Resume

Michael J. Marcus

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Highlights

- Doctorate in Electrical Engineering
- Work experience with increasing responsibility in telecommunications analysis, telecommunications policy formulation, and technical management in both military and civil sectors
- Initiated and directed pioneering spectrum policy breakthroughs resulting in:
    - unlicensed spread spectrum bands used for 802.11 systems (and indirectly commercialization of CDMA cellular technology)
    - commercialization of millimeterwave frequencies (greater than 57 GHz)
    - "interruptible spectrum"/ "Public Safety/Private Partnership"
- Lived and worked in Japan with "hands on" experience in Japanese telecommunications regulatory policy
- Special Advisor to Mrs. Viviane Reding, European Commissioner for Information Society & Media
- IEEE Fellow
- Chair, IEEE-USA Committee on Communication Policy 2012

Education

6/68 S.B. (Electrical Engineering) M.I.T.
2/72 Sc.D. (Electrical Engineering - Computer Science with Operations Research Minor) M.I.T.

3/81 Program in Executive Leadership and Management, Federal Executive Institute
12/82 National Communications Security Course, National Cryptologic School
10/97-8/98 Japanese Language, Diplomatic Language Services, Inc.
10/97-6/98 Japan Area Studies, Foreign Service Institute
4/99 Administrative Training Course for Deputy Division Chiefs, National Institute for Public Administration (Japan)

Employment

10/10 – Present Adjunct Professor, Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University. Teaching course on spectrum engineering and policy with the focus on supporting technical innovation which preventing harmful interference. Also participating in research programs on innovative uses of spectrum.

4/04 – Present Director, Marcus Spectrum Solutions LLC. Providing consulting services in radio technology and spectrum policy issues to a variety of clients worldwide. Clients have included both the European Commission and private clients in US and other countries.

9/94-3/04 Associate Chief for Technology, Office of Engineering and Technology, FCC (ES-4) Initiated a variety of technical policy issues including Docket 94-124 which ultimately made 6.2 GHz of spectrum above 40 GHz available for commercial use for the first time and a pending rulemaking on commercial use of 90 GHz band.

Also initiated proposal to make 13 GHz of spectrum in 71-95 GHz available for commercial use. Leader of cognitive radio initiative, Docket 03-108, proposing several unprecedented applications of "smart radios" to allow more intense use of spectrum and new types of radio services. Senior Technical Advisor and key player in FCC Spectrum Policy Task Force and chair of its working group on Unlicensed Systems and Experimental Licenses resulting in a wide variety of proposals to change spectrum policy. Responsible for technical review of the products of FCC's main technical organization as well as specific policy issues such as millimeterwave technology and cognitive radio technology.

10/97-10/99 Mike Mansfield Fellow. Selected by the Mansfield Center for Pacific Affairs to participate in a Congressionally authorized exchange program with similar agencies in Japan. Spent 1 year in Japanese language and culture studies and then 1 year in Japan working with: Radio Department of Ministry of Posts and Telecommunications, Association of Radio Industries and Businesses/ARIB, Telecom Engineering Center/TELEC, and Office of Hon. Naokazu TAKEMOTO, National Diet of Japan.

6/00-12/00 Desk officer, Department of State, Japan Desk. On detail from FCC to develop program to explain regulatory transparency to Japanese government and advise on US/Japan telecommunications issues. Also handled a variety of US/Japan issues dealing with science and technology cooperation.

2/87-9/94 Assistant Chief for Technology, Field Operations Bureau, FCC. (ES-3) Responsible for technical program of 400 member organization dealing with radio enforcement. Proposed and led new development efforts into a variety of radio fingerprinting areas using digital signal processing techniques. Led technical investigations which successfully located source of first known instances of satellite jamming, "Captain Midnight" and "Playboy" cases. Initiated successful satellite industry efforts to develop ground-based technology to locate source of signals illuminating satellites. Responsible for interagency negotiations with Federal Aviation Administration to find mutually acceptable procedures for preventing interference to aeronautical systems from FM broadcasting facilities and break an interagency impasse on FM radio licensing. Responsible for bureau's technical review of pending FCC policy decisions.

10/91-5/92 Visiting Researcher, Research Center for Advanced Science and Technology, University of Tokyo, and Visiting Researcher, Communications Research Laboratory, Ministry of Posts and Telecommunications (Japan). Under auspices of National Science Foundation's Japan Program studied spectrum management policy in Japan and performed digital signal processing research.

9/81-1/87 Chief, Technical Analysis Division, Office of Science and Technology, FCC, Washington, DC (ES-3) Responsible for supervision of 35 engineers and support staff members working in analysis, programming, and experimental areas at two locations forming the bulk of the FCC's in-house analytical capabilities. Initiated FCC proceedings for spread spectrum technology which were the world's first regulatory actions for this technology (Dockets 81-413 and 81-414) and formed the regulatory basis for Wi-Fi, Bluetooth, and a variety of products. Also initiated proceedings to examine integrated services digital networks (ISDN) and the changing role of CCITT (Docket 83-841), and examine the basic foundations of FCC technical regulations and their relationship to technical innovation (Docket 83-114). Developed proposals to streamline regulatory process to encourage development and introduction of new technology (Docket 85-171). Represented FCC at a wide variety of domestic and international fora.

9/86-12/86 Visiting Associate Professor, Department of Electrical Engineering and Computer Science and Sloan School of Management, Massachusetts Institute of Technology. Developed and taught two courses on communications technology and policy.

9/79-9/81 Chief, Technical Planning Staff, Office of Engineering and Technology, FCC, Washington, DC (GS-15) Responsible for the initiation and staffing of a long range planning group. Initiated FCC action to create a regulatory environment for spread spectrum technology. Helped formulate Final Decision of Second Computer Inquiry and initiated Protocol Inquiry (Docket 80-756) as a long term follow-on. Responsible for advising Chief Scientist and Commission on a wide variety of new technology and national security issues.

9/77-6/81 Professional Lecturer, Department of Electrical Engineering, George Washington University. Developed and taught a course of telecommunications traffic theory. Taught course on group and set theory

5/75-9/79 Research Staff Member, Institute for Defense Analyses, Arlington, VA Participated in technical studies to support decision making in the Office of the Secretary of Defense in two areas: communications ECCM and computer networking for the intelligence community. Coauthored three reports analyzing a variety of policy options to counter hostile communications threats ranging from tactics to ECCM hardware to jammer location and destruction. Prepared proposal for integrating various DoD intelligence networks.

1/72-5/75 1 Lt., USAF, VELA Seismological Center, Air Force Technical Applications Center, Alexandria, VA Project Officer for underground nuclear test detection research. Responsible for the communications design of a worldwide digital collection and processing system for seismic data. Technical direction of a variety of R&D contracts in the communications and signal processing areas from concept formulation to contract negotiation to contract monitoring. Early user of ARPANET/Internet.

1/69-12/71
6/66-9/66
6/67-9/67
2/68-9/68
6/69-9/69 Consultant to Bell Telephone Laboratories on time division switching; Bell Telephone Laboratories, Holmdel and Murray Hill, NJ (MIT Co-op Program) Basic work areas: key telephone system design, data network design, and switching system research. During last two assignments designed and analyzed a new type of switching system for time multiplexed signals and designed a new type of time slot interchanger. Received two patents.

Major Awards

FCC Engineer of the Year Award, 1990

IEEE-USA Electrotechnology Transfer Award, 1994

Citation:"For his pioneering work in the conception, drafting, and enactment of the Federal regulations that legalized commercial spread spectrum radio under FCC Part 15, the rules governing unlicensed devices; thus spawning a multimillion dollar, worldwide, wireless industry."
http://www.ieeeusa.org/awards/pastrecipients/electrotechnology.html

Mike Mansfield Fellowship, 1997-99
http://www.mansfieldfdn.org/fellow/fellow.htm

IEEE Fellow, 2004

Citation: “For leadership in the development of spectrum management policies”
http://www.ieee.org/portal/index.jsp?pageID=corp_level1&path=about/awards/fellows&file=new-fellows.xml&xsl=generic.xsl

Patents

US Patent 3,573,381, "Time Division System", 1971

US Patent 3,700,819, "Time Division Switching System with Time Slot Interchange", 1972

Conference Keynote Addresses

IEEE International Microwave Symposium, June 2004

16th International Zurich Symposium on Electromagnetic Compatibility, February 2005

IEEE International Conference on Ultra-Wideband, September 2005

Open Publications and Presentations

[Links to many of these are available at http://www.marcusspectrum.com/PubliclyAvailableOutputs.htm]

"Design and Analysis of a New Type of Time-Division Switching System", S.M. Thesis, MIT Department of Electrical Engineering, June 1969

"The Queuing Crossbar - A Hybrid Time-Division and Space Division Network" (with H.S. McDonald), Proc. 1969 Nat. Elec. Conf., p. 605-610

"Space-Time Equivalents in Connecting Networks", Proc. 1970 Int. Conf. Comm., p. 35-25_35-31

"Designs for Time Slot Interchangers", Proc. 1970 Nat. Elec. Conf., p. 812-817

"New Approaches to the Analysis and Design of Connecting and Sorting Networks", Sc.D. Thesis, MIT Department of Electrical Engineering, February 1982 (Available from NTIS as AD 740 198)

"Bounds for the Growth of the Number of Contacts in Connecting Networks", Proc. Seventh Int. Teletraffic Cong., 1973

"The Theory of Connecting Networks and Their Complexity:A Review", Proc. IEEE, Vol. 65 No. 9 (September 1977) p. 1263-1271

"Communications ECCM: A Spectrum of Techniques", Signal, Vol. 32, No. 6 March 1978) p. 47-51

"Analysis of Tactical Communications Jamming Problems", IEEE Trans. Comm., Vol. COM-28, No. 9 (September 1980)p. 1625-1630

"The Integrated Services Digital Networks: Developments and Regulatory Issues" (with A. M. Rutkowski), Comp. Comm. Rev., Vol. 12, No. 3-4 (July-October 1982)p. 68-82

"The Potential Use of Adaptive Antennas to Increase Land Mobile Frequency Reuse" (with S. Das), Proc. Second Int. Conf. on Radio Spectrum Conservation Techniques (1983), p. 113-118 (Also published in Mobile Radio Technology, Vol. 2, No. 1 (January 1984), p. 52-56

"Regulatory Aspects of ISDN in the US", Telephony, April 1985

"Spread Spectrum: A New Law Enforcement Tool", APCO Communication Bulletin, September/October 1985, p.62

"Recent US Regulatory Decisions on Civil Uses of Spread Spectrum", Proc. IEEE Global Telecom. Conf. 1985, p. 504-506 (Also published in Mobile Radio Technology, Vol. 4, No. 2 (March 1986) p. 66-68

"Technical Deregulation: A Trend in U.S. Telecommunications Policy", IEEE Communications Magazine, Vol. 25, No. 1 (January 1987) p. 66-68

"Satellite Security: The Legacy of Captain Midnight", Telecommunications, Vol. 21, No. 6, (June 1987) p. 61-66
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"Regulatory policy considerations for radio local area networks", IEEE Communications Magazine Vol. 25 , No. 7, (July 1987), p. 95 – 99

"Radio Local Area Networks: Regulatory and Technical Considerations", IEEE Communications Magazine, Vol. 25, No. 7 (July 1987) p. 95-99

"Technical Standards for Broadband Networks and Their Policy Implications", Integrated Broadband Networks: The Public Policy Issues (M.C.J. Elton, Ed.) North Holland, 1991, p. 295-310

"Japanese Regulatory Institutions and Practices" (with Gail H. Marcus), Business & the Contemporary World, Vol. 6, No. 1 (1994) p. 57-69

"The Ministry of Posts and Telecommunications and the Federal Communications Commission: Similarities and Differences", Keio Communications Review, No. 20, 1998, p. 75-84

"Personnel Practices in the Japanese Government", MIT Japan Program, MITJP 98-04, 1998

"U.S./Japan Trends in Software Radio"(in Japanese, with Hiroshi Asami), Journal of the ITU Association of Japan, Vol. 31, No. 3. P. 12-15 (March 2001)

":Millimeterwave Spectrum Policy in the USA", Proc. Third Topical Symposium on Millimeter Waves – Technical Digest, p. 13-15 March 2001 (Yokosuka Research Park, Japan)

"Regulatory Transparency in Japan: Half Full or Half Empty", Asia Perspectives, Vol. 3, No. 2 , p. 20-22 (March 2001)

"Long Term Monitoring Issues for Non-Geostationary Orbital Satellites", Proc. 4th International Space Radio Monitoring Meetings (September 2001)

"New FCC Software Defined Radio Policy", Proc. Software Defined Radio Study Group Workshop on Software Radio, p. 1-6, October 2001, (Tokyo, Japan)

"Microwave Spectrum Strategy and Allocations in the USA", *Dainikai Miriha Woukushoppu* (Proc. Second Millimeterwave Workshop), p. 1-26 (Yokosuka Research Park, Japan, October 2001)

"Facilitating Spectrum Management Reform via Callable/Interruptible Spectrum" (with Mark M. Bykowsky), 2002 Telecommunications Policy Research Conference, September 2002, http://intel.si.umich.edu/tprc/papers/2002/147/SpectrumMgmtReform.pdf

"Linux, Software Radio, and the Radio Amateur", *QST*, October 2002 (Voted by readers as best article in issue.)

"New FCC Policies for Ultrawideband Systems" Proc. *Denpa Kodoriyou Shinposhiumu* 2002 (Advanced Radio Technology Symposium), p. 3-17 (Tokyo, Japan, December 2002)

- "Required Advances in Microwave Devices and Components to Meet the Needs of Future Wireless Telecommunication Systems", Keynote address, International Microwave Symposium 2004

- "Complementary Use of Fixed and Mobile Monitoring for NGSO Systems", Presentation at The 7th International Space Radio Monitoring Workshop, Toulouse, France, September 2004

- "Wireless Communications Standards and Regulations", Presentation at Phoenix IEEE Workshop, December 2004
- "EMC Paints the Lane Markings on the Wireless Information Highway", Keynote address at EMC Zurich 2005, February 2005 (.ppt 22MB)

- "Research Topics in Unlicensed Spectrum Use", Presentation at An Open Future For Wireless Communications? A Communications Research Network (CRN) Open Day & Workshop, University of Cambridge (UK), 19-20 April 2005

- " Thoughts on Basic Issues of Spectrum Policy", Presentation at Wireless Utopias 05, Science Museum, London, UK May 2005

- "Unlicensed Cognitive Sharing of TV Spectrum: The Controversy at the Federal Communications Commission", IEEE Communications Magazine, May 2005

- "Observations on Communications Policy and Economic Growth", Presentation at Cambridge-MIT Institute, University of Cambridge (UK), 29 June 2005

- "UWB - The Potential and the Controversy", Keynote address at ICU 2005 (International Conference on Ultrawideband) September 2005, Zurich, Switzerland,

- "Next Generation Spectrum Policy: The Impacts of Software Defined Radio and Cognitive Radio", Remarks at Dynamic Spectrum Panel, IEEE International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC). September 2005, Berlin

- "Cognitive Radio: The Next Wi-Fi or the Next HiperLAN", Remarks at Cambridge-MIT Institute Wireless Technology Roadmap Workshop, University of Cambrige (UK) , October 2005

- New America Foundation Issue Brief: Reclaiming the Vast Wasteland: Why Unlicensed Use of White Space in the TV Bands Will Not Cause Interference to DTV Viewers (Coauthored with Paul Kolodzy and Andrew Lippman) 10/05

- "Real Time Spectrum Markets and Interruptible Spectrum New Concepts of Spectrum Use Enabled by Cognitive Radio", Presentation at IEEE Dynamic Spectrum Access Networks 2005 Conference, 11/05 Baltimore, Maryland. Also published in *Journal Of Communication and Networks*, Volume 8, Number 2, p.158-162 (June 2006)

- "The Technology and Politics of Increasing Intensity of Spectrum Use", Presentation at
Symposium on Spectrally Efficient Wireless Communications, University of California San Diego 11//05

"Impact of Recent ITU-R Recommendations on UWB Development", 2005 International Workshop on UWB Technologies, Yokosuka, Japan, 12/05 (.ppt 3MB)

"Spot Markets: A Quantum Leap in Spectrum Efficiency?", *Policy Tracker*, February 2006, p. 10-11

Presentations at Policy Tracker conference "Unlocking the digital dividend: RRC 06 and beyond",March 2006, London, UK:
"Some US-Style Thinking on Economics and the Digital Switchover"
"Spectrum Leasing/Trading: Technical and Legal Issues"

"Why Unlicensed Use of the White Space in the TV Bands Will Not Cause Interference to the DTV Viewers", 8th ANNUAL INTERNATIONAL SYMPOSIUM ON ADVANCED RADIO TECHNOLOGIES, March 2006, Boulder, CO

"Reconsidering the Ban on In-flight Communications: An American Perspective", In-Transport Communications Conference, April 2006, London UK

"EIRP or PFD Regulation", Presentation to Agence Nationale de Frequences (French spectrum regulator), April 2006

"Lessons from Elsewhere: The US Perspective", European Commission Public Workshop on Technical, Regulatory and Economic Issues Relating to Collective Use of Radio Spectrum, April 2006, Brussels, Belgium

"A Tale of Two Companies or Why is it so Important to Get Spectrum Policy Right", The Wireless Event , London, UK, May 2006

publishes first Spectrum Policy and Regulatory Issues column in issue - "Basics of Spectrum Policy for the Wireless Engineer", *IEEE Wireless Communications,* June 2006

"Why Unlicensed Use of Vacant TV Spectrum Will Not Cause Interference to DTV Viewers", New America Foundation Wireless Futures Program Issue Brief # 19, July 2006 (Update of 10/05 edition, coauthored again with Paul Kolodzy and Andrew Lippman)

MSS Reply Comments in Docket 06-89 (FCC/NTIA Spectrum Test-bed), July 2006

"Spectrum Policy Issues and their Impact on Economic Growth", TUDelft/Delft University of Technology, The Netherlands, Telecommunications Colloquium , September 12, 2006

"The Big Picture for TV Broadcasting - An American Techie's Viewpoint" PolicyTracker Autumn conference "Unlocking the Digital Dividend: A Pan-European Perspective" September 21,2006, Brussels, Belgium

"WRC and Its Impact on Wireless Technology", *IEEE Wireless Communications*, October 2006

"Legal, Economic & Technical Aspects of 'Collective Use' of Spectrum in the European Community" , Mott MacDonald for European Commission, November 2006 "Spectrum Regulation of Wireless Medical Devices in US and Europe" http://ec.europa.eu/information_society/policy/radio_spectrum/docs/workshop_collective_use/cus_rep_fin.pdf

Keynote address at ISMICT - 2006 International Symposium on Medical Information and Communications Technology, December 1,2006, Yokohama, Japan

"Basics of Transparency for Regulation", Presentation to RATEL (Republic Telecommunications Agency), Belgrade, Serbia, December 2006

"Quantifying the Impact of Unlicensed Devices on Digital TV Receivers", New America Foundation-sponsored study at University of Kansas, Coauthored with Paul Kolodzy, Daniel DePardo, Joseph B. Evans, James A. Roberts, Victor R. Petty, Alexander M. Wyglinski, 1/07

New America Foundation Technical Comments on FNPRM, Docket 04-186 (TV Whitespace Rulemaking) 1/31/07

"How can the Digital Dividend Be Best Divided", *Westminster eForum Keynote Seminar: Digital Dividend Review*, February 2007, London, UK. Transcript of remarks and discussions are published in Digital Dividend Review, Westminster eForum, ISBN 978-I-905029-62-4

"CR: Cooperative Radio or Confrontational Radio", *Proc. 2nd IEEE International Symposium on New Frontiers in Dynamic Spectrum Access Networks 2007* (DySPAN 2007), 4/07 Page(s):208 – 211

The Civil Use of Spread Spectrum and the Success of Wi-Fi, 10th Economics of Infrastructures Conference, TU Delft, Delft, The Netherlands, 5/31/07 http://collegerama.tudelft.nl/mediasite/Catalog/?cid=73e977a6-0283-4ee6-9813-a61df0dd1778

"Radio Spectrum Policy and its Impact on the Information Society, Free Speech and Economic Growth", Harvard University, Cambridge, Massachusetts, 10/07

"New Approaches to Private Sector Sharing of Federal Government Spectrum", Presentation to the Interdepartmental Radio Advisory Committee (IRAC), 8/09

"Spectrum Inventory Issues", IEEE Wireless Communications, 8/09, p. 4-5

"Radio Technical Innovation and Spectrum Policy: A Help or a Hindrance", Keynote/banquet address, Personal, Indoor and Mobile Radio Communications Conference (PIMRC2009), Tokyo, Japan 9/09

"Measurements and Analysis of Secondary User Device Effects on Digital Television Receivers," (with several coauthors) *EURASIP Journal on Advances in Signal Processing*, Vol. *2009*, 2009

2009 Regulatory Review: The Year of Rebuilding and Preparing for New Initiatives", Wireless Design and Development, Nov/Dec 2009, Supplement p.11-12

"Wireless Innovation and Spectrum Policy: FCC Opens a New Inquiry", *IEEE Wireless Communications*, December, 2009

"Opinion: is the FCC seeing the light over broadcast spectrum?", *PolicyTracker*, January 18, 2010

"Cognitive Radio Under Conservative Regulatory Environments - Lessons Learned and Near Term Options". IEEE DySPAN, April 2010, Singapore

"Spectrum Issues in FCC's National Broadband Plan", *IEEE Wireless Communications*, April 2010

"Spectrum Policy for Radio Spectrum Access". *Proc. IEEE, May 2012*

Spectrum Policy and Regulatory Issues Columns Published in *IEEE Wireless Communications*

"Basics of spectrum policy for the wireless engineer" 6/06
"WRC and Its Impact on Wireless Technology", 10/06
"Antennas, NIMBY, and regulation" 6/07
"The underlay/overlay controversy" 10/07
"WAPECS – Europe Moves towards Technical Flexibility for Wireless Systems" 2/08
"Harmful Interference: The Definitional Challenge", 6/08
"Anatomy of a Spectrum Policy Court Decision", 10/08
"Sharing Government Spectrum with Private Users: Opportunities and Challenges", 6/09
"Spectrum Inventory Issues" 8/09
"Can Cognitive Radio Technology Help Solve Some Difficult Spectrum Management Issues by Creating 'Virtual Guardbands' " 4/11
"Spectrum Policy Issues in Wireless Education Programs" 4/12

Published Interviews

CQ, Vol. 36, No. 12, (December 1980) p. 10-16

RCR, July 2, 1984, p. 5-8

Nikkei Electronics, No. 839, January 20, 2003, p. 184-186 (In Japanese)