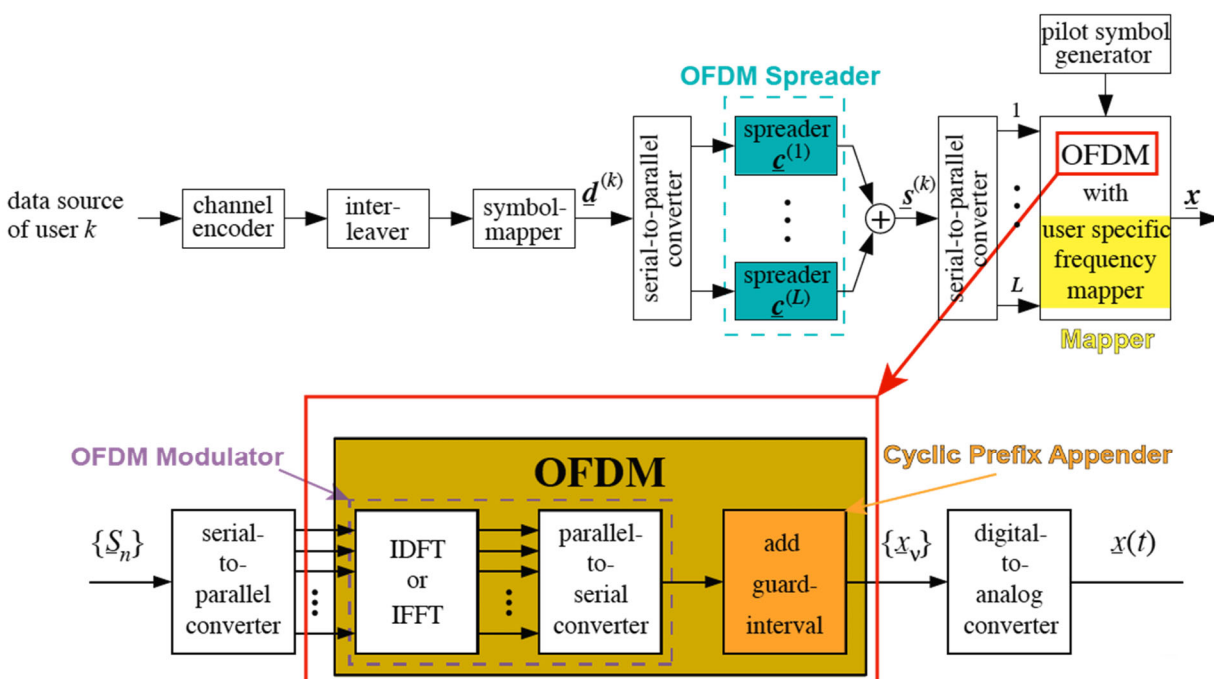
282. Kaiser's IFFT is an N_C -point IFFT, where N_C refers to the "number of subcarriers." EX1005-Kaiser, 140. For example, Kaiser's Table B.1 & Fig. B.4 disclose a 256-point IFFT ($N_C=256=M$) and an 8-point spreading matrix ($L=8=N$), such that $M>N$. EX1005-Kaiser, 134. Bury's IDFT has more inputs than the DFT matrix to accommodate the entire system bandwidth shared by all users. EX1007-Bury, 858 (Fig. 1).

283. Thus, Kaiser in view of Bury renders obvious claims 2 and 18.

[Claim 3] "The OFDM transmitter recited in claim 1, wherein the OFDM modulator comprises an inverse fast Fourier transform."

284. Kaiser in view of Bury teaches this limitation.

285. Specifically, Kaiser discloses an OFDM modulator with an IFFT, as shown in the annotated figure below:



286. Table B.1 in Kaiser further discloses an example in which a 256-point IFFT was used. EX1005-Kaiser, 134.

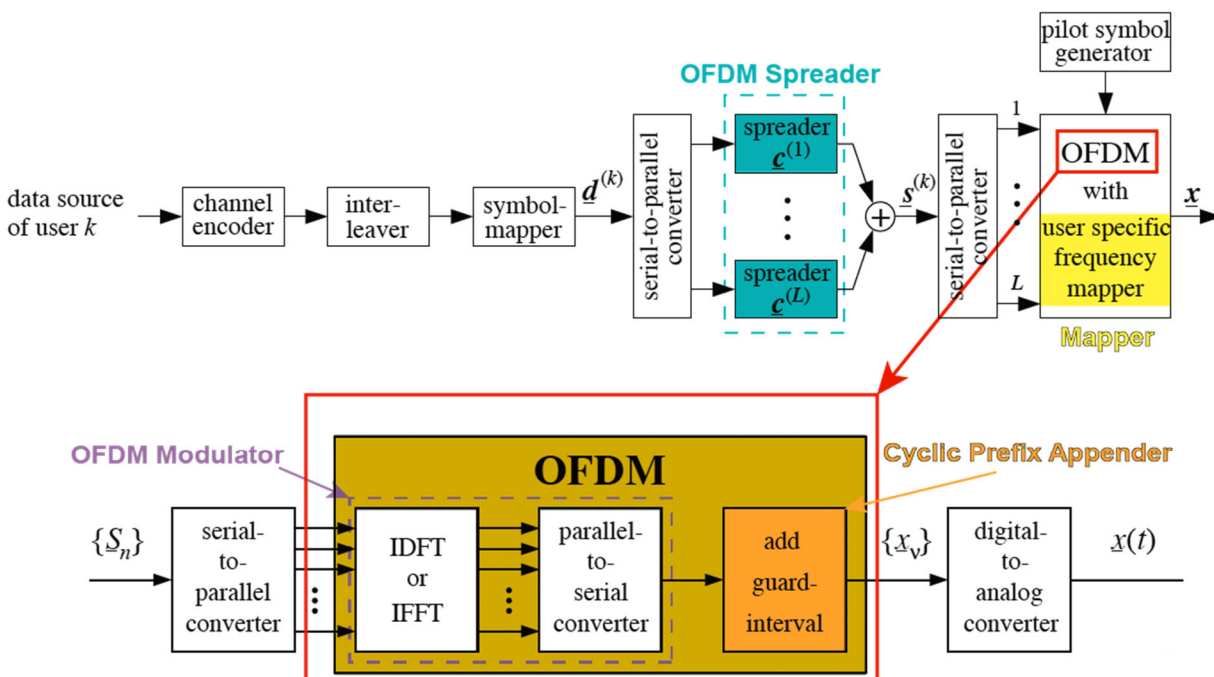
287. Thus, Kaiser in view of Bury renders obvious claim 3.

[Claim 7] “The OFDM transmitter recited in claim 1, further comprising a cyclic prefix appender configured to append at least one of a cyclic prefix, a postfix, and a guard interval to the OFDM transmission signal.”

[Claim 17] “The method recited in claim 11, further comprising appending at least one of a cyclic prefix, a postfix, and a guard interval onto the DFT-spread OFDM signal.”

288. Kaiser in view of Bury teaches claims 7 and 17.

289. Specifically, Kaiser in view of Bury discloses a cyclic prefix appender that was used to add a guard interval including a cyclic prefix to a DFT-spread OFDM signal:



EX1005-Kaiser, 34, 132 (Figs. B.2 & 3.2 (annotated), 133 (“OFDM with guard interval is applied in SS-MC-MA systems in the same way as in MC-CDMA systems, cf. Section 3.1.1.”), 33 (“[t]he guard interval is a cyclic prefix added to each OFDM symbol which is obtained by extending the duration of the OFDM symbol”); *see* EX1007-Bury, 859 (disclosing adding a cyclic extension in the transmitter).

290. Thus, Kaiser in view of Bury renders obvious claims 7 and 17.

[Claim 8] “The OFDM transmitter recited in claim 1, wherein the OFDM spreader is configured to provide channel precoding.”

291. Kaiser in view of Bury teaches this limitation.

292. As I noted above regarding Grounds 1-2, the ’842 patent says that spreading with a CI matrix is an example of precoding, and explains that such a matrix can include DFT spreading codes.

293. As detailed above relative to limitations 1A and 11A, Kaiser in view of Bury renders obvious a DFT spreader and DFT spreading data symbols before OFDM modulation, thereby disclosing that the spreader is configured to provide channel precoding in the context of the ’842 patent.

294. Thus, Kaiser in view of Bury renders obvious claim 8.

XII. GROUND 6: Claim 4 is obvious over Kaiser in view of Bury and Toshiba

A. Reasons for Combining Prior Art

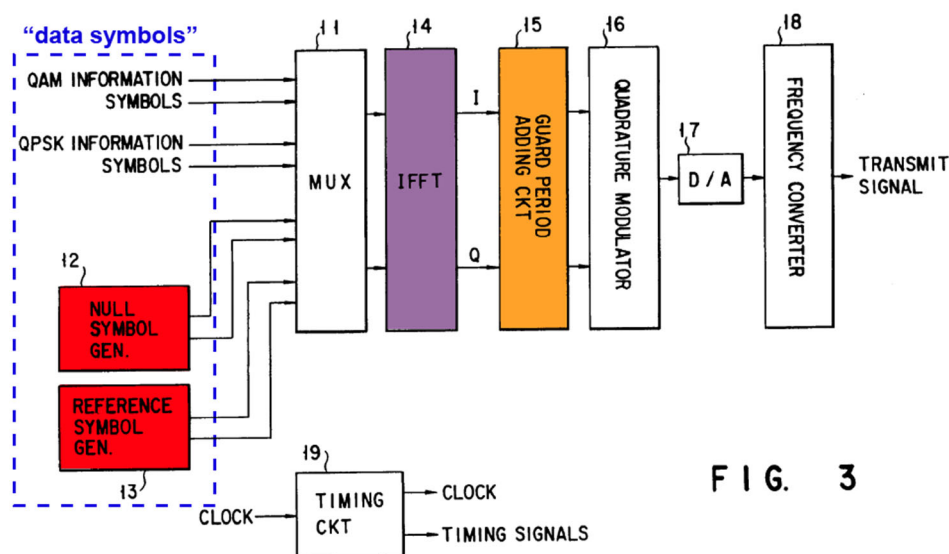
295. Kaiser and Bury do not describe “data symbols” comprising “reference-

signal symbols” (claim 4) or “data symbols” multiplexed (e.g., time-multiplexed) with “reference-signal symbols” (claim 9). However, these features are disclosed in Toshiba, as I explain above regarding Ground 3.

296. Although Kaiser and Bury do not mention “data symbols” that include “reference-signal symbols,” a POSITA would have understood that reference-signal symbols were commonly used in OFDM systems for performing necessary functions such as synchronization, timing, and properly demodulating received signals at a receiver.

297. Toshiba teaches the use of reference signal symbols including “null symbol data” and “reference symbol data” for these purposes. EX1041-Toshiba, 8:13-42. Toshiba’s null symbols are “used in the receiver as a reference symbol for timing synchronization,” while the “reference OFDM symbol[s]” have known phase and amplitude and are “used in the receiver as a synchronization reference symbol adapted to recognize the frame and as demodulation reference signals for demodulating the phase and amplitude of each carrier.” EX1041-Toshiba, 8:13-42.

298. Toshiba’s reference-signal symbols are multiplexed with other symbols before being OFDM modulated as shown below.



EX1041-Toshiba, FIG. 3 (annotated), 9:33-10:2.

299. Kaiser’s SS-MC-MA mobile radio system encodes data symbols using QPSK modulation. EX1005-Kaiser, 134. However, Kaiser also states that “progress in wireless communications entails a demand for higher data rates.” EX1005-Kaiser, 5. According to Kaiser, this demand can cause the system performance to suffer due to ISI unless an OFDM system is used. *Id.* As a reference, Kaiser cites to literature that discloses an OFDM system that uses QAM modulation. *Id.* Thus, a POSITA would have understood that higher order modulation schemes including QAM allowed higher data rates to be achieved. EX1041-Toshiba, 1:38-52 (explaining that digital television “needs a high transmission rate” and thus uses “multi-valued QAM” to modulate data for each carrier).

300. Kaiser also states that “[t]ime and frequency synchronization” are “perfect within this thesis” citing the literature for more information. EX1005-

Kaiser, 37. Thus, a POSITA would have investigated techniques for (1) increasing Kaiser's data rates and/or bandwidth efficiency, and (2) obtaining timing synchronization.

301. A POSITA considering ways to achieve these goals would have understood that Toshiba's OFDM transmission techniques accomplish both goals. EX1041-Toshiba, 2:5-13 (an "object of the invention" includes reducing the amount of reference data needed to successfully demodulate "multi-valued modulated symbols" thus "increasing data transmission efficiency"), 8:25-29 (using null symbols allows for achieving "time synchronization"); EX1005-Kaiser, 137 (disclosing that "high bandwidth efficiency" and "great flexibility" are achieved).

302. A POSITA also would have understood from Toshiba that demodulating QAM-modulated symbols required "reference symbols whose phase and amplitude are already known" and that sending "null symbols" facilitates "timing synchronization." EX1041-Toshiba, 1:53-56, 8:25-38. Toshiba further discloses time-multiplexing various types of data symbols: information symbols, null symbols, and reference symbols before OFDM modulation techniques are performed, as previously explained.

303. A POSITA also would have found it obvious in view of the teachings of Kaiser, Bury, and Toshiba to include training symbols (Toshiba's null symbols) and synchronization symbols (Toshiba's reference symbols) which are time

multiplexed when implementing Kaiser in view of Bury's DFT spreader, mapper, OFDM modulator, and guard interval appender. This was obvious to a POSITA because Kaiser assumes time synchronization, but merely refers to the literature about ways to achieve it, thus leading a POSITA to consider methods known in the art. EX1005-Kaiser, 37.

304. A POSITA also would have been motivated and found it obvious to time-multiplex Toshiba's reference-signals with Kaiser's data symbols before spreading and OFDM modulation because such a configuration is contemplated by Toshiba. EX1041-Toshiba, FIG. 3 (showing multiplexing before IFFT). Indeed, as I previously explained, it was at least obvious to try because there are only two ways to implement reference-signal symbols in the Kaiser-Bury, either by spreading them with other symbols or not.

305. A POSITA also would have been motivated and found it obvious to apply Toshiba's time-multiplexing of information, null, and reference symbols such that Kaiser's complex-valued data symbols ($\underline{d}^{(k)}$) includes each type of symbol. Doing so merely required combining prior art elements (various types of data symbols including reference-signal symbols) according to known methods (time-multiplexing them into a data stream) to achieve the predictable result of being able to use null symbols to achieve timing synchronization and reference symbols to be able to obtain phase and amplitude information and synchronization permitting

demodulation of QAM encoded information symbols as taught by Toshiba.

306. A POSITA would have recognized that modifying Kaiser-Bury in view of Toshiba in this way would have provided predictable benefits, including (1) providing a timing synchronization technique to Kaiser, which assumed perfect synchronization, and (2) allowing Kaiser to use QAM modulation, thus improving data rates.

307. Modifying the Kaiser-Bury combination with Toshiba also would have resulted in applying Toshiba's known technique of time-multiplexing information and reference-signal symbols before OFDM modulation to Kaiser's known OFDM transmitter, which was ready for improvement in the form of increased data rates and timing synchronization techniques. The combination would have produced the predictable result of having reference signal symbols embedded in the OFDM signal received at a receiver, thereby allowing for timing synchronization and demodulation of QAM modulated information symbols.

308. A POSITA would have reasonably expected to succeed in implementing the proposed combination. In particular, Toshiba teaches a known way to employ reference-signal symbols and uses them to obtain time synchronization and allow for demodulation of QAM modulated data symbols, thereby improving data rates, as previously explained.

309. A POSITA would have had no difficulty time-multiplexing various

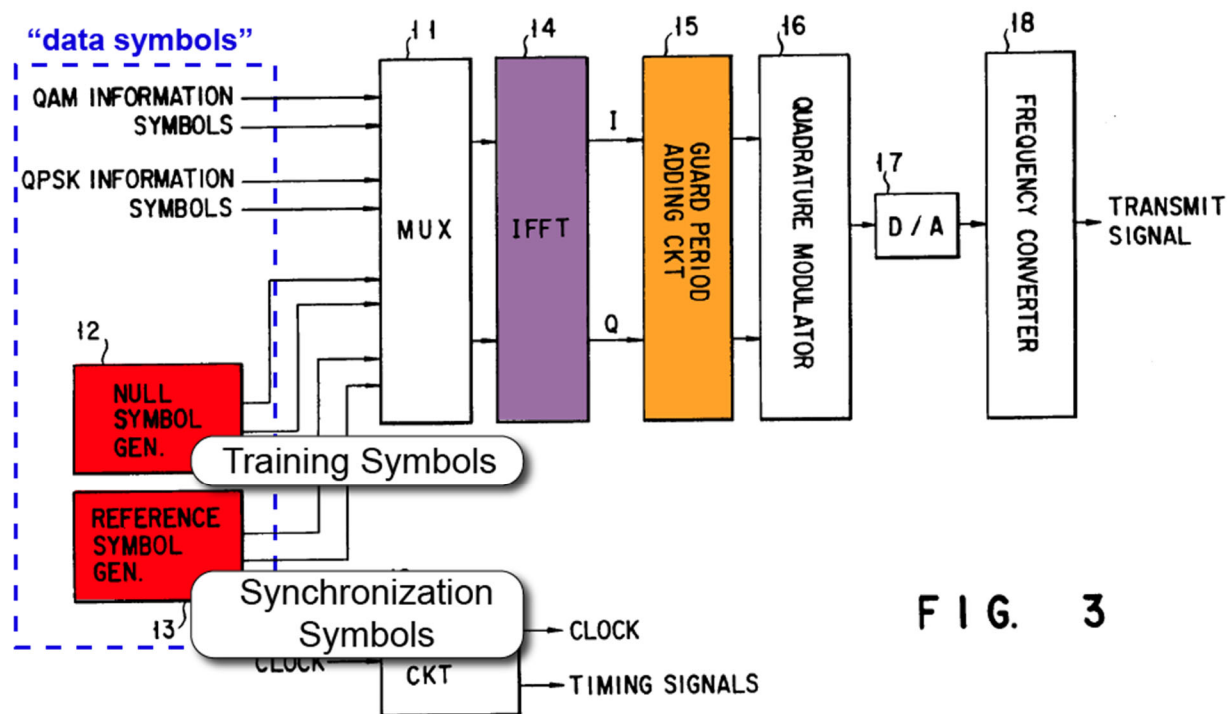
types of symbols together because the symbols vary only in the data that they contain and their ensuing use by the system. As explained above regarding Toshiba and Ground 3, Toshiba's symbols would all be operated on the same way mathematically to be DFT spread, mapped to subcarriers, and processed by an IFFT as part of modulating the output signal. These steps were understood by a POSITA and merely changing the data content and use of the symbols would have been viewed as a simple modification to Kaiser in view of Bury.

B. Challenged Claims

[Claim 4] “The OFDM transmitter recited in claim 1, wherein the data symbols comprise reference-signal symbols, which comprise at least one of known training symbols and synchronization symbols.”

310. Kaiser in view of Bury and Toshiba teaches this limitation.

311. Specifically, Kaiser discloses “complex-valued data symbols $\underline{d}^{(k)}$.” EX1005-Kaiser, 132. However, Kaiser does not describe “reference-signal symbols, which comprise at least one of known training symbols and synchronization symbols.” This is illustrated in the annotated version of Toshiba's FIG. 3, below.



EX1041-Toshiba, FIG. 3 (annotations and labels added).

312. An explanation of how Toshiba's "null symbols" are training symbols and how Toshiba's reference symbols are synchronization symbols in the context of the '842 Patent is provided above regarding Ground 3, claim 4. Toshiba discloses these symbols for the same reasons here, and thus Kaiser in view of Bury and Toshiba renders obvious claim 4 because it was obvious to modify Kaiser in view of Bury so that Kaiser's data symbols $\underline{d}^{(k)}$ comprise Toshiba's reference-signal symbols, for the reasons explained above.

313. Thus, Kaiser in view of Bury and Toshiba renders obvious claim 4.

[Claim 9] “The OFDM transmitter recited in claim 1, wherein the plurality of data symbols are at least one of time-multiplexed with reference-signal symbols, frequency-multiplexed with reference-signal symbols, and code-multiplexed with reference-signal symbols.”

314. Kaiser in view of Bury and Toshiba teaches this limitation.

315. As I previously explained, Toshiba discloses time-multiplexing data symbols (e.g., modulated “information symbols”) with reference-signal symbols (“null symbols” and “reference symbols”). In particular, for each OFDM frame transmitted in Toshiba, the null symbols are first, reference symbols are second, and then modulated information signals follow in subsequent time slots, as required by this claim.

316. For the reasons explained above, a POSITA would have found it obvious to modify Kaiser in view of Bury such that data symbols are time multiplexed with reference signal symbols (e.g., Toshiba’s null and reference symbols) based on Toshiba such that Kaiser’s data symbols $\underline{d}^{(k)}$ include information, null, and reference symbols as described by Toshiba.

317. Thus, Kaiser in view of Bury and Toshiba renders obvious claim 9.

XIII. GROUND 7: Claims 22, 25-26, 28 are obvious over Kaiser in view of Bury and Dowling

A. Reasons for Combining Prior Art

318. Ground 7 relies on Kaiser in view of Bury and Dowling and addresses claims 22, 25-26, and 28. These claims require a processor and memory, as

previously discussed above regarding Ground 4.

319. More particularly, Kaiser suggests that at least some of the transmitter structure is implemented in hardware. EX1005-Kaiser, 137. Bury is silent as to whether its transmitter is implemented in hardware or software. It would have been obvious to implement the combined Kaiser-Bury OFDM transmitter discussed above relative to Ground 5 in computer instructions stored in memory (e.g., software) that are executed by a processor coupled to the memory based on Dowling.

320. Dowling explains that various aspects of an OFDM transmitter “may be implemented as software modules which execute on a programmable processor architecture.” EX1042-Dowling, 3:46-50; *id.* at 5:66-6:1 (disclosing that the transmitter, receiver, and precoder may be implemented in hardware or software”); 21:62-64 (disclosing that the “present invention” is applicable to FFT based multicarrier modulation and OFDM systems).

321. As I explain above relative to Ground 4, in software implementations the software is stored in memory and is provided from memory to a processor when executed. EX1008-Chen (describing OFDM-CDMA software radio); EX1011-Walton, 0124-25 (explaining that modulation “and other techniques” can be implemented in “hardware, software, or a combination thereof” and that “[t]he software codes may be stored in a memory unit...and executed by a processor”).

322. A POSITA also would have been motivated to implement the Kaiser-

Bury transmitter including functions of spreading, mapping, modulation, and cyclic prefix appending functions (among others) in a software radio (including code in memory and a processor coupled to memory to execute the code). Implementing Kaiser in view of Bury in this fashion per Dowling, rather than in specialized hardware, would merely have required the simple substitution of one known element (a software-based transmitter) for another (hardware implementation of same) to obtain predictable results (the same functionality performed in software rather than hardware).

323. Likewise, as previously explained in Ground 4, this modification merely required the predictable use of prior art elements (software-based transmitter components) according to their established functions (i.e., performing the same functions taught by the combination of Kaiser and Bury). Similarly, a POSITA would have understood that this required mere application of a known technique (software implementation) to a known device (Kaiser's transmitter) ready for improvement to yield predictable results (a transmitter performing the combined Kaiser-Bury operations in software).

324. A POSITA also would have expected to succeed in making this combination. Kaiser discloses an OFDM transmitter and defines the various mathematical operations for each of the components. Implementing the required mathematical operations in software would have needed only routine knowledge

because software is well-suited for performing mathematical operations (e.g., DFT spreading, performing an IFFT, etc.). As I explain relative to Ground 4, a POSITA would have expected to succeed in using a software implementation given that implementing OFDM transmitter elements in software was well known in the field.

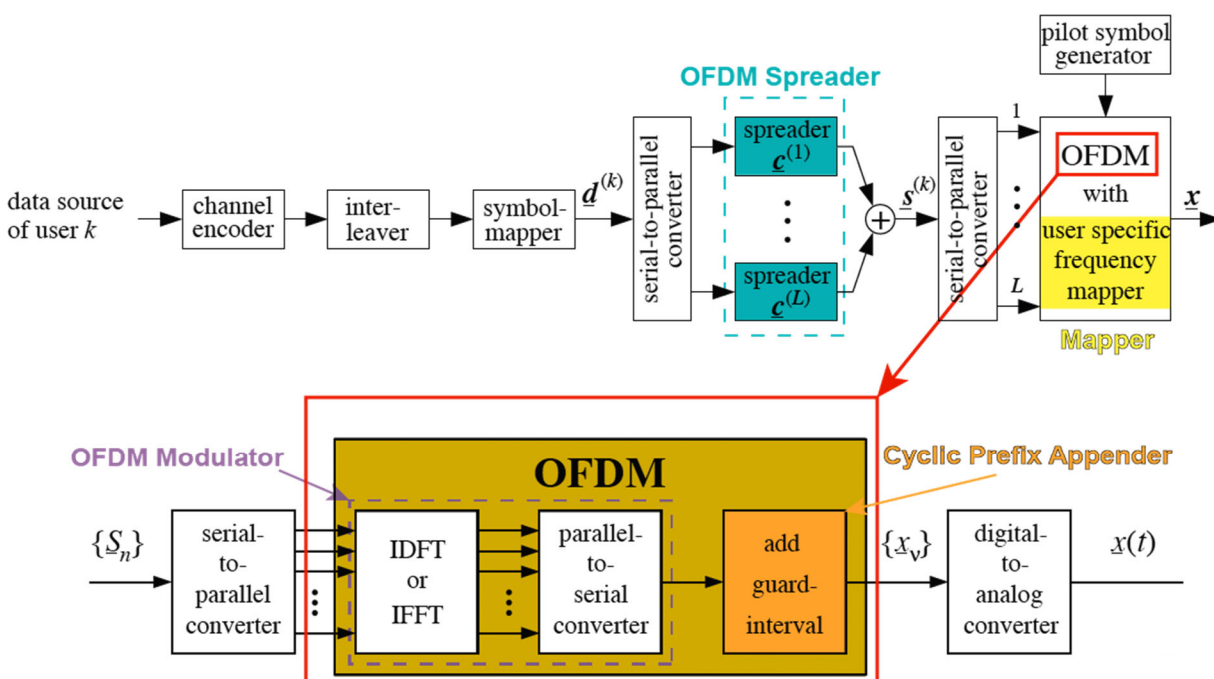
B. Challenged Claims

1. Independent Claim 22

[Claim 22, 22Pre] An apparatus comprising:

325. Kaiser in view of Bury and Dowling teaches the preamble.

326. Kaiser illustrates an OFDM transmission apparatus, as depicted below:



EX1005-Kaiser, 34, 132 (Figs. 3.2 & B.2 (annotated)).

327. Thus, Kaiser in view of Bury and Dowling teaches the preamble.

[22A] “a processor; and”

[22B] “a non-transitory memory coupled to the processor, the non-transitory memory including a set of instructions stored therein and executable by the processor to:”

328. Kaiser in view of Bury and Dowling teaches this limitation.

329. Dowling discloses multi-carrier transmitters having modulators, precoders, among other things, and further details that the disclosed transmitter and modulation techniques “may be implemented as software modules which execute on a programmable processor architecture.” EX1042-Dowling, 3:46-50; *id.* at 5:66-6:1 (disclosing that the transmitter, receiver, and precoder may be implemented in hardware or software”), 21:62-64 (disclosing that the “present invention” is applicable to FFT based multicarrier modulation and OFDM systems).

330. A POSITA would have understood that software represents computer instructions that are stored in memory and executed by a processor, these limitations merely represent a typical implementation in view of Dowling in which OFDM transmitter elements are implemented using a processor and memory. *See* EX1008-Chen; EX1011-Walton, 0124-25.

331. For the reasons already explained above and in Ground 4, a POSITA would have found it obvious to implement the combined Kaiser-Bury system in software stored in memory for execution by a processor coupled to the memory as recited in claim 22.

332. Thus, Kaiser in view of Bury and Dowling teaches these limitations.

[22Bi] “for a set of data symbols, perform an N -point discrete Fourier transform (DFT) spreading on the set of data symbols to generate a plurality N of DFT-spread data symbols;”

333. Kaiser in view of Bury and Dowling teaches this limitation for the reasons previously explained regarding limitations 1A, 11A, and claim 2.

334. More particularly, the Kaiser-Bury N -point DFT generates a plurality N of DFT-spread data symbols ($S_l^{(m)}$) because Kaiser in view of Bury would have DFT-spread “ L ” input data symbols ($D_l^{(m)}$) resulting in “ L ” outputs (in Bury’s nomenclature, “ M ” inputs and “ M ” outputs). EX1005-Kaiser, 34, 132 (Figs. 3.2 & B.2 (annotated above)).

335. Thus, Kaiser in view of Bury and Dowling teaches this limitation.

[22Bii] “map the N DFT-spread data symbols to at least N subcarriers of a plurality M of Orthogonal Frequency Division Multiplexing (OFDM) subcarriers to generate a set of complex subcarrier amplitudes; and”

336. Kaiser in view of Bury and Dowling teaches this limitation for the reasons previously explained regarding limitations 1B, 11B, and claim 2.

337. The Kaiser-Bury combination discloses and renders obvious the claimed function because the resulting combination *map[s] the N DFT-spread data symbols ($S_l^{(k)}$) to at least N subcarriers (i.e., a subset of subcarriers 1 to N_C based on Kaiser’s disclosure of a 256-point IFFT used in the OFDM modulator. EX1005-Kaiser, 132, 134, Figure B.4.*

338. Kaiser's mapping also results in generating complex subcarrier amplitudes because DFT-spread complex-valued data symbols in the combined Kaiser-Bury system are applied to N subcarriers, which then have a complex amplitude.

339. Thus, Kaiser in view of Bury and Dowling teaches this limitation.

[22Biii] “perform an M-point inverse discrete Fourier transform (IDFT) on the set of complex subcarrier amplitudes to generate a time-domain sequence to be transmitted into a wireless channel, the time-domain sequence comprising a superposition of the OFDM subcarriers,”

340. Kaiser in view of Bury and Dowling teaches this limitation for the reasons discussed above regarding limitations 1C, 11C, and claim 2.

341. More particularly, Kaiser in view of Bury discloses performing an M-point IDFT on the complex subcarrier amplitudes previously discussed in order to generate a time-domain sequence to be transmitted into a wireless channel. An IFFT is a well-known type of IDFT, and Kaiser uses such an IDFT to convert complex subcarrier amplitudes from the frequency domain to the time domain. EX1005-Kaiser, 32 (describing $\{\underline{x}_v\}$ as representing the complex envelope of source symbols). This results in a time domain sequence comprising a superposition of the OFDM subcarriers.

342. Thus, Kaiser in view of Bury and Dowling teaches this limitation.

[22Biv] “wherein the N-point DFT spreading is configured to provide the superposition with a reduced peak-to-average power ratio.”

343. Kaiser in view of Bury and Dowling teaches this limitation.

344. More particularly, as described above regarding the combination of Kaiser and Bury, Bury discloses that DFT spreading should be used to improve PAPR. EX1007-Bury, 857, 860.

345. Thus, Kaiser in view of Bury and Dowling teaches this limitation, and Kaiser in view of Bury and Chen renders obvious claim 22.

2. Dependent Claims

[Claim 25] “The apparatus recited in claim 22, wherein $M > N$.”

346. Kaiser in view of Bury and Dowling teaches this limitation for the reasons explained above regarding claim 2.

347. Thus, Kaiser in view of Bury and Dowling teaches this limitation and renders obvious claim 25.

[Claim 26] “The apparatus recited in claim 22, wherein the IDFT comprises an inverse fast Fourier transform.”

348. Kaiser in view of Bury and Dowling teaches this limitation for the reasons explained above regarding claim 3.

349. Thus, Kaiser in view of Bury and Dowling teaches this limitation and renders obvious claim 26.

[Claim 28] “The apparatus recited in claim 22, wherein the non-transitory memory further comprises instructions to append at least one of a cyclic prefix, a postfix, and a guard interval to the time-domain sequence.”

350. Kaiser in view of Bury and Dowling teaches this limitation for the reasons explained above regarding claim 7.

351. Thus, Kaiser in view of Bury and Dowling teaches this limitation and renders obvious claim 28.

XIV. DECLARATION IN LIEU OF OATH

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. If called to testify as to the truth of the matters stated herein, I could and would testify competently.

I declare under penalty of perjury that the foregoing is true and correct.

March 28, 2025

A handwritten signature in black ink, appearing to read "Harry Bims", written over a horizontal line.

Harry V. Bims, Ph. D.

Dr. Harry V. Bims
Protocomm Systems, LLC
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Mountain View, CA 94043
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650-283-4174

PROFESSIONAL SUMMARY

Harry Bims, PhD, EE, provides expert witness support services for telecommunications-related intellectual property litigation. These services include deposition and court testimony, expert reports, and infringement research, for patent, copyright, and trade secret litigation matters. He has 30+ years of telecommunications industry experience, and holds twenty-two US patents in network architecture and chip design for wireless communications.

EMPLOYMENT HISTORY

12/2001 - 05/2004 AirFlow Networks, Inc. • Sunnyvale, California

Position: *CEO/CTO & Founder*

As the sole founder of the company, created the original business plan, raised venture capital, and hired the core engineering team. Grew the company to 32 people and shipped products for revenue in the US and overseas. Fifteen patents on the core technology have issued. These patents, which relate to wireless network infrastructure based on the 802.11 specification, have been sold to Broadcom.

03/2001 - 12/2001 Bay Partners LLC • Cupertino, California

Position: *Entrepreneur in Residence*

Reported to the partners of this VC firm as a technology expert on a range of wireless and networking subjects. Reviewed business plans and participated in due diligence activities related to several startups seeking funding. Developed a business plan for a startup that builds network infrastructure for 802.11 enterprise networks.

09/1999 - 03/2001 Symmetry Communications Systems Inc • San Jose, California

Position: *Director, Software Architecture*

Reporting to the CEO, responsible for the software architecture of their core SGSN and GGSN products for the GPRS market. Formulated a software technology roadmap, showing the evolution from 2.5G to 3G SGSN and GGSN products. Management responsibility for Firmware, Hardware, Performance, and Systems Engineering Groups. Provided management support of early field trials of the system on a global basis.

07/1999 - 09/1999 **T-SPAN Systems Corporation • Palo Alto, California**

Position: *Member of Technical Staff*

Designed a wireless home LAN protocol for the company. Also designed and built a PC-based platform to demonstrate their technology. Company is now publicly traded as Atheros Communications.

07/1992 - 12/1998 **Glenayre Technologies-Wireless Access Group • San Jose, California**

Position: *Member of Technical Staff; Sr. Member of Technical Staff; Manager of NOC Systems*

Employee #6 at the company, which was acquired by Glenayre Technologies, Nov 1997. Designed and built a 4-channel ReFLEX50 pager demonstration in 1 week. Participated in early field trials and feasibility studies, culminating in a Pioneer's Preference license award from the FCC to SkyTel Corporation for Narrowband PCS development.

Invented, designed, and built from concept through full implementation, a patented two-way pager test system for the ReFLEX50 and ReFLEX25 protocols. This system was used throughout company operations for performance testing of the ReFLEX pager designs from Wireless Access, and Motorola. Over 16 systems were deployed around the country for manufacturing tests, engineering protocol tests, antenna tests, and pager repair tests.

The project required technical skills in PC hardware design, C++, object-oriented programming, signal processing techniques, NT device driver development, Win32 user interface development, real-time, multi-threaded control, and proficiency with wireless communications lab equipment. Three patents have been issued based on technical inventions in this capacity.

Co-developed a wireless application protocol for sending and receiving encrypted email messages over the paging channel. Led the project team that deployed a software encryption module based on this protocol for government agencies.

10/2012 – Present **BoughtStuff, Inc • Palo Alto, California**

Position: *Founder*

The company has developed a mobile application for storage and delivery of product information to smartphones over wireless networks.

Bims Laboratories, Inc Work History

6/2009 – 7/2009 **Eastman Kodak Company • Rochester, NY**

Position: *Technology Consultant*

Providing technology assessment on certain wireless communication patents.

10/2009 – 1/2017 **IEEE 802.16 Working Group**

Position: *Task Group Secretary, Task Group Vice-Chair, Task Group Chair, Working Group Vice-Chair & Secretary, IEEE 802.16 Expert*

Served in several leadership capacities within this group that is working on improvements to the IEEE 802.16 standard, otherwise known as WiMAX. The 802.16 Working Group entered hibernation on March 2018. From that time until the present, I am on the roster of Experts designated by the Chair to answer questions and provide clarification about the 802.16 standards.

2/2014 – Present **Access Network Protocol Development**

Position: *Technical Lead Developer*

Developing a C++17-based DES of SDRs for wired and wireless network protocols, that includes IMT-2020 channel models. Implementations of the IEEE 802 and LTE protocol families, plus PTP, PPoE, IPv6, digital cable, Bluetooth, DSL, frame relay and many other managed node models for smart grid and vertical IoT applications. Used for technical analysis of emerging wireless standards amendments.

Protocomm Systems, LLC Consulting History

04/1999–07/1999 **Gigabit Wireless, Inc. • San Jose, California**

Position: *Technical Leader*

Technical leader for the Wireless MAC design group. Responsible for

comparative analysis of competing wireless MAC protocol standards.
Responsible for the creation of a proprietary MAC protocol specification document, simulation of the protocol, and implementation in a prototype.
Participated in early 802.16 protocol standards. This company was acquired by Intel Corporation.

3/2007 – 10/2009 **Apple, Inc. • Cupertino, CA**

Position: *Technology Consultant*

Participating in IEEE 802.16 standards meetings as an affiliate of the client.

7/2003 – Present **Various expert witness engagements (see below)**

Position: *Technical Expert Witness*

Testified as a wireless technology expert in patent infringement cases. For a list of such cases, see below.

Technical Expert Witness Experience

10/2024 – Present **Fish & Richardson LLP (representing Apple)**

Case: Resonant Systems, Inc. d/b/a RevelHMI v. Apple Inc.

Civil Action No. 7:23-cv-00077-ADA

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS, MIDLAND-ODESSA DIVISION

Testifying expert in this patent case involving haptic technology

For Plaintiff:

For Defendant: Fish & Richardson, LLP

Attorneys:

Status: Case ongoing

03/2024 – Present **Client: Fish & Richardson, LLP (representing General Motors Company, and General Motors LLC (“GM”), Tesla Inc., and American Honda Motor Co., Inc., and Honda Development & Manufacturing of America, LLC (“Honda”))**

Client: DLA Piper LLP (representing Toyota Motor North America, Inc., Toyota Motor Sales, U.S.A., Inc., and Toyota Motor Engineering & Manufacturing North America, Inc., and Toyota Motor Credit Corporation (“Toyota”))

Client: Venable LLP (representing FCA US LLC)

Client: Brooks Kushman LLP (representing Ford Motor Co.)

Client: Jenner & Block LLP (representing Nissan North America Inc. and Nissan Motor Acceptance Corporation A/K/A Nissan Motor Acceptance Company LLC (“Nissan”))

Case: Neo Wireless, LLC v GM, Tesla, Honda, Toyota, FCA US LLC, Ford Motor Co., and Nissan, Civil Action No. 2:22-MD-03034-TGB (E.D. Mich)

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF MICHIGAN SOUTHERN DIVISION

Testifying expert in this District Court matter involving 5G communications.

Expert Report:

March 28, 2024 Opening Expert Report on Invalidity

April 25, 2024 Rebuttal Expert Report on Non-Infringement

May 23, 2024 Expert Deposition

Attorneys: For Plaintiff:

For Defendant: Fish & Richardson, LLP, DLA Piper LLP, Venable LLP, Brooks Kushman LLP, Jenner & Block LLP

Status: Case ongoing

3/2024 – Present **Client: Finnegan, Henderson, Farabow, Garrett, & Dunner, LLP (representing Motorola Mobility LLC)**

Case: Lenovo (UNITED STATES) Inc. and Motorola Mobility LLC (Petitioners) v. Headwater Research LLC. (Patent Owner)

IPR Petition relating to Headwater Research LLC v Motorola Mobility LLC and Lenovo (United States) Inc. Case No. 4:23-cv-04496-JST (N.D. Cal.)

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARDa

Testifying expert in these matters involving application-level prioritization across networks.

April 17, 2024 9,198,076	Expert Declaration ISO IPR Petition regarding US Patent
July 17, 2024 10,749,700	Expert Declaration ISO IPR Petition regarding US Patent
July 15, 2024 9,198,076	Expert Declaration ISO IPR Petition regarding US Patent
August 8, 2024	Expert Declaration regarding US Patent 9,198,076

Attorneys: For Patent Owner:
For Petitioner: Finnegan

Status: Case ongoing

2/2024 – Present **Client: Bookoff McAndrews LLP (representing Motorola Mobility, LLC)**

Case: Patent Litigation between Ericsson and Motorola/Lenovo in Colombia

Location Testifying expert in these matters involving 5G networking technology.

Expert Declaration:

March 4, 2024 (COLOMBIA) Non-Essentiality and Non-Infringement
Technical Opinion regarding CO38083

March 20, 2024 (COLOMBIA) Invalidity Technical Opinion regarding
CO38001

March 27, 2024 (COLOMBIA) Non-Infringement Technical Opinion regarding
CO38001

March 27, 2024 (COLOMBIA) Non-Infringement Technical Opinion regarding
CO36031

March 27, 2024 (COLOMBIA) Non-Infringement Technical Opinion regarding
CO37362

April 16, 2024 (COLOMBIA) Non-Infringement and Non-Essentiality
Technical Opinion regarding CO37550

April 19, 2024 (COLOMBIA) Non-Essentiality Technical Opinion regarding
CO38002

July 19, 2024 (COLOMBIA) Invalidity Technical Opinion Regarding
CO38457

Attorneys: For Plaintiff:

For Defendant: Bookoff McAndrews, LLP

Status: Case ongoing

2/2024 – Present **Client: Fish & Richardson, LLP (representing Lenovo (United States))**

Case: Certain Cellular Base Station Communication Equipment, Components Thereof,
and Products Containing Same

U.S. Int'l Trade Commission Inv. No. 337-TA-1388

U.S. Int'l Trade Commission Inv. No. 337-TA-1397

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –
Administrative Law Judge Hon. Bryan F. Moore

Testifying expert in this patent case involving 5G networking technology

August 7, 2024 Declaration Regarding Claim Construction

August 21, 2024 Rebuttal Declaration Regarding Claim Construction

September 10, 2024 Initial Expert Report Regarding Infringement and
Domestic Industry

September 25, 2024 Rebuttal Expert Report Regarding Validity

October 4, 2024 Expert deposition testimony

December 9-10, 2024 Live testimony at 1397 trial.

Attorneys: For Plaintiff:

For Defendant: Fish & Richardson

Status: ITC case ongoing

2/2024 – Present **Greenberg Traurig LLP (representing Samsung)**

Case: Samsung Electronics Co., Ltd., (Petitioner) v. Asus Technology Licensing Inc.
(Patent Owner), IPR2024-00614

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE
PATENT TRIAL AND APPEAL BOARD

Testifying expert in this patent case involving LTE networking technology

March 8, 2024: PTAB Declaration ISO IPR petition

August 12, 2024: PTAB Declaration ISO IPR petition – US Patent 10,785,759

Attorneys: For Patent Owner:
For Petitioner: Greenberg Traurig LLP
Status: Case ongoing

7/2022 – Present **Client: Fish & Richardson LLP (representing LG Electronics, Inc.)**

Case: LG Electronics, Inc. v Invention Investment Fund I, L.P., Invention Investment Fund II, LLC, Intellectual Ventures I, LLC, and Intellectual Ventures II, LLC., Civil Action No. N22C-11-145-SKR-CCLD

Location: SUPERIOR COURT FOR THE STATE OF DELAWARE

Testifying expert in these matters relating to a breach of a License Agreement

April 19, 2024: Opening Expert Report

October 10 – 15, 2024: Live trial testimony

Attorneys: For Plaintiff: Fish & Richardson LLP
For Defendant:
Status: Jury award

1/2024 – Present **Client: Kramer Levin Naftalis & Frankel, LLP (representing Acceleration Bay, LLC.)**

Case: Acceleration Bay, LLC v Amazon Web Services, Inc.
Civil Action No.: 22-904-RGA-SRF

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
– Hon. Richard G. Andrews

Testifying expert in this patent case involving internet data broadcasting.

Expert Declaration:

February 12, 2024: Expert Report Regarding Technology Tutorial of Asserted Patents

May 28, 2024 Live Deposition Testimony

September 23, 2024 Live trial testimony

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP
For Defendant: Fisch Sigler LLP
Status: Jury Award

12/2023 – Present **Kirkland & Ellis LLP (representing Motorola Mobility LLC & Lenovo)**

Case: Certain Mobile Phones, Components Thereof, and Products Containing the Same
U.S. Int'l Trade Commission Inv. No. 337-TA-1375

Certain Electronic Devices, including Mobile Phones, Tablets, Laptops,
Components Thereof, and Products Containing the Same
U.S. Int'l Trade Commission Inv. No. 337-TA-1376

Telefonaktiebolaget LM Ericsson v Lenovo (United States), Inc.
Civil Action No. 5:23-cv-569 (E.D.N.C.)

Lenovo (United States) v Telefonaktiebolaget LM Ericsson
Civil Action No. 5:23-cv-570 (E.D.N.C.)

IPR Petition Lenovo (United States) Inc. (Petitioner) v Telefonaktiebolaget LM
Ericsson (Patent Owner)

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION
Administrative Law Judge Hon. MaryJoan McNamara

Testifying expert in this patent case involving 5G networking technology.

March 15, 2024 IPR Declaration ISO Petition for IPR Review

April 30, 2024 Expert Report on Invalidity

May 14, 2024 Rebuttal Expert Report Regarding Non-Infringement

May 31, 2024 Deposition Testimony

July 12-15, 2024 Live Testimony at Trial

February 24, 2025 IPR Declaration ISO Petitioner's Reply to Patent Owner's
Response

Attorneys: For Plaintiff:

For Defendant: Kirkland & Ellis LLP

Status: Decision pending

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF
NORTH CAROLINA

Attorneys: For Plaintiff:

For Defendant: Kirkland & Ellis LLP

Status: Case ongoing

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF NORTH CAROLINA

Testifying expert in this patent case involving establishing point-to-point connections between mobile devices.

Attorneys: For Plaintiff: Kirkland & Ellis LLP

For Defendant:

Status: Case ongoing

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD
Case IPR2024-TBD

March 15, 2024: Declaration in support of Petition for IPR

Attorneys: For Petitioner: Kirkland & Ellis LLP

For Patent Owner:

Status: Case ongoing

12/2023 – Present **Fish & Richardson LLP (representing Reolink)**

Case: IPR Petition Shenzhen Reolink Technology Co., Ltd., Reolink Innovation Inc., Reolink Innovation Co., Ltd. (China) (Patent Owner) v Throughtek, Co., Ltd. (Patent Owner), Attorney Docket No. 52472-0005IP1

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

January 29, 2024: PTAB Declaration ISO IPR petition

Attorneys: For Patent Owner:

For Petitioner: Kirkland & Ellis LLP

Status: Case ongoing

7/2023 – Present **Client: Finnegan, Henderson, Farabow, Garrett, & Dunner, LLP (representing MediaTek)**

Case: U.S. Int'l Trade Commission Inv. No. 337-TA-1367

Certain Electronic Devices and Semiconductor Devices having Wireless Communication Capabilities and Components Thereof

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –

Administrative Law Judge Hon. Bryan F. Moore

Testifying expert in this patent case involving IEEE 802.11 technology.

Expert Reports:

January 18, 2024 Rebuttal expert Report regarding Non-infringement

Videotaped Deposition:

February 15, 2024 Videotaped expert deposition

ITC Trial testimony:

March 24, 2024 Non-infringement witness statement

Attorneys: For Plaintiff:

For Defendant: Finnegan

Status: ITC case ongoing

8/2023 – Present **Kirkland & Ellis LLP (representing TP-Link Technologies Co Ltd.)**

Case: U.S. Int'l Trade Commission Inv. No. 337-TA-1361

In the Matter of Certain Wi-Fi Routers, Wi-Fi Devices, Mesh Wi-Fi Network Devices, and Hardware and Software Components Thereof (ICC Case No. 27699/PDP)

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –
Administrative Law Judge Doris Johnson Hines

Testifying expert in these matters involving base station and wireless mesh technology.

November 9, 2023: Expert report concerning Invalidity

November 30, 2023: Expert rebuttal report on Non-Infringement and Technical Domestic Industry

January 22, 2023: Live testimony at ITC trial

Attorneys: For Plaintiff: LLP

For Defendant: Kirkland & Ellis LLP

Status: Trial verdict pending

5/2023 – Present **Client: Fish & Richardson LLP (representing Samsung Electronics, Co. Ltd.)**

Case: In the Matter of an Arbitration Pursuant to the Rules of the International Court of Arbitration of the International Chamber of Commerce (ICC Case No. 27699/PDP)

Location: INTERNATIONAL CHAMBER OF COMMERCE

Testifying expert in these matters involving international patent arbitration between Interdigital and Samsung.

January 8, 2024 Rebuttal expert report

June 18, 2024 Second expert report

Attorneys: For Plaintiff: Alston & Bird LLP

For Defendant: Fish & Richardson LLP

Status: Case ongoing

10/2022 – 2/2023 **Client: Finnegan, Henderson, Farabow, Garrett & Dunner LLP (representing Samsung Electronics, Co. Ltd.)**

Case: IPR Petition relating to Apex Beam Technologies, LLC v. Samsung Electronics, Co. Ltd., Civil Action No. 2:22-cv-00188)

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in these matters involving smart antenna technology.

February 27, 2023: Expert Declaration ISO petition for Inter Partes review

February 28, 2023: “Xia” Expert Declaration ISO petition for Inter Partes review

February 28, 2023: “Liu” Expert Declaration ISO petition for Inter Partes review

Attorneys: For Patent Owner:

For Petitioner: Finnegan, Henderson, Farabow, Garrett & Dunner LLP

Status: Case settled

7/2022 – Present **Client: Russ, August & Kabat LLP (representing Vivato, Inc.)**

Case: XR Communications, LLC d/b/a Vivato Technologies v D-Link Systems, Inc., Civil Action No. 8:17-cv-00596-DOC(JDE)

Location: UNITED STATES DISTRICT COURT FOR THE CENTRAL DISTRICT OF CALIFORNIA – Hon. David O. Carter

Testifying expert in these matters involving smart antenna technology.

Expert Declaration:

August 23, 2022: Rebuttal Expert Report on Validity

August 31, 2022: Deposition testimony

Attorneys: For Plaintiff: Russ, August & Kabat LLP

For Defendant:

Status: Case ongoing

6/2022 – 1/2024 Client: Fish & Richardson LLP (representing Samsung Electronics, Co. Ltd.)

Case: G+ Communications, LLC v Samsung Electronics Co. Ltd. et. al, Civil Action No. 2:22-cv-78

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS – Hon. Rodney Gilstrap

Testifying expert in these matters involving smart antenna technology.

March 13, 2023: Expert Declaration ISO Samsung Defendants' Claim Construction Proposals

June 28, 2023: Opening Expert Report on Invalidity

December 18, 2023: PTAB Declaration ISO IPR Petition

Attorneys: For Plaintiff: Russ, August & Kabat LLP

For Defendant: Fish & Richardson

Status: Jury trial verdict

5/2022 – 6/2023 Client: Kilpatrick Townsend LLP (representing Apple, Inc.)

Case: IPR Petition relating to Apple, Inc. v. Mullen Industries LLC, Civil Action No. 6:22-cv-00145

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in these matters involving remote notification devices.

August 8, 2022: Expert Declaration

May 23, 2023: Expert Deposition

Attorneys: For Patent Owner: Mintz, Levin, Cohn, Ferris, Glovsky, and Popeo, P.C.
For Petitioner: Kilpatrick Townsend LLP
Status: Case settled

3/2022 – 9/2023 **Client: Kirkland & Ellis LLP (representing Samsung Electronics Co. Ltd.)**

Case: California Institute of Technology v Samsung Electronics Co. Ltd., Civil Action No. 2:21-cv-00446

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS – Hon. Rodney Gilstrap

Testifying expert in these matters involving LDPC codes.

November 22, 2022: Declaration regarding claim construction

December 20, 2022: Rebuttal Declaration regarding claim construction

May 22, 2023: Rebuttal expert report on non-infringement

May 31, 2023: Deposition testimony

Attorneys: For Petitioner: Kirkland & Ellis LLP

For Plaintiff: Mintz, Levin, Cohn, Ferris, Glovsky, and Popeo, P.C.

Status: Case settled

2/2022 – 12/2022 **Client: Fish & Richardson LLP (representing Apple, Inc.)**

Case: Litigation between Ericsson and Apple in Belgium, Brazil, Germany, Netherlands, and Colombia, and US matters:

Ericsson Inc. et. al. v. Apple Inc., Civil Action No. 6:22-cv-00061-ADA

Ericsson Inc., et. al. v. Apple Inc., Civil Action No. 2:21-cv-00376

Apple Inc. v. Telefonaktiebolaget LM Ericsson, et. al., Civil Action No. 2:21-cv-00460

In the Matter of Certain Mobile Phones Tablet Computers, Smart Watches, Smart Speakers, and Digital Media Players, and Products Containing Same.

U.S. Int'l Trade Commission Inv. No. 337-TA-3596

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS WACO DIVISION – Hon. Alan D. Albright

UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS

UNITED STATES INTERNATIONAL TRADE COMMISSION

Testifying expert in these matters involving 5G networking technology.

Expert Declaration:

May 18, 2022 COLOMBIA: Invalidity and Non-Infringement Technical Opinion regarding certain Colombia patents

April 27, 2022 COLOMBIA: Invalidity and Non-Infringement Technical Opinion regarding certain Colombia patents #1

April 27, 2022 COLOMBIA: Invalidity and Non-Infringement Technical Opinion regarding certain Colombia patents #2

March 28, 2022 COLOMBIA: Invalidity and Non-Infringement Technical Opinion regarding certain Colombia patents

March 9, 2022 BRAZIL: Invalidity Technical Opinion regarding Brazil patents

May 26, 2022 BRAZIL: Response to Ericsson Statement regarding Brazil patents

August 25, 2022 BRAZIL: Live testimony before the Brazil Patent and Trademark Office regarding invalidity

November 15, 2022 (COLOMBIA) Invalidity and Non-Infringement Technical Opinion regarding CO37550

Attorneys: For Plaintiff:

For Defendant: Fish & Richardson, LLP

Status: Case settled

1/2022 – 3/2023 **Client: Finnegan LLP (representing Toyota Motor Corp., et. al.)**

Case: Intellectual Ventures I LLC, et. al. v. Toyota Motor Corp., et. al., Civil Action No. 2:21-cv-389

Toyota Motor Corp. (Petitioner) v. Intellectual Ventures II, LLC (Patent Owner)
Case No. IPR2022-01355

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS MARSHALL DIVISION –

UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this District Court and PTAB matter involving IEEE 802.11 wireless networking.

Expert Declaration:

January 13, 2023: Marshall Division Declaration on Invalidity

August 25, 2022: PTAB Declaration ISO Petition for IPR

April 8, 2024: PTAB Declaration ISO Petition for IPR2022-00973

Attorneys: For Plaintiff:

For Defendant/Petitioner: Finnegan, LLP

Status: Case settled

9/2021 – Present **Client: Schulte, Roth & Zabel LLP (representing TrackThings LLC)**

Case: TrackThings LLC v. NETGEAR, Inc. Civil Action No. 22-981-RGA-JLH

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

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Testifying expert in this District Court matter involving wireless network reconfiguration.

July 9, 2024 Expert Rebuttal report regarding Validity of US Patent Nos. 9,642,017, 9,332,442, and 10,107,893

August 15, 2024 Reply Expert Report regarding infringement

July 9, 2024 Rebuttal Expert Report regarding Validity

October 17, 2024 Deposition testimony

Attorneys: For Plaintiff: Schulte, Roth, and Zabel

For Defendant: Quinn Emanuel

Status: Case ongoing

9/2021 – Present **Client: Stroock LLP/Schulte, Roth & Zabel (representing TrackThings LLC)**

Case: TrackThings LLC v. Amazon.com, Inc. and Amazon.com Services LLC, and eero LLC., Civil Action No. 6:21-cv-00720; Civil Action No. 6:23-cv-00133-ADA

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS WACO DIVISION – Hon. Alan D. Albright

Testifying expert in this District Court matter involving wireless network reconfiguration.

March 17, 2023: Expert declaration ISO claim construction responses

February 24, 2023 Rebuttal Expert report regarding Validity
January 25, 2024 Expert report on Infringement
February 9, 2024 Expert report regarding Infringement
March 8, 2024 Rebuttal Expert report regarding Validity
March 29, 2024 Live deposition testimony
Attorneys: For Plaintiff: Schulte, Roth, and Zabel
For Defendant: Quinn Emanuel
Status: Case ongoing

12/2020 – Present **Client: BlankRome (representing Samsung Electronics Co., Ltd)**

Case: TOT Power Control, S.L. v. Samsung Elecs. Co., Ltd and Samsung Elecs. Am. Inc., Civil Action No. 1:21-cv-01305-MN

IPR Petition relating to TOT Power Control, S.L. v. Samsung Elecs. Co., Ltd and Samsung Elecs. Am. Inc., Civil Action No. 1:21-cv-01305-MN

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
– Hon. Maryellen Noreika

UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE
PATENT TRIAL AND APPEAL BOARD

Testifying expert in this district court and IPR proceeding involving power control methods in wireless systems.

September 12, 2022 Expert Declaration regarding IPR for 865 patent

August 23, 2024 Expert Report on Invalidity

October 1, 2024 Expert report on Non-infringement

October 22, 2024 Reply Expert Report on Invalidity

November 8, 2024 Live deposition testimony

Attorneys: For Plaintiff: DLA Piper
For Defendants: Blank Rome

For Patent Owner: Hausfeld, LLP

For Petitioner: Blank Rome

Status: Case ongoing

5/2024 – Present **Client: BlankRome (representing Samsung Electronics Co., Ltd)**

Case: Secure Wi-Fi LLC v. Samsung Elecs. Co., Ltd and Samsung Elecs. Am. Inc.,
Civil Action No. 2:24-cv-00047

IPR Petition relating to TOT Power Control, S.L. v. Samsung Elecs. Co., Ltd and
Samsung Elecs. Am. Inc., Civil Action No. 1:21-cv-01305-MN

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF
TEXAS

Testifying expert in this IPR proceeding involving randomizing MAC addresses in
Wi-Fi networks.

September 3, 2024 Expert Declaration regarding IPR for 384 patent

September 3, 2024 Expert Declaration regarding IPR for 005 patent

September 3, 2024 Expert Declaration regarding IPR for 552 patent

Attorneys: For Petitioner: Blank Rome, LLP

Status: Case ongoing

10/2021 – 5/2022 **Client: Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
(representing MediaTek Inc.)**

Case: NXP USA, Inc. v. MediaTek Inc., et. al., Civil Action No. 2:21-cv-000318-JRG –
Hon. Rodney Gilstrap

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF
TEXAS MARSHALL DIVISION

Testifying expert in this District Court matter involving 802.11n, 802.11ac, and
802.11ax chipsets.

Expert Report:

February 3, 2022 Declaration ISO Defendant's Claim Construction Brief

Attorneys: For Plaintiff: Duane Morris, LLP

For Defendant: Finnegan, LLP

Status: Case settled

09/2021 – 9/2024 **Client: Fish & Richardson, LLP (representing Samsung Electronics Co., Ltd., et. al.)**

Case: Smart Mobile Technologies, LLC v. Samsung Electronics Co., Ltd., et. al., Civil Action No. 6:21-cv-00701-ADA. Hon. Alan D. Albright

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS WACO DIVISION

Testifying expert in this District Court matter involving wireless voice and data transfer.

Expert Report:

June 8, 2022 Declaration ISO Defendant's Claim Construction Brief

Attorneys: For Plaintiff: Hagens Berman Sobol Shapiro, LLP

For Defendant: Fish & Richardson, LLP

Status: Case closed

05/2021 – 6/2021 **Client: Sidley Austin (representing HP Inc. and Microsoft Corporation)**

Case: SynKloud Technologies, LLC v. HP Inc., Civil Action No. 1:19-cv-01360-RGA and Microsoft Corporation v. SynKloud Technologies, LLC, Civil Action No. 1:20-cv-00007-RGA

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

Testifying expert in this District Court matter involving wireless cloud storage.

Expert Report:

June 25, 2021 Declaration ISO Microsoft and HP's Claim Construction Brief

Attorneys: For Plaintiff:

For Defendant: Sidley Austin

Status: Case settled

05/2021 – 5/2022 **Client: DLA Piper (representing Motorola Mobility LLC)**

Case: U.S. Int'l Trade Commission Inv. No. 337-TA-1253
Certain LTE-Compliant Cellular Communication Devices
Motorola v. Evolved Wireless LLC.

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –
Administrative Law Judge Cameron R. Elliot
Testifying expert in this ITC matter involving LTE cellular device handover.

Expert Report:

November 16, 2021 Expert Report on NonInfringement and Lack of Technical
Domestic Industry

Expert Testimony:

December 15, 2021 Deposition testimony

Attorneys: For Plaintiff: Nelson Bumgardner Albritton P.C.; Adduci, Mastriani &
Schaumberg, LLP

For Defendant: DLA Piper

Status: Case settled

04/2021 – 6/2022 **Client: Desmarais LLP (representing Google LLC and FitBit Inc.)**

Case: Cellspin Soft, Inc. v. Fitbit, Inc., No. 4-17-cv-05928-YGR

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF
CALIFORNIA

Hon. Yvonne Gonzalez Rogers

Testifying expert in this patent case involving the distribution of real-time health
data.

Expert Testimony:

October 29, 2021 Expert Report on NonInfringement

Attorneys: For Plaintiff: Garteiser Honea PLLC and Corcoran IP Law PLLC

For Defendant: Desmarais LLP

Status: Case settled. Summary Judgment for Non-Infringement.

3/2021 – 9/2021 **Client: Fish & Richardson (representing Samsung)**

Case: U.S. Int'l Trade Commission Inv. No. 337-TA-1248

Certain Cellular Communications Infrastructure Systems, Components Thereof,
and Products Containing Same

U.S. Int'l Trade Commission Inv. No. 337-TA-DN-3525

Certain Cellular Communications Infrastructure Systems, Components Thereof,
and Products Containing Same

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION

Testifying expert in this ITC matter regarding 3GPP technology.

Attorneys: For Plaintiff: Winston & Strawn, LLP

For Defendant: Fish & Richardson, LLP

Status: Case terminated in its entirety based on an Initial Determination.

2/2021 – 11/2021 **Client: Fish & Richardson (representing Quectel)**

Client: Axinn, Veltrop & Harkrider LLP (representing Thales DIS AIS USA, LLC)

Client: Pearl Cohen LLP (representing Telit)

Case: U.S. Int'l Trade Commission Inv. No. 337-TA-1240

Certain UMTS and LTE Cellular Communication Modules and Products
Containing the Same

Koninklijke Philips N.V. v Quectel Wireless Solutions Co. Ltd., Thales DIS AIS
Deutschland GmbH, Thales S.A., Telit Wireless Solutions, Inc., Telit
Communications PLC, CalAmp Corp, Xirgo Technologies, LLC, Laird
Connectivity, Inc., Thales DIS AIS USA LLC

Case No. 1:20-cv-1713 (D. Del)

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –
Administrative Law Judge Hon. David P. Shaw

Testifying expert on 3GPP mobile device operation.

Expert Testimony:

July 21, 2021 Expert Report on Invalidity

August 6, 2021 Deposition Testimony

October 12, 2021 Live Testimony before ALJ David P. Shaw

Attorneys: For Plaintiff: Mayer Brown LLP

For Defendants: Fish & Richardson; Axinn, Veltrop & Harkrider LLP

Status: Case closed

11/2020– Present **Client: Orrick, Herrington & Sutcliffe LLP (representing PayPal Holdings, Inc.)**

Case: IOENGINE LLC v PayPal Holdings, Inc.

Civil Action No. 1:18-cv-00452-WCB

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

Hon. William C. Bryson

Testifying expert in this patent case involving peripheral device communication to remote servers.

Expert Testimony:

November 19, 2021 Expert Report on Invalidity

January 7, 2022 Expert Report on Non-Infringement

January 20-21, 2022 Deposition Testimony on Invalidity and Non-Infringement

Status: Case ongoing

11/2020 – Present **Client: DLA Piper (representing Apple, Inc.)**

Case: Maxell v. Apple Inc. In the Matter of Certain Mobile Electronic Devices and Laptop Computers

U.S. Int'l Trade Commission Inv. No. 337-TA-1215

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –
Administrative Law Judge Hon. Dee Lord

Testifying expert on 3GPP mobile device operation.

Expert Testimony:

February 25, 2021: Opening Expert Report Regarding Invalidity

March 11, 2021: Rebuttal Expert Report regarding NonInfringement and Lack of Technical Domestic Industry

March 24, 2021: Videotaped deposition

Attorneys: For Plaintiff: Mayer Brown LLP

For Defendant: DLA Piper LLP

Status: Case settled

11/2020– 11/2020 **Client: Folio Law Group PLLC (representing Dali Wireless)**

Case: Dali Wireless, Inc. v. John Mezzalingua Associates, LLC d/b/a JMA Wireless and Teko Telecom SRL (an Italian Corporation)

Civil Action No. 19-2367-RGA

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

Testifying expert in this patent case involving distributed antenna system networks.

Expert Testimony:

November 6, 2020: Declaration Regarding Interpretation of Asserted Claims

Status: Case closed

8/2020– 8/2022 **Client: Folio Law Group PLLC (representing Dali Wireless)**

Case: Dali Wireless, Inc. v. Corning Optical Communications, LLC,

Civil Action No. 3:20-cv-06469-EMC

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF TEXAS – Hon. Edward M. Chen

Testifying expert in this patent case involving distributed antenna system networks.

Expert Testimony:

February 12, 2021: Declaration Regarding Interpretation of Asserted Claims

June 29, 2022: Expert Report on Infringement

August 22, 2022: Deposition Testimony

October 11, 2022: Supplemental Expert Report on Infringement

Status: Case closed

3/2020– 8/2021 **Client: Folio Law Group PLLC (representing Dali Wireless)**

Case: Dali Wireless, Inc. v. CommScope Technologies, LLC and CommScope Holding Company, Inc..

Civil Action No. 1:19-cv-00952-MN

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE – Hon. Maryellen Noreika

Testifying expert in this patent case involving distributed antenna system networks.

Expert Testimony:

June 23, 2021: Expert report on infringement.

August 17, 2021: CORRECTED Reply Expert report on infringement of '338 Patent

Status: Case closed

03/2020 – 8/2022 **Client: Sidley Austin LLP (representing Lenovo and Motorola)**

Case: InterDigital Technology Corporation, IPR Licensing, Inc., InterDigital Communications, Inc., InterDigital Holdings, Inc., and InterDigital, Inc. v. Lenovo Holding Company, Inc., Lenovo (United States) Inc., and Motorola Mobility LLC

Civil Action No. 19-1590-LPS

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
Hon. Leonard P. Stark

Testifying expert in this patent case involving 3G and 4G cellular standards.

Expert Testimony:

April 16, 2022 Expert report on Invalidity of '665 and '954 patents

June 16, 2022 Expert Report on Invalidity of 8,675,612 and 9,456,449 patents

June 16, 2022 Rebuttal Expert Report on Invalidity of 8,085,665 and 8,427,954 patents

July 17, 2022 Rebuttal expert report regarding non-infringement of '612 and '449 patents

July 18, 2022 Rebuttal expert report on non-infringement of '665 and '954 patents

August 8, 2022 Rebuttal Expert Report on Invalidity of '612 and '449 patents

August 31, 2022 Videotaped expert Deposition

Status: Case closed

3/2020– 5/2022 **Client: Finnegan, Henderson, Farabow, Garrett & Dunner LLC (representing Google)**

Case: IPR Petition Google LLC, v. Sonos, Inc., Case No. IPR2021-01563

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE
PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving wireless home speaker
systems.

Expert Testimony:

September 27, 2021: Declaration ISO petition for Inter Partes Review

May 10, 2022: Supplemental declaration ISO petition for Inter Partes Review

June 29, 2022: Videotaped deposition testimony

Status: Case closed

08/2019 – 6/2021 **Client: Fish & Richardson (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Cisco, Inc.

Civil Action No. 5:17-cv-00072-BLF-SVK

Location: UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF
CALIFORNIA SAN DIEGO DIVISION – Hon. Susan Van Keulen

As a testifying expert, provided a technology tutorial in this patent case involving
internet security technology.

Expert Testimony:

August 14, 2019 Tutorial expert report on network security technology.

September 4, 2019 Deposition Testimony

Attorneys: For Plaintiff: Fish & Richardson

For Defendant:

Status: Case settled

8/2019 – 5/2020 **Client: Fish & Richardson (representing LG Electronics, Inc.)**

Case: Bell Northern Research, LLC v. LG Electronics, Inc., et. al.

USDC-SDCA Civil Action No. 18-cv-2864-CAB-BLM

Location: UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF
CALIFORNIA – Hon. Cathy Ann Bencivengo, Magistrate Judge: Hon. Barbara
L. Major

Testifying expert on wired/wireless communication in gaming systems.

Expert Testimony:

November 20, 2019 Declaration ISO motion for summary judgment

Attorneys: For Plaintiff: Skiermont Derby LLP

For Defendant: Fish & Richardson

Status: Case closed

7/2019 – 05/2021 **Client: O’Melveny & Myers LLP (representing Apple Inc.)**

Case: Maxell, Ltd. v. Apple Inc.,

Case No. 5:19-cv-00036-RWS.

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS TEXARKANA DIVISION – Hon. Robert W. Schroeder III

Testifying expert on 3G cellular telephone technology.

Expert Testimony:

May 7, 2020: Opening Expert Report Regarding Invalidity

June 4, 2020: Rebuttal Expert Report on Non-Infringement

Deposition Testimony: June 24, 2020

Attorneys: For Plaintiff: Mayer Brown LLP

For Defendant: O’Melveny & Myers LLP

Status: Case settled.

4/2019 – Present **Client: Perkins Coie (representing Nintendo of America, Inc.)**

Case: Genuine Enabling Technology LLC v. Nintendo Company Ltd., and Nintendo of America, Inc., W.D. Wash.,

Civil Action No. 2:19-cv-00351-RSM

Location: UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF WASHINGTON – Hon. Ricardo S. Martinez

Testifying expert on wired/wireless communication in gaming systems.

Expert Declarations:

October 23, 2019 Declaration ISO claim constructions

November 26, 2019 Sur-reply declaration ISO claim constructions

January 23, 2020 Declaration ISO motion for summary judgment

April 20, 2020 Opening Expert Report Regarding Invalidity

Expert Depositions:

December 19, 2019

Claim Construction Hearing Testimony:

February 24, 2020 Tutorial testimony on the technology of the Asserted Patents

Attorneys: For Plaintiff: Bayard, P.A.

For Defendant: Perkins Coie

Status: Case ongoing

12/2019 – 12/2019 **Client: Erise IP (representing Apple Inc.), Haynes and Boone, LLP (representing Ericsson Inc)**

Case: Ericsson Inc. (Petitioner) v. Uniloc 2017, LLC (Patent Owner)

Apple Inc. (Petitioner) v. Uniloc 2017, LLC (Patent Owner) Case No. IPR2020-00224

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving ARQ data exchange on LTE networks.

Expert Declarations:

December 16, 2019 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 7,075,917

Attorneys: For Petitioner: Erise IP; Haynes and Boone, LLP

For Patent Owner:

Status: Case closed

6/2019 – 7/2020 **Client: Fish & Richardson (representing Microsoft Corporation)**

Case: Microsoft Corp. (Petitioner) v. Uniloc 2017, LLC (Patent Owner)

Uniloc 2017, LLC v. Microsoft Corp.

USDC Central District of California, Case Nos. 8:18-cv-2053, 8:18-cv-2054, 8:18-cv-2224; 8:19-cv-0428, 8:19-cv-0477, 8:19-cv-0196

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving 3GPP transport formats and

channels.

Expert Declarations:

August 6, 2019 Declaration in support of claim construction

Attorneys: For Plaintiff: Feinberg Day LLP

For Defendant: Fish & Richardson

Status: Case settled

2/2019 – 5/2020 **Client: Klarquist Sparkman, LLP (representing Microsoft Corporation)**

Case: Uniloc 2017, LLC v. Microsoft Corp.

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE
PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving ARQ data exchange on LTE
networks.

Expert Declarations:

April 14, 2019 Declaration ISO Petition for Inter Partes Review of U. S.
Patent No. 7,075,917

Attorneys: For Plaintiff:

For Defendant: Klarquist LLP

Status: Case settled

10/2018 – 6/2021 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Eset, Inc.

Civil Action No. 3:17-cv-00183-CAB-BGS

Location: UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF
CALIFORNIA SAN DIEGO DIVISION – Hon. Cathy Ann Bencivengo

As a testifying expert, provided a technology tutorial in this patent case involving
internet security technology.

Expert Declaration:

October 5, 2018 Tutorial expert report on network security technology.

March 11, 2020 Jury trial testimony.

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP

For Defendant:

Status: Jury Trial Mistrial due to COVID-19.

Case closed.

9/2018 – 6/2021 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Juniper, Inc.

Civil Action No. 15-cv-03295-BLF-SVK

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA SAN JOSE DIVISION – Hon. Beth L. Freeman

As a testifying expert, provided a technology tutorial in this patent case involving internet security technology.

Expert Declaration:

September, 11, 2018 Tutorial expert report on network security technology.

Videotaped Deposition:

November 7, 2018

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP

For Defendant:

Status: Case closed

9/2017 – 9/2018 **Client: (Covington & Burling representing Huawei Device USA, Inc.)**

Case: Optis Wireless Technology, LLC, et. al. v. Huawei Technologies Co. Ltd, et. al.

Civil Action No. 2:17-cv-123-JRG-RSP

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS MARSHALL DIVISION – Hon. Roy S. Payne

Testifying expert regarding 3G and LTE technology.

Expert Declarations and Reports:

November 3, 2017: Declaration regarding Claim Construction.

March 26, 2018: Initial Expert Report Regarding Invalidity

April 23, 2018: Rebuttal Expert Report on Non-Infringement

April 27, 2018: Rebuttal Expert Report on Secondary Considerations

Videotaped Deposition: May 10, 2018

May 14, 2018: Declaration in support of Motion for Partial Summary Judgment

Jury Trial Testimony: August 22, 2018 and August 23, 2018

Attorneys: For Plaintiff: McKool Smith
For Defendant: Covington & Burling

Status: Jury award

6/2017 – 4/2018 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Symantec, Inc.

Civil Action No. 4:14-cv-02998-HSG

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA OAKLAND DIVISION

As a testifying expert, provided a technology tutorial in this patent case involving internet security technology.

Expert Declaration:

July 27, 2017 Tutorial expert report on security technology.

Videotaped Deposition:

August 29, 2017

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP
For Defendant: Quinn Emmanuel

Status: Case settled

5/2017 – 3/2018 **Client: Barnes & Thornburg, LLP (representing Ooma, Inc.)**

Case: Ooma, Inc. (Petitioner) v. Deep Green Wireless, LLC (Patent Owner)

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

As a testifying expert, provided a technology tutorial in this patent case involving voice and data communications over wireless networks.

Expert Declaration:

June 8, 2017 Expert report on prior art wireless network technology.

Videotaped Deposition:

February 15, 2018

Attorneys: For Petitioner: Barnes & Thornburg LLP
For Defendant: Mischcon De Reya New York, LLP
Status: Case closed

3/2017 – 6/2019 **Client: Fish & Richardson (representing Apple, Inc.) / Gibson, Dunn & Crutcher LLP (representing Compal Electronics, et. al.)**

Case: Apple Inc. v. Qualcomm Inc.

Qualcomm Inc. v. Compal Electronics, Inc., et. al.

Civil Action No. 3:17-cv-00108 / Civil Action No. 3:17-cv-01010

Location: UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF CALIFORNIA – Hon. Gonzalo P. Curiel, Magistrate Judge: Hon. Mitchell D. Dembin

Testifying expert regarding LTE technology.

Expert Declaration:

December 11, 2017: Declaration regarding Claim Construction.

Expert Report:

June 29, 2018: Opening Expert Report regarding invalidity

August 3, 2018: Expert Report on infringement

October 2, 2018: Rebuttal Expert Report on Invalidity

Videotaped Deposition:

October 25, 2018

None

Attorneys: For Apple: Fish & Richardson
For Qualcomm: Quinn Emanuel Urquhart & Sullivan LLP / Cravath, Swaine & Moore LLP
For Compal Electronics, Inc., et. al: Gibson, Dunn & Crutcher LLP
Status: Case settled.

3/2017 – 1/2018 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Blue Coat Systems, LLC

Civil Action No. 15-cv-03295-BLF-SVK

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF

CALIFORNIA SAN JOSE DIVISION – Hon. Beth L. Freeman

As a testifying expert, provided an opening technology tutorial at trial in this patent case involving internet security technology.

Expert Declaration:

March 29, 2017 Tutorial expert report on security technology.

Videotaped Deposition:

May 2, 2017

October 31 – November 2, 2017: Jury Trial Testimony

January 8-10, 2018: Jury Trial Testimony (retrial after mistrial):

Live Testimony on Network Security Technology Tutorial

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP

For Defendant: Morrison & Forrester & Quinn Emmanuel

Status: Jury award

1/2017 – 7/2017 **Client: Foster Pepper LLP (representing Dali Wireless)**

Case: Dali Wireless, Inc. (Petitioner) v. CommScope Technologies, LLC (Patent Owner)

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this patent case involving RF transport networks.

Expert Reports:

4-26-17 Declaration ISO petition for IPR

6-30-17 Declaration ISO Opening claim construction brief

Videotaped Deposition:

July 24, 2017

Status: Case closed

1/2017 – 6/2019 **Client: Dorsey & Whitney LLP (representing Dali Wireless)**

Case: CommScope Technologies, LLC (Plaintiff/Counterclaim Defendant) v. Dali Wireless, Inc. (Defendant/Counterclaim Plaintiff)

Civil Action No.: 3:16-cv-477

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF

TEXAS DALLAS DIVISION

– Hon. Barbara M. G. Lynn

Testifying expert in this patent case involving RF transport networks.

Expert Reports:

8-24-18 Expert Report regarding Invalidity of CommScope patents

8-24-18 Expert Report regarding Infringement of Dali Wireless patents

11-5-18 Expert Report regarding Validity of Dali Wireless patents

11-5-18 Expert Report regarding Non-Infringement of CommScope patents

1-9-19 Declaration ISO opposition to MSJ

1-18-19 Declaration ISO partial MSJ on Non-infringement and Invalidity

5-2-19 Declaration ISO Motion for Sanctions

Videotaped Deposition:

November 20, 2018

Live Testimony at Jury Trial:

June 10-13, 2019

Attorneys: For Plaintiff: Dorsey & Whitney, LLC

For Defendant: Carlson Caspers, P.A.

Status: Jury award.

11/2016 – 4/2019 **Client: Boies, Schiller & Flexner LLP (representing Apple Inc.)**

Case: Evolved Wireless, LLC v. Apple, Inc.

Civil Action No.: 1:15-cv-00542-SLR

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

– Hon. Sue L. Robinson

Testifying expert in this patent case involving LTE wireless networks.

Expert Reports:

11-06-17 Declaration ISO Summary Judgment of Validity

10-05-17 Declaration ISO Summary Judgment of Non-Infringement

10-03-17 Supplemental Expert Report on Non-Infringement

07-24-17 Supplemental Expert Report on Secondary Considerations of Non-Obviousness

6-26-17 Expert Report on Non-Infringement

5-22-17 Expert Report on Invalidity

Videotaped Deposition:

August 11, 2017

Live Testimony at Jury Trial:

March 29 - April 1, 2019

Attorneys: For Plaintiff: Boies, Schiller & Flexner LLP

For Defendant: Robins Kaplan LLP

Status: Jury verdict of non-infringement.

7/2016 – 4/2018 **Client: Jackson Walker LLP (representing D&M Holdings, Inc., *et. al.*)**

Case: Sonos, Inc., v. D&M Holdings, d/b/a The D+M Group, D&M Holdings U.S. Inc., and Denon Electronics (USA), LLC

Civil Action No.: 16-0141-RGA

D&M Holdings Inc., d/b/a The D+M Group, D&M Holdings U.S. Inc. v. Sonos, Inc.

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
– Hon. Richard G. Andrews

Testifying expert in this patent case involving wireless speaker networks.

Expert Testimony:

9-11-17 Expert Report on Infringement

6-29-22 Remote Videotaped Deposition

Attorneys: For Plaintiff: Jackson Walker LLP

For Defendant: Potter Anderson & Corroon LLP

Status: Case settled

7/2016 – 1/2018 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Palo Alto Networks, Inc. (Petitioner) v. Finjan, Inc. (Patent Owner)

Case IPR2015-02001, Case IPR2016-00157. US Patent No. 8,225,408 B2

Case IPR2015-01974

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE
PATENT TRIAL AND APPEAL BOARD

Testifying expert in this patent case involving wireless speaker networks.

Expert Declaration:

8-9-16 Expert Declaration, Patent 7,647,633

8-9-16 Expert Declaration, Patent 8,225,408

8-30-16 Supplemental Expert Declaration, 7,647,633

Status: Case settled

5/2016 – 7/2018 **Client: (Winston & Strawn LLP representing Atlantic Broadband Group, LLC, et. al.)**

Case: ChanBond LLC v. Atlantic Broadband Group, LLC, et. al.

Civil Action No: 15-842-RGA, 15-843-RGA, 15-844-RGA, , 15-845-RGA, , 15-846-RGA, , 15-847-RGA, , 15-848-RGA, , 15-849-RGA, , 15-850-RGA, , 15-851-RGA, , 15-852-RGA, , 15-853-RGA, , 15-854-RGA

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
– Hon. Richard G. Andrews

Testifying expert regarding digital cable technology.

Expert Report:

10-24-17 Expert Report on Invalidity

Videotaped Deposition:

None

Attorneys: For Plaintiff: Bayard, P.A.

For Defendant: Winston & Strawn LLP

Status: Case settled

5/2016 – 11/2019 **Client: (Torys LLP representing Telus, Bell, and Rogers)**

Case: Wi-LAN Inc. v Telus Communications Company, Rogers Communications Canada Inc., and Bell Mobility Inc.

Court File No. T-301-16; Court File No. T-303-16; Court File No. T-304-16

Location: CANADIAN FEDERAL COURT – Hon. Mandy Aylen

Testifying expert regarding LTE technology.

Expert Report:

June 14, 2019 Expert Report regarding invalidity

Videotaped Deposition:

None

Attorneys: For Plaintiff: Torys LLP

For Defendant:

Status: Case settled

12/2015 – 4/2016 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Acceleration Bay, LLC.)**

Case: Activision Blizzard, Inc., Electronic Arts Inc., Take-Two Interactive Software, Inc., 2K Sports, Inc., Rockstar Games, Inc., and Bungie, Inc., Petitioner v. Acceleration Bay, LLC, Patent Owner.

Case IPR2015-01951, Case IPR2015-01953, Case IPR2015-01964, Case IPR2015-01970, Case IPR2015-01996, Case IPR2016-00724, Case IPR2016-00747

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR patent case involving internet data broadcasting.

Expert Declaration:

January 4, 2017 Supplemental Declaration ISO Patent Owner's Response -- Case IPR2016-00724

January 4, 2017 Supplemental Declaration ISO Patent Owner's Response -- Case IPR2016-00747

December 7, 2016 Declaration ISO Patent Owner's Response – Case IPR2016-00724; Secondary Considerations of Non-Obviousness

December 7, 2016 Declaration ISO Patent Owner's Response – Case IPR2016-00747; Secondary Considerations of Non-Obviousness

July 17, 2016 Declaration ISO Patent Owner's Response – Patent 6,714,966; Secondary Considerations of Non-Obviousness

July 17, 2016 Declaration ISO Patent Owner's Response – Patent 6,829,634; Secondary Considerations of Non-Obviousness

July 17, 2016 Declaration ISO Patent Owner's Response – Patent 6,701,344; Secondary Considerations of Non-Obviousness

Videotaped Deposition:

February 7, 2017 and February 8, 2017

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP
For Defendant: Winston & Strawn
Status: Cased closed

4/2016 – Present **Client: Kramer Levin Naftalis & Frankel, LLP (representing Acceleration Bay, LLC.)**

Case: Acceleration Bay, LLC v Activision Blizzard, Inc., Electronic Arts Inc., Take-Two Interactive Software, Inc.

Civil Action No.: 14-453 (RGA), 16-454 (RGA), 16-455 (RGA)

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE
– Hon. Richard G. Andrews

Testifying expert in this patent case involving internet data broadcasting.

Expert Declaration:

September 24, 2017: Expert Report Regarding Technology Benefits of the Asserted Patents

Videotaped Deposition: January 4, 2018

July 17, 2018: Reply Report Regarding Technology Benefits of the Asserted Patents

April 29 – May 3, 2024 Live Tutorial Testimony at Trial about benefits of Asserted Patents

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP
For Defendant: DLA Piper

Status: Jury Award

12/2015 – 9/2016 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Sophos, Inc.

Civil Action No. 3:14-cv-01197-WHO

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA SAN FRANCISCO DIVISION – Hon. William H. Orrick

As a testifying expert, provided a technology tutorial in this patent case involving internet security technology.

Expert Declaration:

December 21, 2015 Tutorial expert report on network security technology.

Videotaped Deposition:

February 22, 2016

September 5 – 9, 2016 Jury Trial:

Live Testimony at Jury Trial regarding tutorial on network security

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP

For Defendant: DLA Piper

Status: Jury Trial

9/2015 – 2/2016 **Client: Brinks Gilson & Lione (representing LifeWatch Services, Inc., and Card Guard Scientific Survival, Ltd.)**

Case: Card Guard Scientific Survival Ltd.

Reexam Control No. 12/706,541

Location: UNITED STATES PATENT AND TRADEMARK OFFICE

Provided testimony in this Patent Office re-examination appeal.

Expert Declaration:

November 13, 2015 Declaration under 37 C.F.R §1.132.

February 13, 2016 Declaration ISO petition for IPR.

Attorneys: For Plaintiff: Brinks Gilson & Lione

Status: Re-examination appeal decision invalidated the patent.

9/2015 – 1/2017 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Proofpoint, Inc. and Armorize Technologies, Inc.

Civil Action No. 13:cv-03999-BLF

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA SAN JOSE DIVISION – Hon. Howard R. Lloyd, Hon. Haywood S. Gilliam, Jr.

As a testifying expert, provided an opening technology tutorial report in this patent case involving internet security technology.

Expert Declaration:

October 7, 2015 Tutorial expert report on network security technology.

Videotaped Deposition:

November 6, 2015

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP
For Defendant: Quinn Emanuel
Status: Case settled

8/2015 – 12/2015 **Client: Brinks Gilson LLP (representing ZTE Corporation and ZTE (USA), Inc.)**

Case: Inter-System Handover of a Mobile Terminal Operable with a First and a Second Radio Access Network

ZTE v. Vringo Infrastructure, Inc.

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving 3GPP cellular technology.

Expert Declarations:

08-28-15 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 7,126,940

09-04-15 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 7,242,943

09-04-15 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 7,558,283

09-04-15 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 8,812,000

09-04-15 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 7,724,720

10-12-15 Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 7,242,933

Videotaped Deposition:

None

Attorneys: For Plaintiff:
For Defendant: Brinks Gilson, LLP
Status: Case settled.

11/2014 – 3/2024 **Client: Fish & Richardson (representing Regents of the University of Minnesota)**

Case: Regents of the University of Minnesota v. AT&T Mobility, LLC, Sprint Solutions, Inc., T-Mobile USA, Inc., Cellco Partnership d/b/a Verizon Wireless
Civil Action No. 14-cv-4666

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF MINNESOTA
– Hon. Tony N. Leung

Testifying expert on 3GPP error correction coding, precoding, and modulation.

February 10, 2023 Expert Report regarding Objective Indicia relating to Validity

May 12, 2023: Expert Deposition

April 14, 2023: Rebuttal Expert Report regarding Validity

September 25, 2024 Supplemental Rebuttal Expert Report regarding Validity

October 2, 2024 Expert Deposition

Attorneys: For Plaintiff: Fish & Richardson
For Defendant:

Status: Case settled

10/2014 – 2/2015 **Client: Alston & Bird (representing Microsoft Corporation)**

Case: Microsoft Corporation. v. IPR Licensing, Inc.

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving cellular technology.

Expert Declarations:

October 16, 2014 Supplemental Declaration ISO Petition for Inter Partes Review of U. S. Patent No. 8,380,244

September 25, 2024 Supplemental Rebuttal Expert Report regarding Validity

Attorneys: For Plaintiff: Fish & Richardson LLP
For Defendant:

Status: Case settled

9/2014 – 4/2015 **Client: Reed & Scardino, LLP (representing Mobile Telecommunications**

Technologies, LLC)

Case: Mobile Telecommunications Technologies LLC v. Amazon.com, Inc.

Civil Action No. 2:13-CV-883-JRG-RSP

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS MARSHALL DIVISION – Hon. Roy S. Payne

Testifying expert in this patent case involving package delivery notification systems and reliable delivery of wireless messages.

Expert Reports:

4-06-15 Second Supplemental Expert Report on Infringement

2-10-15 Expert Report on Infringement

2-24-15 Supplemental Expert Report on Infringement

Videotaped Deposition:

2-25-15

Declaration:

3-20-15 Declaration ISO Response to Opposition Motion

Attorneys: For Plaintiff: Reed & Scardino LLP

For Defendant: Greenberg Traurig LLP

Status: Case settled

5/2014 – 7/2015 **Client: Kramer Levin Naftalis & Frankel, LLP (representing Finjan, Inc.)**

Case: Finjan, Inc. v. Blue Coat Systems, Inc.

Civil Action No. 3:13-cv-03999-BLF

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA SAN JOSE DIVISION – Hon. Beth L. Freeman

As a testifying expert, provided an opening technology tutorial at trial in this patent case involving internet security technology.

Expert Declaration:

January 12, 2015 Tutorial expert report on security technology.

Videotaped Deposition:

March 18, 2015

Live Jury Trial Testimony: July 20, 2015.

Live Bench Trial on Laches Testimony: September 8, 2015

Attorneys: For Plaintiff: Kramer Levin, Naftalis, & Frankel LLP

For Defendant: Wilson Sonsini

Status: Jury award.

4/2014 – 12/2014 **Client: Reed & Scardino, LLP (representing Mobile Telecommunications Technologies, LLC)**

Case: Mobile Telecommunications Technologies LLC v. United Parcel Service, Inc.

Civil Action No. 1:12-cv-03222-AT

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF GEORGIA ATLANTA DIVISION – Hon. Amy Totenberg

Testifying expert in this patent case involving package delivery notification systems.

Expert Reports:

7-3-14 Opening Expert Report regarding Infringement

8-11-14 Rebuttal Expert Report regarding Infringement

Videotaped Depositions:

10-7-14

Declaration:

11-24-14 Declaration ISO Response to MSJ

Attorneys: For Plaintiff: Reed & Scardino LLP

For Defendant: Alston & Bird LLP

Status: Case settled.

12/2013 – 9/2015 **Client: Brinks Gilson & Lione LLP (representing ZTE Corp, and ZTE (USA), Inc.)**

Case: ZTE Corporation and ZTE (USA) Inc. v. InterDigital Technology Corporation

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this IPR proceeding involving cellular technology.

Expert Declarations:

3-21-14 Declaration in support of the Petition for Inter Partes Review of U. S. Patent No. 8,380,244

Attorneys: For Plaintiff: Brinks Gilson & Lione
For Defendant: Latham & Watkins, LLP

Status: IPR Hearing before PTAB: All disputed claims are unpatentable.

12/2013 – 4/2014 **Client: Kramer Levin Naftalis & Frankel LLP (representing Sirius XM Radio Inc.)**

Case: Catch a Wave Technologies, Inc. v. Sirius XM Radio Inc.
Case No. 3:12-cv-05791-WHA

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA SAN FRANCISCO DIVISION – Hon. William Alsup

Testifying expert in this patent case involving satellite radio systems.

Expert Reports:

2-14-2014 Expert Report regarding non-infringement

Attorneys: For Plaintiff: Freitas Tseng & Kaufman LLP
For Defendant: Kramer Levin LLP

Status: Case settled

2/2013 – 7/2016 **Client: Reed & Scardino, LLP (representing Mobile Telecommunications Technologies, LLC)**

Case: Mobile Telecommunications Technologies LLC v. BlackBerry Corporation.
Civil Action No. 3:12-cv-1652-M

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF TEXAS DALLAS DIVISION – Hon. Barbara M. G. Lynn

Testifying expert in this patent case involving package delivery notification systems.

Expert Reports:

9-3-15 Expert Report on Infringement

Videotaped Depositions:

November 18, 2015

Live Testimony at Jury Trial: July 13, 2016.

Attorneys: For Plaintiff: Baker Botts, LLP
For Defendant: Reed & Scardino LLP
Status: Jury verdict of non-infringement.

9/2013 – 1/2014 **Client: Reed & Scardino, LLP (representing Mobile Telecommunications Technologies, LLC)**

Case: Mobile Telecommunications Technologies, LLC v Clearwire Corporation
Civil Action No. 2:12-CV-308

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS MARSHALL DIVISION – Hon. Roy S. Payne

Testifying expert in this patent case involving wireless networking signals.

Expert Reports:

11-11-13 Rebuttal report regarding validity

Videotaped Depositions:

12-5-13

Declarations:

1-23-14 Declaration before the Patent Trial and Appeal Board in Case IPR2013-00306

Attorneys: For Plaintiff: Reed & Scardino LLP
For Defendant: Shook, Hardy & Bacon, LLP
Status: Case settled

10/2013 – 5/2015 **Client: Foley & Lardner, LLP (representing Motorola Mobility, LLC)**

Case: University of Florida Research Foundation Inc., and Rapid Mobile Technologies, Inc. v Motorola Mobility, LLC.

Case No. 13-cv-61120-KMM-EGT

Location: UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF FLORIDA FORT LAUDERDALE DIVISION – Hon. K. Michael Moore,
Magistrate Judge: Hon. Edwin G. Torres

Testifying expert in this patent case involving mobile device testing systems.

Expert Reports:

None.

Declarations:

11-21-13 Declaration ISO Motorola's Responsive Claim Construction Brief

Attorneys: For Plaintiff: Meltzer & Meksraitis

For Defendant: Foley & Lardner LLP

Status: Case settled

7/2013 – 6/2015 **Client: WilmerHale (representing Broadcom)**

Case: Inter Partes Review of US Patent 6,424,625; 6,772,215; and 6,466,568 owned by Ericsson

Docket No. 0111168-0240

Location: UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE PATENT TRIAL AND APPEAL BOARD

Testifying expert in this Inter Partes Review regarding ARQ mechanisms.

Expert Declarations:

9-19-13 Declaration regarding US Patent 6,772,215

9-19-13 Declaration regarding US Patent 6,466,568

9-29-13 Declaration regarding US Patent 6,424,625

Videotaped Deposition:

5-29-14, and 5-30-14

Attorneys: For Plaintiff: Meltzer & Mathis

For Defendant: Wilmer Cutler Pickering Hale and Dorr LLP

Status: IPR Petition granted. All claims invalidated

4/2013 – 4/2015 **Client: Kilpatrick Townsend & Stockton LLP (representing Google Inc. and Motorola Mobility LLC)**

Case: Fujifilm Corporation v. Motorola Mobility LLC

Case No. 3:12-cv-03587 WHO

Location: UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA SAN FRANCISCO DIVISION – Hon. Richard Seeborg

Testifying expert in this patent case involving smartphone technology and video codecs.

Expert Declarations:

4-23-14 Declaration ISO Motion for Protective Order

12-9-14 Declaration ISO MSJ

Expert Reports:

10-3-14 Opening Expert Report Regarding Invalidity

10-31-14 Rebuttal Expert Report on non-infringement

10-31-14 Appendix A to Rebuttal Report of Dr. Alan Bovik

Videotaped Deposition:

11-19-14, and 11-20-14

Trial Testimony:

April 28, 2015 Non-infringement and invalidity of '970 Patent

Attorneys: For Plaintiff: Morgan, Lewis & Bockius LLP

For Defendant: Kilpatrick Townsend & Stockton LLP

Status: Jury verdict: '970 Patent claims not infringed and invalid.

2/2013 – 10/2013 **Client: Seyfarth Shaw LLP (representing Motorola Mobility LLC)**

Case: University of Florida Research Foundation, Inc. and Rapid Mobile Technologies, Inc. v. Motorola Mobility LLC

Civil Action No. 13-cv-61120-KMM-EGT

Location: UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF FLORIDA – Hon. K. Michael Moore, Magistrate Judge: Hon. Edwin G. Torres

Testifying expert in this employment law case involving mobile device testing systems.

Expert Reports:

3-1-13 Expert Report regarding Non-Infringement

4-1-13 Declaration in Opposition to Plaintiff's MSJ

Attorneys: For Plaintiff: Meltzer & Mathis

For Defendant: Seyfarth Shaw LLP

Status: Case settled

5/2012 – 4/2013 **Client: Paul Hastings LLP (representing Apple, Inc.)**

Case: SmartPhone Technologies, LLC v Research in Motion Corporation, et. al.

Case No. 6:10-cv-00074

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS TYLER DIVISION – Hon. John D. Love

Testifying expert in this patent case involving 3GPP technology.

Expert Reports:

12-31-12 Appendix A to Rebuttal Expert Report of Dr. David Wilson

3-13-13 Appendix A to Supplemental Expert Report of Dr. David Wilson

Attorneys: For Plaintiff: Mintz Levin Cohn Ferris Glovsky and Popeo PC

For Defendant: Paul Hastings LLP

Status: Case settled

8/2012 – 9/2013 **Client: Reed & Scardino, LLP (representing EON Corp. IP Holdings, LLC)**

Case: EON Corp. IP Holdings, LLC v. SKYGUARD, LLC et. al.

Case No. 6:11-cv-00015-LED

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS TYLER DIVISION – Hon. John D. Love

Testifying expert in this patent case involving RF technology for WiFi networking.

Expert Reports:

2-15-13 Expert Report regarding Infringement

Videotaped Deposition:

4-09-13

Attorneys: For Plaintiff: Reed & Scardino, LLP

For Defendant: K&L GATES LLP

Status: Case settled

Client: Reed & Scardino LLP (representing Eon Corp. IP Holdings)

5/2012 – 6/2014

Case: Eon Corp. IP Holdings, LLC v. Landis+Gyr, Inc., et. al.

Case No. 6:09-cv-00317-LED-JDL

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS
TYLER DIVISION – Hon. John D. Love

Testifying expert in this patent case involving two-way wireless networks, before Judge Love.

Expert Report:

7-8-13 Expert Report regarding Infringement by Silver Spring Networks, Inc.

7-8-13 Expert Report regarding Infringement by Itron, Inc.

Videotaped Deposition: September 12, 2013

Live Testimony at Jury Trial: June 2, 2014 – June 6-2014

Attorneys: For Plaintiff: Reed & Scardino LLP

For Defendant: Dentons, LLP

Status: Jury award. All patents found valid and infringed.

3/2012 – 3/2014 **Client: Perkins Coie (representing Intel Corporation)**

Case: Stragent LLC, et. al. v. Intel Corp.,

Case No. 6:11-cv-421-LED (E.D. Tex.)

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF
TEXAS TYLER DIVISION – Hon. Timothy Dyk, Hon. John D. Love

Testifying expert in this patent case involving the use of error detection
technology in computer networking, before Judge Dyk.

Expert Reports:

08-23-13 Expert Report regarding Invalidity

09-23-13 Expert Report regarding Non-Infringement

Videotaped Deposition:

10-08-13, and 10-09-13

Jury trial testimony:

3-13-2014 Live trial testimony on non-infringement and invalidity before Judge
Timothy Dyk

Attorneys: For Plaintiff: Nelson, Bumgardner & Casto

For Defendant: Perkins Coie

Status: Jury verdict for non-infringement and invalidity

2/2012 – 09/2015 **Client: Dewey & LeBoeuf LLP (representing Harris Corporation)**

Case: Harris Corporation v. Ruckus Wireless, Inc.

Case No. 6:11-cv-00618-CEM-CRS

Location: UNITED STATES DISTRICT COURT FOR THE MIDDLE DISTRICT OF
FLORIDA ORLANDO DIVISION – Hon. Charlene Edwards Honeywell

Testifying expert in this patent case involving RF technology for WiFi
networking.

Expert Reports:

3-5-12 Expert Report regarding Infringement

3-6-12 Supplemental Expert Report regarding Infringement

4-6-12 Expert Report regarding Validity

Declarations:

5-30-12 Declaration ISO Claim Construction

6-18-12 Declaration ISO Markman Motion

1-23-15 Declaration ISO Responsive Markman Brief

3-6-15 Supplemental Expert Report regarding Infringement

4-3-15 Rebuttal Expert Report regarding Validity

Videotaped Deposition:

4-30-12

Attorneys: For Plaintiff: Dewey & LeBeouf LLP

For Defendant: Lewis and Roca LLP

Status: Case settled

2/2012 – 2/2013 **Client: Common-Interest-Group (representing Nokia, Huawei, ZTE)**

Case: InterDigital Communications LLC, et. al. v. Huawei Tech Co., LTD., et. al.
Certain Wireless Devices With 3G Capabilities and Components Thereof
U.S. Int'l Trade Commission Inv. No. 337-TA-800

Location: UNITED STATES INTERNATIONAL TRADE COMMISSION –

Administrative Law Judge Hon. David P. Shaw and Administrative Law Judge
Hon. Theodore R. Essex

Testifying expert in this patent case involving 3G wireless, WiFi, and WCDMA
technology.

Expert Reports:

11-30-12 Expert Report regarding Non-infringement

7-31-12 Expert Report regarding Invalidity

11-19-10 Rebuttal Expert Report regarding Validity

12-6-10 Supplemental Expert Report regarding Infringement

Videotaped Deposition:

12-14-12, 12-15-12

ITC Trial testimony:

2-6 through 2-15/13 Non-infringement and Invalidity witness statements, live
testimony

Attorneys: For Plaintiff: Latham & Watkins, LLP

For Defendant: Alston & Bird, Covington & Burling, Brinks Hofer

Status: ITC hearing verdict: All patents not infringed and invalid

9/2010 – 4/2011 **Client: Reed & Scardino LLP (representing Eon Corp. IP Holdings)**

Case: Eon Corp. IP Holdings, LLC v. Sensus USA, Inc., et. al.

Case No. 6:09-cv-00116-LED-JDL

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS
TYLER DIVISION – Hon. John D. Love

Testifying expert in this patent case involving two-way wireless networks

Expert Report:

10-22-10 Expert Report regarding Infringement (Sensus USA, Inc)

11-7-10 Expert Report regarding Infringement (Bell Industries)

11-19-10 Rebuttal Expert Report regarding Validity

12-6-10 Supplemental Expert Report regarding Infringement

Declaration:

12-28-10, 1-18-11

Videotaped Deposition:

12-8-10, 2-3-11

Attorneys: For Plaintiff: Reed & Scardino LLP

For Defendant: Jones Day

Status: Case settled

10/2009 – 2/2010 **Client: White & Case LLP (representing Marvell)**

Case: Marvell Semiconductor, Inc., et. al. v. Commonwealth Scientific Industrial Research Organisation

Case No. 6:07-CV-204 (LED)

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS TYLER DIVISION – Hon. Leonard Davis

Testifying expert in this patent case involving wireless LAN protocols.

Expert Report:

11-24-09 Rebuttal Expert Report

Videotaped Deposition:

01-07-10

Attorneys: For Plaintiff: White & Case LLP

For Defendant: Townsend and Townsend and Crew LLP

Status: Case settled

9/2009 – 2/2010 **Client: Perkins Coie Brown & Bain PA (representing Intel)**

Case: Saxon Innovations, LLC v. Apple, Inc., et. al.

Case No. 6:08-cv-00265-LED

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS TYLER DIVISION – Hon. John D. Love

Testifying expert in this patent case involving wireless technology.

Declarations:

12-04-09 Declaration Regarding Claim Construction

Videotaped Deposition:

01-19-10

Attorneys: For Plaintiff: Susman Godfrey LLP

For Defendant: Perkins Coie Brown & Bain LLP

Status: Case settled

8/2008 – 10/2009 **Client: Reed & Scardino LLP (representing Eon Corp. IP Holdings)**

Case: Eon Corp. IP Holdings, LLC v. Verizon Clinton Center Drive Corp., et. al.

Case No. 6:08-cv-00385

Location: UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF TEXAS TYLER DIVISION – Hon. John D. Love

Testifying expert in this patent case involving two-way wireless networks

Expert Report:

06-22-10 Expert Report

08-16-10 Supplemental Expert Report

Videotaped Depositions:

08-18-10, 08-26-10

Attorneys: For Plaintiff: Reed & Scardino LLP

For Defendant: Simpson Thacher & Bartlett LLP

Status: Case settled

4/2008 – 3/2009 **Client: McDermott, Will & Emery LLP (representing GE Licensing)**

Case: CIF Licensing, LLC d/b/a GE Licensing v. Agere Systems, Inc.

Case No. 07-170 (JJF)

Location: UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE – Hon. Joseph. J. Farnan, Jr.

Testifying expert in this patent case involving modem technology.

Expert Report:

09-05-08 Rebuttal Expert Report

Non-videotaped Depositions:

9-24-08, 9-26-08

Jury trial testimony:

2-04-09

Attorneys: For Plaintiff: McDermott, Will & Emery LLP

For Defendant: Townsend and Townsend and Crew LLP

Status: Jury award. 2 patents infringed and valid, remaining 2 patents non-infringed

2/2008 – 5/2010, **Client: Simpson Thacher & Bartlett LLP (representing Cisco Systems, Inc.)**
2/2011 – 4/2011

Case: Commil USA, LLC v. Cisco Systems, Inc., et. al.

Case No. 2:07-CV-341-DF-CE

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION – Hon. Charles Everingham IV

Testifying expert on invalidity regarding short range communication protocols.

Opening Expert Report

12-23-09

Videotaped Depositions:

02-09-10

Attorneys: For Plaintiff: Sayles Werbner

For Defendant: Simpson Thacher & Bartlett LLP

Status: Jury award for original trial and retrial: patents found valid and infringed.

6/2007 – 4/2009 **Client: Common Interest Group of Co-Defendants**

11/2010 – 4/2012 **Client: Common Interest Group of Co-Defendants**

Case: Commonwealth Scientific and Industrial Research Organisation v. Toshiba
America Information Systems, Inc., et. al.

Case No. 6:06-cv-00550-LED

Case No. 6:09-CV-0399 (LED)

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS
TYLER DIVISION – Hon. Leonard Davis

Testifying expert in this patent case involving wireless LAN technology.

Declarations:

06-05-08 Regarding claim construction

12-17-08 Supporting opposition to summary judgment

04-05-09 Supporting motion for reconsideration

02-24-12 Supporting opposition to summary judgment

Expert Reports:

10-08-08 Rebuttal Expert Reports- Re: TI Chips, Re: Marvell Chips, Re: Airgo Chips, Re: Broadcom Chips, Re: Conexant Chips, Re: Ralink Chips, Re: Atheros Chips

01-27-12 Rebuttal Expert Reports- Re: TI Chips, Re: Broadcom Chips, Re: Ralink Chips, Re: Atheros Chips

Videotaped Depositions:

11-1-08, 11-2-08, 02-14-12

Attorneys: For Plaintiff: Townsend & Townsend LLP

For Defendant: Keker & Van Nest, LLP

Status: Jury trial: patents found valid and infringed.

10/2006 – 8/2009 **Client: Keker & Van Nest (representing Comcast Corporation)**

Case: Rembrandt Technologies, Inc. v. Comcast Corporation

Case No. 2-05-CV-000443 (TJW)

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION – Hon. T. John Ward

Testifying expert in this patent case involving physical layer and data link layer communication protocols for cable networks.

Declaration:

01-10-07 Support of Claim Construction Brief

Videotaped Deposition:

12-22-06 Regarding claim construction opinions

Attorneys: For Plaintiff: McKool Smith

For Defendant: Keker & Van Nest

Status: Case settled

3/2007 – 5/2007 **Client: Niro, Scavone, Haller and Niro (representing MLR, LLC)**

Case: MLR, LLC v. Kyocera Wireless Corporation and Novatel Wireless, Inc.

Case No. 05-CV-0935 B (AJB)

Location: UNITED STATES DISTRICT COURT SOUTHERN DISTRICT OF
CALIFORNIA

Testifying expert in this patent case involving cellular phone technology.

Expert Report:

04-20-07 Expert Report regarding infringement

Attorneys: For Plaintiff: Niro, Scavone, Haller, and Niro

For Defendant: Hogan & Hartson, LLP

Status: Case settled

6/2006 – 10/2006 **Client: Thompson & Knight (representing Ericsson, Inc.)**

Case: Fenner Investments, Ltd., v. Juniper Networks, Inc. et. al.
Case No. 2:05–CV–05 JDL

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

Testifying expert in this patent case involving wireless communications services.

Expert report regarding infringement and invalidity

5-23-06 Rebuttal expert report regarding infringement and invalidity

Attorneys: For Plaintiff: Fulbright & Jaworski

For Defendant Ericsson: Thompson & Knight

Status: Case settled

12/2003 – 5/2006 **Client: Howrey LLP/ Winston & Strawn LLP (representing McKesson Information Solutions, Inc.)**

Case: McKesson Information Solutions, Inc. vs. Bridge Medical, Inc.
Case No. CIV S-02-2669 FCD KJM

Location: UNITED STATES DISTRICT COURT EASTERN DISTRICT OF
CALIFORNIA – Hon. Peter A. Nowinski

Testifying expert in this patent case involving a patient on a patient identification
and verification system that incorporates wireless technology.

Inequitable Conduct Trial live testimony:
5-04-06

Markman Hearing live testimony:
6-29/30-05

Videotaped Depositions:

2-14-04, 6-3-05

Declarations:

12-1-03 Dec. in support of MISI's Opening/Opposition re Claim Construction

12-24-04 Dec. in support of MISI's Motion for Preliminary Injunction

3-1-04 Dec. in support of Claim Construction

6-29-04 Dec. re meaning of "Communication"

7/15/05 Dec. in support of MISI's Opposition to Bridge's Motion for Summary Judgment

Attorneys: For Defendant: Morrison & Foerster

For Plaintiff: Howrey Simon, Winston & Strawn, Morgan Lewis

Status: Bench trial on inequitable conduct: Verdict found inequitable conduct.

07/2003–02/2006 **Client: Heller Ehrman LLP (representing Texas Instruments, Inc.)**

Case: Texas Instruments, Inc. and Stanford University vs. GlobespanVirata, Inc.

Provided discovery of evidence used at trial, concerning the structure and operation of Globespan's ADSL products, and supported litigators in depositions of Globespan engineers.

Attorneys: For Plaintiff: Heller Ehrman

For Defendant: Covington & Burling, LLP

Status: Jury award.

Patents

<u>Patent Number</u>	<u>Date Issued</u>	<u>Title</u>
11,748,764	September 5, 2023	Light-based Data Entry for Personal Inventory and Product Support System
10,332,121	June 25, 2019	Light-based Data Entry for Personal Inventory and Product Support System
9,978,037	May 22, 2018	Personal inventory and product support system
8,995,996	March 31, 2015	Methods and apparatus for performance optimization of heterogeneous wireless system communities
8,935,580	January 13, 2015	Multimedia-aware quality-of-service and error correction provisioning
8,468,426	June 18, 2013	Multimedia-aware quality-of-service and error correction provisioning

8,189,538	May 29, 2012	Reconfiguration of a communication system
8,144,640	March 27, 2012	Location tracking in a wireless communication system using power levels of packets received by repeaters
8,064,380	November 22, 2011	Reconfiguration of a communication system
8,027,637	September 27, 2011	Single frequency wireless communication system
7,957,741	June 7, 2011	Token-based receiver diversity
7,876,704	January 25, 2011	Tunneling protocols for wireless communications
7,689,210	March 30, 2010	Plug-n-playable wireless communication system
7,672,274	March 2, 2010	Mobility support via routing
7,668,542	February 23, 2010	Token-based receiver diversity
7,515,557	Apr 7, 2009	Reconfiguration of a communication system
7,236,470	Jun 26, 2007	Tracking multiple interface connections by mobile stations
7,149,196	Dec 12, 2006	Location tracking in a wireless communication system using power levels of packets received by repeater
6,965,769	Nov 15, 2005	Testing Center
6,862,448	Mar 1, 2005	Token-based receiver diversity
6,788,658	Sep 7, 2004	Wireless communication system architecture having split MAC layer
6,760,318	Jul 6, 2004	Receiver diversity in a communication system
6,557,134	Apr 29, 2003	ARQ method for wireless communication
6,259,911	Jul 10, 2001	Network operations center hardware and software design

Education

<u>Year</u>	<u>College/University</u>	<u>Degree</u>
1993	Stanford University	PhD, Electrical Engineering Thesis: "Trellis Coding for Multi-Level, Partial-Response Continuous Phase Modulation with Precoding"
1988	Stanford University	MS, Electrical Engineering
1985	Rensselaer Polytechnic Institute	BS, Computer and Systems Engineering

Publications

- Goldhamer, M., Grandblaise, D., Bims, H., Feng, S., Piggin, P., Sydor, J., and Wu, X. “Coexistence between 802.16 Systems Operating in Shared Bands”, *Radio Resource Management in WiMAX*, John Wiley & Sons, 2009.
- Bims, Harry. “Surveying the Wireless LANDscape. Or Why Large Wi-Fi Networks Require Good Planning.” *Xchange*. [Online] Available <http://www.xchangemag.com/articles/391supsys1.html>, September 1, 2003.
- Bims, Harry. “Building Voice-Ready Wireless LANs” *Wireless Week*. [Online] Available <http://www.wirelessweek.com/article/CA319429.html?spacedesc=Departments>, September 1, 2003.
- Bims, Harry. “Enabling Voice over WLANs”. White Paper. [Online] Available. http://airflownetworks.com/solutions/pdf/vowlan_wp.pdf. September 2003.
- Bims, Harry. “Securing Enterprise WLANs”. White Paper. [Online] Available. http://web.archive.org/web/20040303212529/airflownetworks.com/solutions/pdf/securing_wlans_wp.pdf. August 2003.
- Bims, H. and Cioffi. J. “Trellis Coding for Full-Response CPM”, *Third Generation Wireless Information Networks*, Kluwer Academic Publishers, 1992.
- Bims, H. and Cioffi. J. “Trellis Coding for Full-Response CPM”, *WINLAB WORKSHOP*, East Brunswick, NJ. October 18-19, 1990.
- Bims, H. and Cioffi, J. “Trellis Coding for Partial-Response CPM”, *1991 International Symposium on Information Theory*, Budapest, Hungary. June 24-28, 1991.
- Bims, H. and Cioffi, J. “Trellis Coding with M-ary MSK Constraints”, *GLOBECOM '89*, Dallas TX. Nov. 1989.

Professional Associations and Achievements

- Jan 2009 – Present Vice-Chair and Board of Directors, Menlo Park Chamber of Commerce
- Nov 2007 – Sep 2010 Vice-Chair and Secretary, IEEE 802.16h License Exempt Group
- Feb 2002 – Jan 2011 Member, City of Menlo Park Planning Commission (2006 Chairperson, 2005 Vice-Chairperson)
- Feb 2012 – Present Senior Member, IEEE
- Jan 2000 – Dec 2000 Chair, IEEE Engineering Management Society – Silicon Valley Chapter
- Jun 1985 - Jun 1991 AT&T Bell Laboratories Cooperative Research Fellow