

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent of: Hays *et al.*  
U.S. Patent No.: 5,659,891 Attorney Docket No.: 39521-0004IP1  
Issue Date: Aug. 19, 1997  
Appl. Serial No.: 08/480,718  
Filing Date: Jun. 7, 1995  
Title: MULTICARRIER TECHNIQUES IN BANDLIMITED CHANNELS

**DECLARATION OF DR. APOSTOLOS K. KAKAES**

1. My name is Apostolos K. Kakaes of Vienna, Virginia. I understand that I am submitting a declaration offering technical opinions in connection with the above-referenced *Inter Partes* Review proceeding pending in the United States Patent and Trademark Office for U.S. Patent No. 5,659,891 (“the ‘891 patent”), and prior art references relating to its subject matter. My current *curriculum vitae* is attached and some highlights follow.

2. I have over thirty (30) years of experience in electrical engineering and computer science and in fixed and mobile communications networks. I attended the University of Colorado from 1974 to 1980, during which, I earned a Bachelor of Science (B.S.) and a Master of Science (M.S.) in applied mathematics with a minor in electrical engineering. I attended the Polytechnic Institute of New York between 1982 and 1988, during which, I earned a Doctor of Philosophy (Ph.D.) in electrical engineering, with a thesis titled “Topological Properties and Design of Multihop Packet Radio Networks.” While pursuing the Ph.D. degree, I held a joint appointment as Special Research Fellow and Adjunct Instructor at the Polytechnic Institute of New York between 1985 and 1986.

3. Between 1982 and 1987, I worked at AT&T Bell Laboratories in Holmdel, New Jersey. While at AT&T Bell Laboratories, I worked on modeling, analysis, design, and performance evaluation of voice and data networks. I developed algorithms for DNHR

(Dynamic, Non-Hierarchical Routing) used in the telephone network. I also worked on analysis of advanced data services and formulation of long term plans for development of enhanced data services and network design tools to support such services.

4. I was an Assistant Professor of Electrical Engineering and Computer Science at The George Washington University (GWU), Washington, D.C., between 1987 and 1994. During my association with GWU, I taught graduate courses in the area of communication engineering, including communication theory, coding theory, voice and data networking, and mobile communications. I also received several research awards/grants, including the prestigious NSF Research Initiation Award.

5. In 1988, I founded Cosmos Communications Consulting Corporation ("Cosmos"), which is a private communications engineering consulting firm specializing in mobile communications, and I have been the President of the company since the founding. Since 1994, I have worked full-time at Cosmos. At Cosmos, among various activities, I have consulted on high level technology-related issues and trends to corporate entities, governmental agencies, and international organizations, such as the United Nations. I have provided technical consultancy to engineering firms, operators, and equipment vendors on issues related to existing or evolving technologies for mobile communications, and to the investment community on issues related to both fixed and wireless communications technologies. I have served as consultant on both civil and criminal legal cases, including several patent infringement cases both at the ITC and in district court. I also participated as a technical consultant in the analysis of large patent portfolios for the purposes of due diligence, sales, and merger and acquisition activities for some of the largest companies in the mobile communications space. These projects spanned a

multidimensional spectrum of technologies in both fixed and mobile communications as they have evolved over the past thirty (30) years.

6. During my work at Cosmos, I have provided expert advice and conducted extensive training for practicing engineers in the field in diverse networking technology areas, including Wireless Local Area Networks (LAN), Metropolitan Area Networks (MAN), and Personal Area Networks (PAN) technologies, paging networks, ad hoc networks, including IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), HIPERLAN, Bluetooth, Near Field Communications, IrDA (Infrared Data Association). My experience includes detailed in depth analysis of cellular networks operating with any of the available access technologies as standardized in various standards, broadly known as AMPS, GSM, GPRS, EDGE (EGPRS); North American TDMA and IS-136, iDEN, IS-95, UMTS, HSPA, and LTE. I have experience in the design and implementation of voice and data networking (circuit switching as well as all the evolving all IP-based technologies), traffic engineering, RF design, Quality of Service (QoS) and resource allocation, MAC protocols, as well as in the design of core networks, both user plane and control plane.

7. Over the course of my career, I have authored and co-authored some thirty (30) publications on various aspects of fixed and mobile communications, as noted in my curriculum vita. I am a member of the Institute of Electrical and Electronics Engineers (IEEE) and actively involved in the Communications Society and the Information Theory Society of IEEE. Between 1991 and 1992, I served as the Secretary of IEEE Communications Society National Capital Area Chapter. Between 1992 and 1993, I was the Vice-Chair of IEEE Communications Society National Capital Area Chapter. I was the Vice-Chair of the Communication Theory Technical Committee of the Communications Society of the IEEE for the 1993-1996 term, and Treasurer of

the Communication Theory Technical Committee of the Communications Society of the IEEE for the 1996-1999 term.

8. I have served as a reviewer for the IEEE, book editors, other technical publications, and various National Science Foundation (NSF) Panels. I have organized technical sessions in technical conferences, including the IEEE International Conference on Communications (ICC) and IEEE Global Communications Conference (Globecom). I served as the Technical Program Chair for the Communication Theory Mini-Conference in 1992.

9. I am familiar with the content of U.S. Patent No. 5,659,891 (the “891 patent”). In addition, I have considered the various documents referenced in my declaration as well as additional background materials. For example, I have considered: (1) Dr. Rade Petrovic *et al.*, *Permutation Modulation for Advanced Radio Paging*, IEEE Proceedings of Southeastcon '93 (7 Apr 1993) (“Petrovic”); (2) Leonard J. Cimini, *Analysis and Simulation of a Digital Mobile Channel Using Orthogonal Frequency Division Multiplexing*, 33 IEEE Transactions on Communications 665 (Jul. 1985) (“Cimini”); (3) WIPO Publication No. 1989/008355 to Raith *et al.* (“Raith”); and (4) C. Alakija and S. P. Stapleton, *A Mobile Base Station Phased Array Antenna*, 1992 IEEE International Conference on Selected Topics in Wireless Communications at 118 (Jun. 1992) (“Alakija”). I have also reviewed certain sections of the prosecution history of the ‘210 patent and the claim construction orders from *Mobile Telecommunications Technologies, LLC v. Apple Inc.*, Civil Action No. 2:13-cv-258-JRG-RSP (E.D. Tex.) and *Mobile Telecommunications Technologies, LLC v. Clearwire Corp.*, Civil Action No. 2:12-cv-308-JRG-RSP (E.D. Tex.).

10. Counsel has informed me that I should consider these materials through the lens of one of ordinary skill in the art related to the ‘891 patent at the time of the invention, and I have

done so during my review of these materials. I believe one of ordinary skill as of June 7, 1995 (the priority date of the '891 patent) would have at least a B.S. degree in electrical engineering, computer science, computer engineering, or equivalent education. This person would also need to have at least two years of experience in the design and configuration of wireless paging systems, or other two-way wireless communications systems and be familiar with the operation and functionality of multicarrier transmissions. I base this on my own personal experience, extensive training that I provided for those in the industry as well as my knowledge of colleagues and other professionals at the time. With this in mind, for purposes of this analysis, references that I make to the views of a person of ordinary skill are intended to relate the views of that person as of June 7, 1995 or earlier, whether stated with respect to the present or past tense.

11. Counsel has advised me that, during *Inter Partes* Review, that claim terminology must be given the broadest reasonable interpretation. Counsel has advised me that this means the claims should be interpreted as broadly as their terms reasonably allow, but that such interpretation should not be inconsistent with the patent's specification and with usage of the terms by one of ordinary skill in the art. Counsel has also informed me that this may yield interpretations that are broader than, or different from, the interpretation applied during a District Court proceeding, such as the pending MTel litigation.

12. I have no financial interest in either party or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

13. My findings, as explained below, are based on my study, experience, and background in the fields discussed above, informed by my education in applied mathematics and

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