

## 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.: 01048-21IP891  
Issue Date: Aug. 19, 1997  
Appl. Serial No.: 08/480,718  
Filing Date: Jun. 7, 1995  
Title: MULTICARRIER TECHNIQUES IN BANDLIMITED CHANNELS

### **CORRECTED<sup>1</sup> DECLARATION OF DR. BEHNAAM AAZHANG**

1. My name is Dr. Behnaam Aazhang, of Houston, Texas. 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.

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<sup>1</sup> The only changes to this declaration as compared to my previously submitted Declaration are (i) the change in title, (ii) this footnote (iii) a sentence added to paragraph 20, and (iv) paragraphs K15 to K51 below, added so as to physically reproduce paragraphs 15 to 51 from the Declaration of Dr. Kakaes, which I previously had incorporated by reference in my earlier declaration, so that someone wishing to cite those paragraphs representing my testimony can review this Corrected Declaration without also having to review Dr. Kakaes’ declaration.

2. I have over thirty (30) years of experience in electrical and computer engineering in wireless communications with a focus on the interplay of communication systems and networks, including network coding, user cooperation, spectrum sharing, and opportunistic access. I attended the University of Illinois at Urbana-Champaign from 1979 to 1986, where I earned a Bachelor of Science, a Master of Science, and a Ph.D. in Electrical and Computer Engineering.

3. In 1985 I joined the faculty of Electrical and Computer Engineering at Rice University as an Assistant Professor. In 2001, I became the J. S. Abercrombie Professor, at Rice University. At Rice, I have been teaching undergraduate courses in communication theory and systems, and developed a hands-on education laboratory for digital communications. I also teach graduate courses in the area of communication engineering, including wireless communications, random processes, detection and estimation theory, information and coding theory, spread spectrum communication systems, and topics in multiple access communications. In addition, I have received several NSF and NASA research grants, as well as being awarded numerous contracts with Texas Instruments, IBM, the State of Texas, National Instruments, the United States Air Force, and Nokia.

4. In 1997, I founded the Center on Multimedia Communications at Rice University, in Houston, Texas. From 1997 until 2005, I served as its Director

where I supervised core faculty, graduate students, staff members, and managed a budget of more than \$4 million in annual research expenditures.

5. From 2004 to 2014, I served as the Chair of Electrical and Computer Engineering at Rice University where I supervised faculty, staff members, and graduate students, and managed a budget of more than \$4.5 million annual for operating costs and \$12 million annual external research funding.

6. From 2006 to 2013, I served as an Academy of Finland Distinguished Visiting Professor (FiDiPro) at the University of Oulu, in the Center for Wireless Communication in Oulu, Finland, where I taught short courses on Cooperative Communications and on Understanding Wireless Networks.

7. In 2014, I became the Director of the Center for Neuro-Engineering, a multi-university research cluster within the Gulf Coast Consortium, which fosters collaboration among researchers and clinicians from Rice University, Baylor College of Medicine, The University of Texas Health Sciences, and The University of Houston. The Center for Neuro-Engineering is focused on an emerging field intersecting neuroscience and engineering.

8. Over the course of my career, I have authored and co-authored some three hundred (300) publications on various aspects of fixed and mobile communications, as noted in my curriculum vitae. My papers have been cited by other publications over 19,000 times and in 2003 I was recognized as a Thomson-

ISI Highly Cited Researcher. In 2004, I received the IEEE Communication Society Stephen O. Rice Best Paper Award. 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. I have served as the secretary and the treasurer of IEEE Information Theory Society. I am also a Fellow of IEEE and a fellow of American Association for the Advancement of Science (AASS). I was a commission member of the Mayor's Commission on Cellular Towers from 1998 to 2004. I also served as a panelist for The National Science Foundation.

9. I have served as an editor for the IEEE and other publications. In 2007, I served as the editor of the KICS Journal of Communication and Network's Special Issue on Cooperative Communications. I also served as editor for the IEEE Journal on Selected Areas in Communication's Special Issue on Cooperation and Relay in December 2006, and the IEEE Transactions on Communications from 1993 to 1998. I have organized technical sessions in technical conferences, which included serving as the Publications Chair of the IEEE International Symposium on Information Theory, held in San Antonio, Texas in January 1993; the General Chair for the IEEE International Theory Symposium on Information Theory, held in Austin, Texas in June 2010; the IEEE Communication Theory Workshop, held

in Dorado, Puerto Rico in May 2006, as well as the Third Annual Texas System Day Symposium, held in Texas in November 1989.

10. From 1996 to 2009, I was granted 13 patents as inventor or co-inventor.

11. From 1998 to the present, I have served as a consultant on a variety of cases all over the United States, including several patent infringement cases. These cases involved Samsung, MOSAID, Wi-LAN, Marvell, Qualcomm, LG Inc., the City of Houston, Lockheed-Martin, WorldCom, Rockwell International, Research and Development Laboratory, IBM Federal System Company, and Startek International Corp. In addition, I have served as a consultant on international litigation, including cases involving Nokia, in Finland, and ETRI, in Korea.

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.

### **I. Scope of Assignment**

13. I have been asked to provide my findings as to whether certain subject matter of the '891 patent is disclosed in certain references, including: (1) Dr. Rade Petrovic *et al.*, *Permutation Modulation for Advanced Radio Paging*, IEEE

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