

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HTC Corporation and HTC America, Inc.,
Petitioners

v.

INVT SPE LLC,
Patent Owner

Case No. IPR2018-01557
U.S. Patent No. 6,760,590

DECLARATION OF RAYMOND NETTLETON, Ph.D

I, Raymond Nettleton, declare:

I. Introduction

1. My name is Raymond Nettleton, Ph.D. I have been retained as a technical expert and submit this declaration on behalf of INVT SPE LLC (“INVT”), which I understand is the owner of U.S. Pat. No. 6,760,590 (the “’590 patent”), claims 1-8 of which are being challenged in a petition for *inter partes* review. I also understand that claims 1, 2, 5, and 6 of the ’590 patent have been disclaimed by INVT.

2. I have no financial interest in or affiliation with INVT or the Petitioners, which I understand are HTC Corporation and HTC America, Inc. My compensation does not depend upon the outcome of, or my testimony in, this *inter partes* review proceeding or any litigation proceedings.

3. I have been asked to provide an opinion on certain documents and arguments relating to the validity of the ’590 patent that were submitted in conjunction with and are relevant to the Petition for *inter partes* review.

II. Background/Qualifications

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

5. I am currently employed as an associate professor at the University of Colorado - Boulder, within the College of Engineering and Applied Science.

6. I also provide consulting services through my telecommunications consulting company, Ray W Nettleton LLC. In that capacity I provide telecommunications consulting services in relation to wireless technologies and networking, among other things.

7. I have a Doctor of Philosophy degree in electrical engineering and communications from Purdue University, awarded in December 1978. The topic of my thesis was "Spectral Efficiency in Land-Mobile Communications: A Spread Spectrum Approach." This work, which focused on the code division multiple access (CDMA) format, ended up forming part of the third generation (3G) of wireless mobile telecommunication technology;

8. I obtained my Masters of Science in Electrical Engineering from Purdue University in June 1976; and

9. I obtained a Bachelor of Technology from the University of Dayton, graduating Magna cum Laude in June 1974.

10. Since January 1, 2014 I have been a Life Member of the Institute of Electrical and Electronics Engineers (IEEE).

11. After completing my Ph.D., in 1979 I was appointed an Assistant Professor in the Department of Electrical Engineering and Systems Science at Michigan State University. I taught both graduate and undergraduate courses in communications, signal processing and signal theory and probability and stochastic

processes. As part of this role I also successfully obtained research grants from the US National Science Foundation and Hitachi, and conducted research into power control and composite code design for CDMA cellular systems.

12. In 1983 I left Michigan State University and became manager at the Amecom Division of Litton Systems, Inc. (now part of Northrup Grumman), a telecommunications equipment and services provider to the US Armed Forces. I supervised R&D in classified US Government programs, including designing (i) a digital modem using a Fast Fourier Transform algorithm for demodulation; and (ii) signal processing algorithms and software for a 200MHz-bandwidth optical film recorder used for electronic intelligence (ELINT) purposes.

13. From 1985 until 1986 I was a principal engineer at McCreary Research, Inc., a military communications consulting firm. I was responsible for the technical analysis of various US Navy communication systems.

14. In 1986 I became project manager at Stanford Telecommunications, Inc., a satellite communications manufacturing and consulting company (now part of Alcatel Lucent). In this role I established and supervised a team which performed mathematical modelling, simulation, and analysis of satellite communications systems. I also performed interference analyses and wrote analysis software for various NASA scientific spacecraft.

15. I moved to the business and technology consultancy firm Booz | Allen | Hamilton, Inc. in 1989 as a Senior Associate. In this role I provided technical leadership to 28 professionals working on cellular, personal and satellite communications. For example, I provided technical advice on cellular spectrum regulatory plans for clients such as Oftel and Austel, the respective telecommunications regulating bodies in the UK and Australia.

16. In 1991 I became a director and distinguished member of technical staff at US West Advanced Technologies, Inc. (US West Advanced). US West Advanced was the R&D division of US West Communications, Inc. US West Communications had a background in wire-line technology and was operating an analog, first-generation cellular service, but had limited prior experience in digital wireless cellular technologies. US West Communications therefore established a program within US West Advanced in order to investigate, develop and select promising digital cellular technologies. In this role, I supervised 50 professionals in fields such as engineering, mathematics, computer science and economics. These professionals had a broad range of skills including in relation to air interfaces (i.e. wireless), core networks (i.e. wired), human interfaces, infrastructure costing and financials. My role included creating plans and new services for entering the digital wireless market at 1.9GHz, for expanding existing markets and for entering new

markets. This work included performing technical due diligence studies on wireless-related investment opportunities.

17. From 1996 until 2000 I was the Senior Vice President and Chief Technology Officer of Formus Communications Inc., a US\$1 billion international broadband connectivity and IP solutions company with a license population coverage of 200 million. I was also a cofounder of that company. In that role I was responsible for technology policy, selection of network vendors and architectures, and advising national telecommunications regulators. I was the company's primary speaker at industry conferences, and part of a small core team responsible for acquiring Fixed Wireless Access Licenses in the USA, Argentina, Colombia, Peru, Uruguay, Ecuador Norway, Ireland, Finland, Denmark, Poland, Luxembourg, Belgium, Spain, Germany, Switzerland, and New Zealand (and potentially expanding into South Africa, Malaysia, Singapore, Thailand, Korea, Taiwan and the Philippines).

18. Since 2002 I have been an Associate Professor in the College of Engineering and Applied Science at the University of Colorado - Boulder. Between April 2002 and May 2004 I was the Department Chair. As chair, in addition to my teaching and research roles, I managed budgets, scheduling and academic matters at the Department level, and interacted with the Dean and Provost on administrative matters. As Associate Professor I teach the

Interdisciplinary Telecommunications Program, which offers a graduate degree in Interdisciplinary Telecommunications. This addresses all aspects of the telecommunications industry, including technical, economic, legal, regulatory and business. My classes cover topics such as wireless local area networks, cellular networks, satellite, and wireless communications technologies. Additionally, I have conducted research into ad hoc antenna arrays, ad hoc network addressing, and core network aspects of cellular/Wi-Fi handoff. I also teach a course on commercial satellite operations and communications at the Colorado Center for Astrodynamics Research.

19. From 1994 to the present day I have also provided telecommunications consulting services to a range of clients. This has included:

- a. providing technical and networking consulting to telecommunications companies. For example, I provided consulting services to MCI (a US competitive local exchange carrier) by comparing proprietary Motorola wireless technology against GSM wireless technology;
- b. preparing wireless services research reports for telecommunications consulting houses; and
- c. writing a fast computer algorithm to evaluate intermodulation products in a multitenant radio tower environment.

20. I have published a number of papers and reports in engineering journals such as the IEEE “Spectrum” Journal, the IEEE “Communications” Magazine, the IEEE Journal on Vehicular Technology, and numerous conference records. I was the co-editor of the 1993 IEEE Journal on Selected Topics in Communications and authored a chapter/section titled “Terrestrial Radio Links” for the “Handbook of Modern Electrical and Electronic Engineers” edited by C Belove, 1986. I have also delivered presentations at conferences organized by industry bodies such as the IEEE, the International Wireless Industry Consortium, and the Wireless Communication Association International. Examples of these papers and presentations are set out in my résumé.

21. I am also listed as the co-inventor of two granted US patents (both of which have now expired), namely:

- a. US patent no. 4,189,677 titled “Demodulator Unit for Spread Spectrum Apparatus Utilized in a Cellular Mobile Communications System”; and
- b. US patent no. 4,222,115 titled “Spread Spectrum Apparatus for Cellular Mobile Communication Systems.”

III. Materials Considered

22. Appendix B to this declaration lists materials that I have considered in rendering the opinions that I express in this declaration. In forming my opinions, I have also relied on my experience and education.

IV. Applicable Law

23. I am not an attorney. I offer no opinions on the law. But counsel has informed me of legal standards that apply to the issue of patent validity. I have applied these standards in arriving at my conclusions. I understand that a prior art reference must be considered in its entirety, including portions that would lead away from the claimed invention. I also understand that a reference may be said to teach away when a person of ordinary skill, upon reading the asserted reference, would be discouraged from following the path set out in the challenged patent, or would be led in a direction divergent from the path that was taken by the patent applicant.

V. *Gils* Teaches Away From Using Two Different Linear Unequal Error Protecting (“LUEP”) Codes.

24. I have been asked to determine whether POSITA would have understood the reference W. van Gils, “Design of error-control coding schemes for three problems of noisy information transmission, storage and processing,” Ph.D., dissertation, Eindhoven Univ. of Technology, Eindhoven, the Netherlands, 1988. (“Gils”) to teach away from using two separate LUEP codes to encode a single

data word. I conclude that Gils teaches away from using LUEP codes in this fashion.

A. Overview of Gils

25. *Gils* purports to be a Ph.D. thesis entitled “Design of Error-Control Coding Schemes for Three Problems of Noisy Information Transmission, Storage and Processing.” *Gils* at iii. The thesis appears to have been submitted to the Eindhoven University of Technology in The Netherlands. *Id.*

26. As explained by Gils, generally, when a code word is transmitted, the receiver can correct a certain number of bits in the code word that are received erroneously and detect (but not correct) a certain number of additional errors. *Id.* at 4. *Gils* teaches the use of a particular type of codes called linear unequal protection (“LUEP”) codes, which “provide more protection for select positions in the input message words than is guaranteed by the minimum distance of the code.” *Id.* at 13. *Gils* generally seeks “to give parts of mutually different importance different protection against errors,” and states “this can be done by using different coding schemes for the different parts, but more elegantly by using a single so-called Unequal Error Protection coding scheme.” *Gils* at v.

27. In other words, using LUEP codes ensures that certain bits can be corrected, even if the code word is received with more erroneous bits than the minimum distance would normally allow to be corrected. *Id.* at 14. *Gils* teaches

that the use of a single LUEP code presents an improvement over using multiple types of codes to provide unequal error protection. *Id.* at v.

28. Table 1 of *Gils* provides a number of exemplary LUEP codes. *Id.* at 25. One exemplary code provided in Table 1 is provided below:

n	k	$d(n, k)$	separation vector
6	4	2	A 3222

Id. at 25. In this example, the length of the code word is 6. *Id.* at 24. The length of the data word to be encoded is 4. *Id.* $d(n, k)$ denotes the maximum minimum distance of the code (*e.g.*, the largest number of bits that can be different between any two code words). *Id.* Thus, in the example above, for any two valid code words, the largest number of bits that can possibly be different between the two code words is two. *Id.*

29. Table 1 also identifies the “separation vector” for each of the codes listed therein. *Id.* In this example, the separation vector is 3222. *Id.* Each value in the separation vector corresponds to a bit of the data word and denotes how many errors can occur in the received code word while still guaranteeing that the bit in the data word is correctly decoded. *Id.* at 14 (“complete nearest neighbour decoding guarantees the correct interpretation of the i th message digit if no more than $(s_i - 1)/2$ errors have occurred in the transmitted codeword,” where s_i is the separation vector values). Thus, the first bit in the data word can be correctly

interpreted if no more than one of the bits in the code word is received erroneously. *See id.* at 16 $((3 - 1)/2 = 1 \text{ bit})$. Errors in the remaining bits can be detected, but not corrected. *Id.* $((2 - 1)/2 = 1/2$, where $1/2$ is rounded down to 0 bits). Thus, *Gils* discloses using a single LUEP code that provides enhanced protection for individual bit positions within the data word.

B. A POSITA Would Have Understood Gils to Teach Away From Using Two Different LUEP Codes To Protect A Single Data Word.

30. As discussed above, Gils generally seeks “to give parts of mutually different importance different protection against errors,” and states “this can be done by using different coding schemes for the different parts, *but more elegantly by using a single so-called Unequal Error Protection coding scheme.*” Gils at v (emphasis added). By describing a single LUEP coding scheme as “more elegant[],” Gils directs a POSITA to use a *single* LUEP code and *not* to employ different coding schemes for different portions of a data word. *See id.* A POSITA would have understood this statement as teaching away from using multiple codes on a single data word, at least in the context of the LUEP codes described in Gils. A POSITA would reach this conclusion because the remainder of Gils is directed to the identification of the LUEP codes that Gils characterizes as “more elegant[],” when used individually, and because Gils never describes using any of the LUEP codes it derives as being used in combination with one another. *Id.*

31. Thus, Gils does not teach a POSITA “to select the two coding schemes that could be used to derive code words for a 4-bit data word” as argued by the Petition. In fact, Gils would lead a POSITA “in a divergent direction from the path that was taken” in the ’590 patent. *Id.* Based on Gils statement that a single LUEP is “more elegant” than using different code schemes, a POSITA would have understood that the codes described in Gils should be used individually and not stitched together as asserted by the Petition. *Id.* Therefore, it is my opinion that Gils teaches away from using the LUEP codes disclosed therein in combination with one another, as asserted by the Petition.

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 Section 1001 of Title 18 of the United States Code.

Respectfully submitted,

Dated: November 28, 2018



Raymond Nettleton, Ph.D.

Appendix A



DR. RAY W. NETTLETON

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Dr. Nettleton is a consultant and expert witness in wireless technologies and networking. His career has included roles as an entrepreneur, corporate officer, international businessperson, engineer, educator, author, lecturer, and researcher. He is a life member of the IEEE.

Expert Witness

- Expert witness in patent infringement and other civil, regulatory and criminal matters
- IP litigation firms include Nixon Peabody, Wilmer Hale, Keker Van Nest, Latham Watkins, McKool Smith, Orrick, Hogan & Hartson, Freeborn & Peters, Patton Boggs, Kenyon & Kenyon, Finnegan Henderson, Alston Bird, Workman Nydegger, Ropes & Gray, Baker Botts, Wilson Sonsini, Dechert, Foley Lardner, Quinn Emmanuel, Munger Tolles Olson, Fish & Richardson, and Hogan Lovells.
- Provided expert witness testimony to Government hearings in Colombia, Brazil, New Zealand, Poland, UK, Ireland, South Africa, Philippines, and the FCC

International telecommunications businessperson & consultant

- Consulting clients include Ball Wireless, Milcom Technologies, MCI, Avantel de Mexico, United International Holdings, Wireless Spectrum Inc., Vesuvius Inc., Superconducting Core Technologies, iSherpa, Sequel, Motorola, NASA, U S Navy & Air Force, and others
- Performed business and technical feasibility and due diligence, technical and market strategy, and regulatory affairs consulting in the UK, Mexico, Brazil, Chile, Ecuador, Bolivia, Colombia, Argentina, South Africa, most of Europe, Korea, India, China, Japan, Philippines, etc.

Entrepreneur and Corporate Officer

- Co-founder and Chief Technology Officer, Formus Communications, an international wireless CLEC with license coverage exceeding 200 million pops in Europe

Innovative telecommunications engineer & Researcher

- Awarded the first two patents in CDMA technology for cellular telephone systems, issued in 1978 (stemming from PhD thesis research) and ultimately leading to the worldwide adoption of CDMA for 3G cellphone technology.
- Conducted research in system performance, power control and code design for CDMA, and in dynamic channel allocation for FDMA and TDMA systems.
- Established the first LMDS cellular propagation and interference trials (Phoenix, Arizona)
- Created the Boulder Industry PCS Test Bed and conducted trials with multiple vendors
- Designed the first 60GHz radio modem to use a Fast Fourier Transform-based algorithm to track very wide Doppler dynamics created by fighter aircraft motion

Educator, Author, Lecturer

- Professor Adjunct, University of Colorado – Boulder, Interdisciplinary Telecommunications Program and the Colorado Center for Astrodynamics Research
- Taught electrical engineering at Michigan State University, University of Maryland, Johns Hopkins University, and University of Denver
- Over 85 articles in industry publications, conference proceedings and technical journals

EXPERIENCE

February 1994 – Present: CONSULTANT; Clients ranging from Fortune 500 to nascent start-ups. Sample assignments:

- Expert witness in intellectual property litigation and criminal matters (see appendix for public domain details.) Expert witness to Government wireless telecom-related hearings including the International Trade Commission and the Federal Communication Commission. See appendix for details.
- New product development for Pfizer Animal Health, Inc.
- Technical and Regulatory Analysis for Wilson Electronics Inc.
- Regulatory engineering support to wireless network planning for Hawaiian Telcom
- Provided technology and network consulting to Velocom, a major CLEC in Argentina, Brazil and Uruguay
- Advised Military Commercial Technologies (MILCOM) on two potential investments relating to the commercialization of military technology
- Wrote Wireless Services research report for RHK, a Silicon Valley telecom consulting house
- Advised Ball Wireless on future market strategy
- Network and wireless link analysis for ISCO International
- Investment advisor to Venture Capital Companies iSherpa (Denver) and Sequel (Boulder)
- Exposed fatal flaws in MCI's proposed acquisition of Nextel stock (Nextel used the iDEN technology) and shut down the transaction
- Advised MCI on the technology and economics of LMDS and LEO satellite systems
- Created wireless local loop plan for Avantel de Mexico
- Performed technical due diligence for United International Holdings on the acquisition of Wireless Ventures International of Brazil (later acquired by Nextel International)
- Wrote marketing plan "Cellular base station receiver front ends" for SCT
- Re-wrote network design plan for Motorola iDEN system in Beijing, China
- Wrote "Smart Convolution" fast computer algorithm to evaluate intermodulation products in a multi-tenant radio tower environment, for UniSite

April 2002 – present: ASSOCIATE PROFESSOR (DEPARTMENT CHAIR, NOW ADJUNCT), Interdisciplinary Telecommunications Program, College of Engineering and Applied Science, University of Colorado – Boulder. The Program offers a graduate degree in Interdisciplinary Telecommunications, combining instruction in the technical, economic, legal, regulatory and business aspects of the telecommunications industry. It also offers joint degrees with the College of Engineering, the Graduate School of Business, and the School of Law. Also taught a course at the Colorado Center for Astrodynamics Research

Teach courses in: local area networks, public networks, satellite, and wireless communications technologies.

Performed research in: Ad Hoc Antenna Arrays, ad hoc network addressing, and core network aspects of cellular / Wi-Fi handoff.

October 1996 – December 2000: CO-FOUNDER, SENIOR VICE PRESIDENT & CHIEF TECHNOLOGY OFFICER, Formus Communications Inc., a \$1B international broadband connectivity and IP solutions company with license population coverage of 200 million. Responsible for technology policy, selection of network vendors and architectures, advising

national telecommunications regulators. Chief spokesman at conferences. Regular strategy advisor in Formus Board meetings.

- One of three-executive team responsible for acquisition of Fixed Wireless Access Licenses in: USA, Argentina, Colombia, Peru, Uruguay, Ecuador, Norway, Ireland, Finland, Denmark, Poland, Luxembourg, Belgium, Spain, Germany, Switzerland, and New Zealand
- Also participated in planning for businesses in South Africa, Malaysia, Singapore, Thailand, South Korea, Taiwan and the Philippines.

April 1991 - February 1994: DIRECTOR & DISTINGUISHED MEMBER, TECHNICAL STAFF, U S WEST Advanced Technologies, Inc., the R&D arm of U S WEST Communications (formerly acquired by Qwest, now CenturyLink). Directed 50 professionals in engineering, mathematics, computer science, economics etc.

- Directed creation of plans and new services to enter the wireless market at 1.9GHz
- Produced plans for Wireless Local Loop to enter new markets abroad, to answer competitive threats at home, and to solve the "held-order" problems of un-served customers
- Performed technical "due diligence" studies on wireless-related investment opportunities

April 1989 - April 1991: SENIOR ASSOCIATE, Booz | Allen | Hamilton, Inc., a major technology and business-consulting house. Provided technical leadership to 28 professionals working on satellite communications. Built consulting business in cellular, personal and satellite communications; managed proposals, marketing and consulting projects.

- Brought in four new contracts to the firm totaling \$1.5M
- Gave expert witness testimony before a hearing of the New Zealand Commerce Commission concerning a license dispute. The Commission found in favor of our client (First City Great Britain Ltd.)
- Advised on cellular spectrum regulatory plans for Booz | Allen's clients Oftel, the British telecommunications regulating board, and Austel, its Australian equivalent
- Designed and performed ground and airborne proof-of-concept tests. Wrote and presented technical sections of American SkyCell's pleadings before the FCC
- Performed spacecraft interference analyses and wrote analysis software for the NASA Spectrum Manager

November 1986 - April 1989: PROJECT MANAGER, Stanford Telecommunications, Inc., a satellite communications manufacturing and consulting company (now part of Alcatel). Supervised seven professionals performing mathematical modeling, simulation and analysis of satellite communications systems.

- Built the analysis group from myself to seven, increasing the NASA funding level of one task by 400% and of a second by 100%
- Performed interference analyses and wrote analysis software for various NASA scientific spacecraft

July 1985 - October 1986: PRINCIPAL ENGINEER, McCreary Research, Inc., a military communications consulting firm. Responsible for technical analysis of various U S Navy communication systems

- Authored communications plans and performed interference analyses for Navy satellite programs

July 1983 - July 1985: MANAGER, Amecom Division of Litton Systems, Inc. (now part of Northrup Grumman), a telecommunications equipment and services provider to the U S Armed Forces. Supervised R&D in classified Government programs.

- Designed a 60GHz digital modem using a Fast Fourier Transform algorithm for demodulation and tracking of the very wide Doppler dynamics resulting from fighter aircraft motion
- Designed signal processing algorithms and developed software for a 200MHz-bandwidth optical film recorder used for electronic intelligence (ELINT) purposes

1979 – 1983: ASSISTANT PROFESSOR of Electrical Engineering and Systems Science, Michigan State University. Taught graduate and undergraduate courses in communications, signal processing and signal theory, and probability and stochastic processes.

- Won research grants from the National Science Foundation and Hitachi. Performed and supervised research into power control and composite code design for CDMA cellular systems
- Supervised PhD thesis "Power Control and Interference Management in a Spread Spectrum Cellular Mobile Radio System", by Hossein Alavi, 1984

EDUCATION

Ph.D. Purdue University, EE/Communications, December 1978
Thesis topic: "Spectral Efficiency in Land-Mobile Communications: A Spread-Spectrum Approach", supervised by Dr. George R. Cooper.

M.S.E.E. Purdue University, June 1976

B.Tech. University of Dayton, Magna cum Laude, June 1974

U.S. PATENTS

4,222,115 "Spread Spectrum Apparatus for Cellular Mobile Communication Systems". George R. Cooper, co-inventor

4,189,677 "Demodulator Unit for Spread Spectrum Apparatus Utilized in a Cellular Mobile Communications System". George R. Cooper and David P. Grybos, co-inventors

These patents have been cited in 291 other patents in the interval 1979 to 2014.

PUBLICATIONS

Reports for Client or Internal Use

1. "Wireless equipment recommendations for Brazil and Argentina", for Velocom, Inc., June 2001
2. "Wireless Strategy Options", for Ball Aerospace commercial wireless division, April 2001
3. "Local Loop Replacement: A Report on Technology, Regulation, Economics and Business Issues", confidential client, September 1995
4. "A Primer on Low Earth Orbiting Satellites", for MCI, January 1995.
5. "Avantel Deployment Program Plan", for Avantel de Mexico, December 1994.
6. "Spectrum Policy Choices for Mexico", white paper for Avantel de Mexico and the SCT (Mexico's regulatory body), November 1994.
7. "Nextel Technology Assessment", due diligence report for MCI, June 1994
8. "Wireless Approaches to Video and Broadband," white paper for U S WEST, January 1994.
9. "PCS Overview and Strategies," white paper for U S WEST, Fall 1993.
10. "Wireless Approaches to Fixed Loop Provisioning," white paper for U S WEST, Fall 1993.

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11. "Opportunities in the Mobile Radio Marketplace," prepared for Hughes Network Systems, Germantown, Maryland, December 3, 1990.
 12. "Orbital Aspects of Interference among S-Band Data Relay Satellite User Spacecraft," Prepared under NASA Contract, December 1989.
 13. "Potential Interference between ATDRSS and DSCS," Prepared under NASA Contract, March 10, 1989.
 14. "Comments on Interference Effects from Japanese DRTS Spacecraft at 170 degrees," Prepared under NASA Contract, December 13, 1988.
 15. "FDMA Performance of the TDRS K_u Band Transponder," Technical Memo to Code 530, prepared under contract to NASA.
 16. "S-Band Frequency Sharing Among Research and Applications Satellites," 8th Annual Meeting of the Space Frequency Coordination Group, November 9-15, 1988, Buenos Aires, Argentina. Prepared under NASA Contract.
 17. "Properties of TDRSS Pseudonoise Sequences," STI/TR880141, September 1988. Technical memo to the Space Network Interoperability Panel. (NASA, ESA, NASDA.) Prepared under NASA contract, September 1988.
 18. "Simultaneous Access of the two KSA Services of One TDRS by STS and SSF," Prepared under NASA contract, August 6, 1988.
 19. "Naval UHF SATCOM Systems Spectral Assessment." Prepared under contract to Space and Naval Warfare Systems Command, Navy Space Project Office, September 1985.
 20. "UHF Follow-On Satellite Communication Package Specification Analysis." Prepared under contract to Space and Naval Warfare Systems Command, Navy Space Project Office, September 1985.
 21. "Comparison of Risk in Services Offered by Two Computer Disaster Recovery Companies," Prepared under contract to Manufacturers Hanover Bank, January 1985.
 22. "Anti-Jam Properties of Slow Frequency-Hopping Signals." Litton Amecom White Paper, proprietary, August 1983.
 23. "Civil Applications of Spread Spectrum, Phase II, Volume 2; Composite Sequences for Pseudonoise Signaling." Prepared under contract to Hitachi Central Research Laboratories, July 1982.
 24. "Civil Applications of Spread Spectrum, Phase II, Volume 1; Frequency Hopping Sequences." Prepared under contract to Hitachi Central Research Laboratories, January 1982.
 25. "Spectral Efficiency in Land-Mobile Communications: A Spread-Spectrum Approach," technical report TR-EE 78-44, Purdue University, prepared under NSF contract. A reprint of the author's Ph.D. thesis, December 1978. With George R. Cooper.

Publications, Presentations and Reports in the Public Domain

26. "Push to Talk over Cellular (PoC): Business Opportunities and Challenges" published by Mindcommerce, February 2008
27. "Solving the Last Mile Problem with Centimeter-Wave Fixed Broadband Wireless", multiclient report published by RHK, Fall 2001
28. "Ultrawideband Interference and Pulse Repetition Frequency", *ex parte* comments of the WCA, Docket 98-153, *in the matter of modifying the Part 15 rules for ultrawideband emissions*, August 2001
29. "Eliminating the Truck Roll Problem in BWA", WCAI Conference Wireless Now!, Boston, MA, June 27-30, 2001
30. "Millimeter Wave Equipment Outlook II", IWPC conference Millimeter Wave Supply Chain Summit, Washington, D.C., April 2001
31. "Broadband Wireless Access in Europe", KC Global Conference on Broadband Access, Amsterdam, October 23rd 2000
32. "The Outlook for Multipoint Broadband Wireless Access", Keynote speech at the Broadband Solutions Conference, Dallas, April 10th 2000;
33. "Formus and Multipoint Systems", IBC Broadband Summit at the Dorchester, London, April 17th 2000;
34. "Formus and Multipoint Systems", Convergence 2000 conference in Brussels, May 22nd 2000;
35. "Economics of Broadband Wireless Access", IBC Broadband Conference in Stockholm, June 15th 2000;
36. "What Service Providers Want", Wireless Communications Association's WCA2000 at the New Orleans Convention Center, July 11th 2000.
37. "Standards in BWA", Wireless Communications Association's WCA2000 at the New Orleans Convention Center, July 10th 2000.
38. "Millimeter Wave Equipment Outlook", IWPC conference Millimeter Wave Supply Chain Summit, New Orleans Convention Center, July 9th 2000.
39. "Formus and Fixed Wireless Access", Private and Wireless Conference 99, Denver Convention Center, September 1999
40. "Formus and Fixed Wireless Access", RAWCON 99, Marriot Denver South, August 1999.
41. "Formus and Fixed Wireless Access", WCA 1999 at the New Orleans Convention Center, July 1999.
42. "LMDS: Its Competitors and Complements", International Institute for Research Broadband Wireless Conference, Phoenix, Arizona, December 1998
43. "LMDS: The Target Markets", International Institute for Research Broadband Wireless Conference, December 1998

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44. "LMDS and Point-to-Multipoint Technology", Shorecliff Broadband Wireless Conference, May 1998
 45. "LMDS and Point-to-Multipoint Technology", COMDEX '98, April 1998
 46. "REACH: A High-Performance Cellular Base Station Front End", Wireless Personal Communications Technologies and Services, SPIE Conference, Philadelphia, PA, October 1995
 47. "Post Auction Stress Syndrome", RCR, September 1995. With Dr. Pierre Dogan
 48. "The Future of Wireless", invited address to the Wireless World '94 conference, a gathering of CEOs and investors in Latin American cellular, private radio and paging concerns, sponsored by Motorola, Orlando, Florida, November 15th 1994.
 49. "PCS in the USA and in the World," invited tutorial at the International Telecommunications Symposium, Rio de Janeiro, August 22 1994.
 50. Special Issue on Personal Communications, Volumes 1 and 2, IEEE Journal on Selected Topics in Communications, August 1993. Invited guest co-editor with Drs. Chuang, Fukada, Andersen.
 51. "U S WEST's Trial Portfolio," PIMRC Conference, Yokohama, Japan, October 13th 1993.
 52. "Personal Communications in the Banking Industry," Banking '93 Conference, New Orleans, May 25th 1993.
 53. "Personal Communications and U S WEST," Keynote Address, National Wireless & Radio Engineers Conference, Denver, CO, June 1 - 4, 1992.
 54. "Preventing Dominance in the Cellular Mobile Telephone Market," report on behalf of First City for the September 11 - 12, 1990 hearings, New Zealand Commerce Commission
 55. "Traffic Statistics in a Self-Organizing Cellular Telephone Scheme," 40th IEEE Conference on Vehicular Technology, May 6-9, 1990, Orlando, FL
 56. "Comments on the Goeken Filing of August 8, 1989," part of the Reply Comments of American Sky Cell Corporation in the matter of Docket 88-96, October 10, 1989, Federal Communications Commission, Washington, D.C.
 57. "A High-Capacity Assignment Method for Cellular Mobile Telephone Systems," 39th IEEE Conference on Vehicular Technology, May 1-3, 1989, San Francisco, CA.
 58. "Spectrally Efficient Mobile Communications via Dynamic Resource Management; *ex parte* Comments on Docket 84-1231," before Federal Communications Commission, 24 April 1986. With Jerry Schloemer and Leo Aubel.
 59. "Airborne Tactical EHF Communications." Milcom '85, Boston, October 1985. Classified **SECRET**.
 60. "ELINT Signal Processing for the Bragg Cell Recorder," presented at the 1985 Symposium on Electronic Intelligence, National Security Agency, May 14th, 1985. With T. Hubin. Classified **SECRET**.

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61. "Terrestrial Radio Links." Section 49.1 of Handbook of Modern Electrical and Electronic Engineering. Edited by Charles Belove, Wiley, 1986.
 62. "Acquisition and Tracking for Frequency-Hopping HF Communications." URSI meeting, Boulder, CO., January 1984.
 63. "Power Control for a Spread Spectrum Cellular Mobile Communications system with Shadow Fading." Conference Record of ICC '83, San Diego, CA, November-December 1983. With Hossein Alavi.
 64. "Spread-Spectrum Principles for Multiple-Access Systems." Invited tutorial paper for First Canadian Domestic and International Satellite Communications Conference, Ottawa, Canada, June 15-17, 1983.
 65. "Spectrum Efficient Cellular Mobile Communications." Tutorial paper for 33rd Annual Vehicular Technology Conference, Toronto, Ontario, May 25-27, 1983, Session C2.
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 67. "Cellular Mobile Communications; the Great Multiplier." With George R. Cooper, IEEE Spectrum, April 1983.
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 71. "Addressing and Modulation for Frequency-Hopping Multiple Access." Conference Record of MILCOM '82, Boston, MA, October 17-20 1982, Paper 35.4.
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 74. "Traffic Theory and Interference Management for a Spread Spectrum Cellular Mobile Radio System." Conference Record of ICC '80, Seattle, WA, June 1980, Paper 24.5.
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 79. "Is Spread Spectrum Mobile Radio Compatible with Narrow-Band Systems?" With George R. Cooper, David Grybos, and Bruce Lusignan, IEEE Communications Magazine 17(5):2-3 · October 1979
 80. "Cellular Land Mobile Radio: Why Spread Spectrum?" With George R. Cooper and David P. Grybos, IEEE Communications Magazine, V. 17:2, pp. 12-24 March 1979.
 81. "Spectral Efficiency of Spread Spectrum Land Mobile Communication Systems." With George R. Cooper, Conference Record of INTELCON/79, Dallas, TX, Horizon House International, February 26 - March 2, 1979.
 82. "A Spread Spectrum Technique for High-Capacity Mobile Communications." With George R. Cooper, IEEE Transactions on Vehicular Technology, special issue on emerging 900 MHz technologies, VT-27:4, November 1978, pp. 264-275.
 83. "Error Performance of a Spread Spectrum Mobile Communications System in a Rapidly Fading Environment." With George R. Cooper, Conference Record of the National Telecommunications Conference, NTC '77, Los Angeles, CA, December 5-7, 1977, Paper 35-5.
 84. "Mutual Interference in Cellular LMR Systems: Narrowband and Broadband Techniques Compared." With George R. Cooper, Conference Record of MIDCON '77, Session 9, Paper 5, Chicago, IL, November 8-10, 1977. Electrical and Electronics Exhibitions, Inc.
 85. "Theoretical Upper Bounds on Spectral-Spatial Utilization in a Cellular Land Mobile Communication System." With George R. Cooper, presented at the IEEE 1977 International Symposium on Information Theory, Cornell University, Ithaca, NY, October 10-14, 1977. Published in abstract form only.
 86. "A Spread Spectrum Technique for High Capacity Mobile Communications." With George R. Cooper, Conference Record of the 27th Vehicular Technology Conference, Orlando, FL, March 16-18, 1977, pp. 98-103.

APPENDIX 1: EXPERT WITNESS SUMMARY 2011-2017¹

1. UNITED STATES DISTRICT COURT FOR NEW JERSEY

High Point SARL vs. T-Mobile

Case no. 2:12-cv-01453-DMC-JAD, 2012- *concluded*

Client: High Point SARL, represented by Dechert. Consulting. CDMA patents

2. US DISTRICT COURT NORTHERN DISTRICT OF ILLINOIS EASTERN DIVISION

US vs. Huanjan Jin

Case no. 80 CR 192, (Theft of trade secrets and economic espionage), 2010-2011 *concluded*

Client: Federal Defender Program, Chicago. Prepared expert disclosure, testified at trial. iDEN technology.

3. UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLORADO

CellPort vs. Peiker

Civil Action No. 09-CV-01007-MSK-MJW, 2010-2013 *concluded*

Client: CellPort, represented by Hutchinson Black & Cook. Product testing, report, testified in deposition. Vehicular handset cradle patents.

4. UNITED STATES INTERNATIONAL TRADE COMMISSION WASHINGTON DC

Nokia vs. Apple

Investigation No. 337-TA-771, 2011- *concluded*

Client: Nokia, represented by Alston Bird. Pre-litigation consultations. Smartphone, positioning and dual-RAT patents

5. U. S. DISTRICT COURT FOR THE DISTRICT OF DELAWARE, WILMINGTON DIVISION

Nokia vs. Apple

Case no. 09 CV 791, 2011- *concluded*

Client: Nokia, represented by Alston Bird. Pre-litigation consultations. Battery saving, dual mode cellular, determination of external connected device, Bluetooth patents.

6. UNITED STATES INTERNATIONAL TRADE COMMISSION WASHINGTON DC

Sony vs. LG

Investigation no. 337-TA-758, 2011- *concluded*

Client: Sony, represented by Kenyon & Kenyon. Product testing and expert report. HDPSA cell change, adaptive voice codec, modulation patents.

¹ In this section “dates”, “ongoing” and “concluded” refer to my professional involvement with the matter. The actual disposition of each case is publicly available at www.pacer.gov (except for Arbitrations, Tribunals, Australia, Netherlands and Canada cases)

7. STATE OF SOUTH CAROLINA COURT OF COMMON PLEAS SEVENTH JUDICIAL CIRCUIT

Joseph & Beverly Tonkovic vs. E.J. Pope & Son, Carl Bryson & Sons, et al

Cases no. 10-CP-42-3212 and 11-CP-42-0872, 2011- *concluded*

Client: Tonkovic, represented by Michael E Spears, PA. Pre-trial consulting, testified in deposition. Cellphone location.

8. UNITED STATES INTERNATIONAL TRADE COMMISSION WASHINGTON DC

HTC vs. Apple

Investigation No. 337-TA-72, 2012- *concluded*

Client: HTC, represented by Finnegan, Henderson, Farabow, Garrett & Dunner. Prepared test plan. Battery saving patents.

9. UNITED STATES PATENT & TRADEMARK OFFICE

Reexamination of US Patent 5,958,006

Docket no. 357037US91RX, 2011- *concluded*

Client: Motorola, represented by Ropes & Gray. Prepared declarations. Data compression patent.

10. UNITED STATES DISTRICT COURT WESTERN DISTRICT OF WISCONSIN

Motorola Mobility & General Instrument vs. Microsoft

Case nos. 10-cv-00699, (*transferred to Western District of Washington*), 10-cv-00700, 2012- *concluded*

Client: Motorola Mobility, represented by Ropes & Gray. Pre-litigation consulting. Optimized messaging patent.

11. UNITED STATES DISTRICT COURT SOUTHERN DISTRICT OF FLORIDA

Motorola Mobility & General Instrument vs. Microsoft

Case no. 10-cv-24063, 2012- *concluded (transferred to Western District of Washington)*

Client: Motorola Mobility, represented by Ropes & Gray. Pre-litigation consulting. Messaging patent.

12. ORANGE COUNTY, CA SUPERIOR COURT

Orange County vs. Murphy & Krasnoperov

Case no. 07NF2970, 2011, *concluded [pro bono]*

Client: Charles Anthony Murphy, represented by Molfetta & Wasserman. Technical consulting. Cell phone location. Testified in court.

13. STATE OF IOWA DISTRICT COURT 8TH DISTRICT

State v. Christopher Pullman

Cause no. FECR 316896, 2012- *concluded*

Client: Office of the State Public Defender. Non-testifying technical consulting. Cellphone location.

14. ONTARIO SUPERIOR COURT OF JUSTICE COMMERCIAL LIST [CANADA]

Commissioner of Competition v Chatr Wireless and Rogers Communications

Case no. CV-10-8993-00CL, 2012- *concluded*

Client: Commissioner of Competition, Canada, Represented By Lenczner Slaght Royce Smith Griffin. Prepared expert report, testified in court. False advertising – dropped call statistics.

15. UNITED STATES DISTRICT COURT, SOUTHERN DISTRICT OF CALIFORNIA

ViaSat et al v. Space Systems/Loral et al

Case No. 3:12-cv-00260-H-WVG – 2012- *concluded*

Client: ViaSat represented by Quinn Emanuel. Pre-litigation consulting. Satellite patents.

16. U. S. DISTRICT COURT, EASTERN DISTRICT OF TEXAS, MARSHALL DIVISION

Apple v Samsung

Case no. 12-cv-000630-LHK, 2012- *concluded*

Client: Samsung represented by Quinn Emanuel. Pre-litigation consulting. 3Gpp HSPA patents.

17. UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF ILLINOIS

Cisco et al v Innovatio IP Ventures

Case no. 11-cv-9308, 2011- *concluded*

Client: Innovatio IP Ventures. Site inspection, code review. Prepared expert report, rebuttal expert report. Testified in deposition and at trial. IEEE 802.11 patents.

18. U. S. DISTRICT COURT, EASTERN DISTRICT OF TEXAS, MARSHALL DIVISION

Mosaid v Marvell et al

Case no. 2:11cv179, 2011- 2013, *concluded*

Client: Mosaid, represented by McKool Smith. Prepared expert report. IEEE 802.11 patents.

19. UNITED STATES DISTRICT COURT, SOUTHERN DISTRICT OF CALIFORNIA

Apple v Motorola Mobility

Case no. 3:12cv00355, 2012- *concluded*

Client: Motorola Mobility, represented by Winston Strawn. Prepared expert report. Breach of contract.

20. SUPERIOR COURT OF CALIFORNIA, COUNTY OF ORANGE

People v Ronald Jordan

Case No. 11HF2340, 2013-, *concluded [pro bono]*

Client: Ronald Jordan, represented by Robison Harley. Testified at trial. Location of cell phone.

21. U. S. DISTRICT COURT NORTHERN DISTRICT OF CALIFORNIA, SAN FRANCISCO DIV.

Barnes & Noble et al v LSI Corp & Agere Systems

Case No. 11-CV-02709-EMC-LB, 2012-2014, *concluded*

Client: LSI, represented by Fenwick & West. Reviewed code, prepared declaration. Variable code rate patents.

22. U. S. DISTRICT COURT NORTHERN DISTRICT OF TEXAS, DALLAS DIVISION

MTel vs. RIM

Civil Action No. 3:12-CV-1652-M, 2013-2014, *concluded*

Client: MTel, represented by Reed & Scardino – patents related to cellular messaging and simulcasting. Infringement analysis. Testified at deposition.

23. U. S. DISTRICT COURT EASTERN DISTRICT OF TEXAS, MARSHALL DIVISION

MTel vs. Sprint Nextel

Case No. 2:12-cv-832-JRG-RSP, 2013-2014, *concluded*

Client: MTel, represented by Reed & Scardino – patents related to cellular messaging and simulcasting. Infringement analysis, prepared declaration, testified in deposition

24. U. S. DISTRICT COURT EASTERN DISTRICT OF TEXAS, MARSHALL DIVISION

MTel vs. Apple

Case No. 2:13-cv-258-JRG-RSP, 2013-2014, *concluded*

Client: MTel, represented by Reed & Scardino – related to cellular messaging and simulcasting. Prepared reports, testified in depositions and at trial

25. U. S. PATENT & TRADEMARK OFFICE, PATENT TRIAL & APPEAL BOARD

NEC IPR vs. CCE

Case No. 2:13-cv-258-JRG-RSP, 2014, *concluded*

Client: NEC, represented by Morgan Lewis – related to cellular neighbor cell information. Inter Partes Review of U. S. Patent no. 6,819,923. Prior art analysis, prepared Expert Declaration under 37 C.F.R. § 1.1328

26. U. S. DISTRICT COURT EASTERN DISTRICT OF TEXAS, MARSHALL DIVISION

MTel vs. Samsung

Case No. 2:13-cv-258-JRG-RSP, 2013-2015, *concluded*

Client: MTel, represented by Reed & Scardino – patents related to cellular messaging. Prepared reports, testified in depositions and at trial

27. INTERNATIONAL COURT OF ARBITRATION, INTERNATIONAL CHAMBER OF COMMERCE

Interdigital Communications Inc. et al vs. Huawei et al

Case No. 20171/RD, 2014- *concluded*

Client: Interdigital, represented by Wilson Sonsini – infringement damages related to wireless patent portfolio. Prepared report, testified at deposition and in tribunal.

28. U. S. PATENT AND TRADEMARK OFFICE, PATENT TRIAL & APPEAL BOARD

Inter Partes Review of U. S. Patent 6,819,923

Trial Number: IPR2014-01131, 2014- *concluded*

Client: ZTE and HTC, represented by Pillsbury. Prior art analysis, prepared Expert Declaration under 37 C.F.R. § 1.1328

29. U. S. DISTRICT COURT, DISTRICT OF DELAWARE

M2M Solutions LLC vs. Sierra Wireless

Case No. 12-030-RGA, 2012- *concluded*

Client: M2M Solutions, represented by Foley Lardner – patents related to wireless monitoring devices. Prepared expert report

30. U. S. DISTRICT COURT, DISTRICT OF DELAWARE

M2M Solutions LLC vs. Enfora/Novatel

Case No. 12-032-RGA, 2012- *concluded*

Client: M2M Solutions, represented by Foley Lardner – patents related to wireless monitoring devices. Prepared expert report, testified at deposition

31. U. S. DISTRICT COURT, DISTRICT OF DELAWARE

M2M Solutions LLC vs. Motorola / Telit

Case No. 12-033-RGA, 2012- *concluded*

Client: M2M Solutions, represented by Foley Lardner – patents related to wireless monitoring devices. Prepared expert report, testified at deposition

32. ICDR, INTERNATIONAL ARBITRATION TRIBUNAL

Clear Talk (DBA) vs. ZTE

Case No. ICDR N 50 198 T 00174 13, 2012-2014, *concluded*

Client: ZTE, represented by Hogan Lovells – Fraud and Breach of Contract. Prepared reports, testified in deposition and at the arbitration hearing.

33. U. S. DISTRICT COURT, EASTERN DISTRICT OF WASHINGTON

Clear Talk (DBA) vs. ZTE

Case No. 12-CV- 110-TOR, 2015, *concluded*

Client: ZTE, represented by Hogan Lovells – Fraud and Breach of Contract. Pre-trial consultation.

34. THE HAGUE DISTRICT COURT, NETHERLANDS

ZTE Netherlands B.V. vs. Vringo Infrastructure Inc.

Case No. C/09/481474 / HA ZA 15-100, 2015 *concluded*

Client: ZTE Netherlands BV, represented by Brinkhof – related to the validity of European patent no. EP 1186119 B2. Prepared reports, attended hearing in The Hague.

35. SUPERIOR COURT OF THE STATE OF CALIFORNIA COUNTY OF RIVERSIDE

People of CA vs. Diana Garcia

Case No. INF1500067, 2016 *concluded [pro bono]*

Client: Diana Garcia, represented by Bosky Kathuria. Location of cell phone. Testified at trial.

36. SUPERIOR COURT OF THE STATE OF CALIFORNIA COUNTY OF VENTURA

People of CA vs. Kelsey Sara Hul

Case No. 201608133, 2016 *concluded*

Client: Kelsey Hul, represented by Howard Rosen. Location of cell phone. Prepared declaration.

37. SUPERIOR COURT OF THE STATE OF CALIFORNIA SAN FRANCISCO DIVISION

Fabienne English et al vs. Apple Inc et al

Case No. 3:14-cv-01619-WHO, 2016 *concluded*

Client: Fabienne English et al, represented by Renee F. Kennedy. Identification of cell phone. Prepared declaration.

38. U.S. DISTRICT COURT, EASTERN DISTRICT OF TEXAS MARSHALL DIVISION

Huawei Technologies Co. Ltd vs. T-Mobile US

Case 2:16-cv-00052, *ongoing*

Client: Huawei, represented by Fish & Richardson. Patents relating to LTE disaster recovery.
Prepared expert reports, testified in deposition

39. FEDERAL COURT OF AUSTRALIA, NEW SOUTH WALES

Voxson Pty Limited vs. Telstra Corporation Limited *et. al.*

Case NSD 2436 of 2013, *ongoing*

Client: Voxson, represented by Melissa McGrath and Craig Smith. Patent relating to transmission of wideband data.

Appendix B

1. Petition for *Inter Partes* Review of U.S. Patent No. 6,760,590 filed August 22, 2018 (Paper 1)
2. U.S. patent No. 6,760,590 (Ex. 1001)
3. File History for U.S. Patent No. 6,670,590 Patent
4. Complaint, *Inventergy, Inc. v. HTC Corporation, and HTC America, Inc.*, C.A. No.: 17-cv-200-VAC-CJB (D. Del. 2017) (Ex. 1003)
5. Inventergy's Voluntary Dismissal Without Prejudice (Ex. 1004)
6. Complaint, *INVT SPE LLC v. HTC Corporation, and HTC America, Inc.*, 2:17-cv-03740-JMV-JBC (D.N.J. 2017) (Ex. 1005)
7. HTC Corp. and HTC America, Inc.'s Motion To Transfer (Ex. 1006)
8. INVT'S Opposition to HTC Corp. and HTC America, Inc.'s Motion to Transfer (Ex. 1007)
9. HTC Corporation and HTC America, Inc.'s Reply Brief In Support Of Their Motion To Transfer (Ex. 1008)
10. PCT Application No. PCT/US98/23428 to Padovani et al. (Ex. 1009)
11. W. van Gils, "Design of error-control coding schemes for three problems of noisy information transmission, storage and processing," Ph.D., dissertation, Eindhoven Univ. of Technology, Eindhoven, the Netherlands, 1988. (Ex. 1010)
12. European Patent No. 0083127 B1 to Driessen (Ex. 1011)
13. B. Masnick and J. Wolf, "On Linear Unequal Error Protection Codes," IEEE Transactions on Information Theory, vol. IT 13, no. 4, pp. 600-607, July 1967. (Ex. 1012)
14. United States Patent No. 7,245,594 to Esteves et al. (Ex. 1013)
15. United States Patent No. 7,079,550 to Padovani et al. (Ex. 1014)
16. United States Patent No. 6,975,611 to Balachandran et al. (Ex. 1015)

17. K. Balachandran, R. Ejzak, S. Nanda, S. Vitebskiy, S. Seth, "GPRS- 136: High-Rate Packet Data Service for North American TDMA Digital Cellular Systems," IEEE Personal Communications, vol. 6, pp. 34-47, June 1999. (Ex. 1016)
18. Declaration of Paul Min, Ph.D. and Curriculum Vitae (Ex. 1017)
19. A.O. Mabogunje, P.G. Farrell, "Construction of Unequal Error Protection Codes," Lecture Notes in Computer Science, vol. 514, Eurocode '90, pp. 87-93, November 1990. (Ex. 1018)
20. U.S. Patent No. 5,691,992 to Molnar et al. (Ex. 1019)
21. United States Patent 6,665,831 to Yoshida et al. (Ex. 1020)
22. United States Patent No. 4,747,104 to Piret (Ex. 1021)
23. United States Patent 6,292,917 to Sinha et al. (Ex. 1022)
24. Philips Journal of Research, Vol. 39, no. 6, 1984 (Ex. 1023)
25. Declaration of Ximena Solano (Ex. 1024)
26. Webpages from WorldCat.org database re Gils Dissertation (Ex. 1025)
27. Correspondence with University of South Wales re Gils Dissertation (Ex. 1026)
28. Webpages from the German National Library of Science and Technology ("TIB - Leibniz Information Centre for Science and Technology and University Library") (Ex. 1027)
29. Correspondence with TIB re Gils Dissertation (Ex. 1028)
30. Correspondence with Karlsruher Institute of Technology (KIT) (Ex. 1029)
31. Correspondence with Hamburg University of Technology (TUHH) (Ex. 1030)
32. Correspondence with Saxon State and University Library Dresden (SLUB) (Ex. 1031)
33. Correspondence with Eindhoven University of Technology (TU/e) (Ex. 1032)
34. Correspondence with Tilburg University (Ex. 1033)
35. Philips Technical Review 1988 (Ex. 1034)

36. Screenshot from Stanford University Library website displaying Philips Tech. Rev. (Ex. 1035)
37. Screenshot from Stanford University Library website displaying Philips Journal (Ex. 1036)
38. Declaration of Oliver Heinisch (Ex. 1037)
39. Certified translated copy of Correspondence with Hamburg University of Technology (TUHH) (Ex. 1038)
40. Certified translated copy of Correspondence with TIB (Ex. 1039)
41. Certified translated copy of Correspondence with the Universitätsbibliothek Stuttgart (Ex. 1040)
42. Certified translated copy of Correspondence with Karlsruher Institut für Technologie (KIT) (Ex. 1041)
43. Declaration of Otto Steinbusch (Ex. 1042)
44. Certified translated copy of correspondence with Eindhoven University of Technology (Ex. 1043)
45. Certified translated copy of correspondence with Bibliotheek UvA/HvA (AMSTERDAM) (Ex. 1044)
46. Certified translated copy of correspondence with the KB National Library of The Netherlands (Ex. 1045)
47. Declaration of Bruce Liebman (Ex. 1046)
48. Correspondence with University of California Riverside (UCR) re the 1984 Philips Journal (Ex. 1047)
49. Correspondence with California State University, Sacramento (CSU) re the 1988 Philips Tech. Rev. (Ex. 1048)
50. Online Catalog Records for the 1984 Philips Journal (Ex. 1049)
51. Online Catalog Records for the Philips Tech. Rev. (Ex. 1050)
52. Declaration of Gerard P. Grenier (“IEEE Declaration”) (Ex. 1051)
53. Declaration of Steve Wasserman (“Retriev-it Declaration”) (Ex. 1052)

54. United States patent 6,167,031 to Oloffson et al. (Ex. 1053)
55. L. Dunning and W.E. Robbins, "Optimal Encodings of Linear Block Codes for Unequal Error Protection," Information and Control vol. 37, pp. 150-177 (1978). (Ex. 1054)
56. A. B. Carlson, "Communication Systems An Introduction to Signals And Noise in Electrical Communication," McGraw-Hill, Inc., 1975. (Ex. 1055)
57. Léon M. H. E. Driessen, "On an Infinite Series of $[4n, 2n]$ Binary Codes," IEEE Transactions on Information Theory, Vol. IT-30, No. 2 (March 1984) (Ex. 1056)
58. Arnold M. Michelson & Allen H. Levesque, Error-Control Techniques for Digital Communication (1985)