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## Early FM Radio

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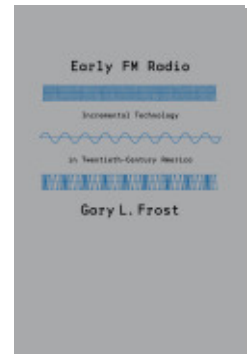
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Almost all literature about the history of frequency modulation before World War II echoes the narrative of Lawrence Lessing's hagiographic biography, *Man of High Fidelity: Edwin Howard Armstrong* (Philadelphia: J. B. Lippincott, 1956; 2d ed., New York: Bantam Books, 1969). Lessing's book exhibits a number of glaring errors and distortions, though. By focusing almost exclusively on Armstrong, it all but ignores the work of anyone else, such as when it dismisses the Poulsen arc merely as an "unsuccessful attempt to employ [frequency modulation]" (p. 198). Moreover, it falsely implies that RCA and AT&T researchers labored mostly with narrowband frequency modulation to make FM broadcast radio practical.

The books that more or less follow Lessing vary widely in quality in how they tell the history of frequency modulation. Don V. Erikson's *Armstrong's Fight for FM Broadcasting: One Man vs. Big Business and Bureaucracy* (University: University of Alabama Press, 1973) is based almost entirely on sources that Lessing cites. Tom Lewis's *Empire of the Air: The Men Who Made Radio* (New York: Edward Burlingame Books, 1991) is more useful and original, in large part because Lewis used material in the Armstrong Papers that Lessing and Erikson apparently neglected, and because Lewis acknowledges the general incompleteness of Lessing's narrative. Christopher H. Sterling and Michael C. Keith's *Sounds of Change: A History of FM Broadcasting in America* (Chapel Hill: University of North Carolina Press, 2008) does not diverge much from Lessing's narrative about prewar frequency modulation, but it is the best history of postwar FM broadcasting. Hugh R. Slotten's *Radio and Television Regulation: Broadcast Technology in the United States, 1920–1960* (Baltimore: Johns Hopkins University Press, 2000) contains a chapter about postwar FM radio that is based principally on government documents and credibly disputes Lessing's interpretation. See "Rainbow in the Sky: FM Radio, Technological Superiority, and Regulatory Decision Making, 1936–1948" (pp. 113–44). Researchers should also consult an anthology published by the Radio Club of America, John W. Morrissey, ed., *The Legacies of Edwin Howard Armstrong* (n.p.: Radio Club of America, 1990), which offers several first-person articles written by men who witnessed the development of early FM broadcasting.

By far the most significant primary source for this book was the Edwin Howard Armstrong Papers collection, located in the Rare Books and Manuscripts Library of Columbia University. A large portion of this collection, comprising more than five hundred boxes, including dozens of microfilm reels, is made up of material that originated within RCA. During a lawsuit that began in 1948, the law firm that represented Armstrong obtained copies of every RCA document related to frequency modulation, including correspondence, research reports, and sales literature. In 1990 that law firm donated these documents to the Armstrong Papers collection and thus researchers have at their disposal an archive of frequency-modulation work within the RCA organization that Lessing did not.

This study also depended on technical literature for primary sources. Researchers should consult the appendix to this book, which lists all patents applied for before 1941 that related to FM radio. These were culled largely from memoranda written by RCA engineers, managers, and patent lawyers. Any one researching FM's history should take care to read patents with no preconceptions and not be led astray by Lessing. For more than half a century, almost every historian of FM radio has accepted his description of what he calls "Armstrong's [four] basic patents of 1933" (p. 205). But only two of these patents describe a wideband FM system, and rather than claim that FM radio suppresses static, one implied that frequency modulation has no effect on static.

Because radio technology evolved so quickly during the early twentieth century, books tended to be less useful primary sources of technical literature for this study than periodicals did, although almost nothing was published about frequency modulation before 1934. The titles of all the magazines and journals cited in this book are too numerous to list, but the most valuable and sophisticated articles appeared in the *Proceedings of the Institute of Radio Engineers*. See also *Proceedings of the Radio Club of America*, *Communication and Broadcast Engineering*, and *Electronics*, all of which also printed articles about the history of frequency modulation. Articles about FM technology and the broadcasting industry written for the layperson were published in various magazines and newspapers, including the most important trade magazine of the 1930s and 1940s, *Broadcasting-Broadcasting Advertising*, as well as the *New York Times*, the *New York Herald-Tribune*, and the British magazine *Wireless World*. The earliest issues of *FM* magazine, which debuted in November 1940, contained many articles about the history of frequency modulation. A helpful anthology of technical articles about early radio is George Shiers, ed., *The Development of Wireless to 1920* (New York: Arno Press, 1977).

This book depended on many government documents. Researchers should read the annual reports of the Federal Radio Commission and of the Federal Communications Commission (Washington, D.C.: Government Printing Office). In 1948 two congressional committees investigated the history of frequency-modulation radio and produced reports that provide valuable transcripts of testimony of dozens of individuals who pioneered frequency-modulation broadcasting. See the two-part report of the House Committee on Interstate and Foreign Commerce, *Radio Frequency Modulation: Hearings on H. J. Res. 78: A Joint Resolution Relating to Assignment of a Section of the 50-Megacycle Band of Radio Frequencies for Frequency Modulation (FM)*, 80th Cong., 2d sess., 1948; as well as the Senate Committee on Interstate and Foreign Commerce, *Progress of FM Radio: Hearings on Certain Charges Involving Development of FM Radio and RCA Parent Policies*, 80th Cong., 2d sess., 1948. During the 1940s, the FCC commissioned a study of chain (i.e., network) broadcasting. It was published as FCC, *Report on Chain Broadcasting* (Washington, D.C.: Government Printing Office, 1941), and was reprinted in Christopher H. Sterling, ed., *Special Reports on American Broadcasting, 1932-1947* (New York: Arno Press, 1974). Five years later, the report's author, Charles A. Siepmann, published *Radio's Second Chance* (Boston: Atlantic-Little, Brown Books, 1946), which argues that FM radio could be an antidote

to errors committed by the FRC and FCC in the regulation of AM broadcasting. For primary documents about the regulation of radio before 1927, the *Radio Service Bulletin*, issued monthly by the U.S. Commerce Department's Bureau of Navigation is helpful. Finally, researchers should read the patent court decision, *Armstrong v. Emerson Radio and Phonograph Corporation*, 179 F. Supp. 95, Southern District of New York, 1959. This document restates the argument that Armstrong invented FM radio alone, but the judge also reviews evidence on both sides at length, something Lessing never does.

To understand the history of FM radio broadcasting, one must know about the history of communications technology and radio broadcasting in general. Since the early twentieth century, scholars of radio have had at their disposal a number of good general histories of radio broadcasting. In addition to Lewis's *Empire of the Air*, these include Gleason L. Archer, *Big Business and Radio* (New York: American Historical Society, 1939); Erik Barnouw, *A Tower in Babel: A History of Broadcasting in the United States to 1933* (New York: Oxford University Press, 1966; repr., 1978); Christopher H. Sterling and John Michael Kittross, *Stay Tuned: A Concise History of American Broadcasting* (Mahwah, N.J.: Lawrence Erlbaum Associates, 2001); W. Rupert Maclaurin, *Invention and Innovation in the Radio Industry* (New York: Macmillan, 1949). A good history of radio from the perspective of audiences is Susan J. Douglas, *Listening In: Radio and the American Imagination, from Amos 'n' Andy and Edward R. Murrow to Wolfman Jack and Howard Stern* (New York: Times Books, 1999). See also Hugh G. J. Aitken, *Syntony and Spark: The Origins of Radio* (Princeton: Princeton University Press, 1976), and *The Continuous Wave: Technology and American Radio, 1900–1932* (Princeton: Princeton University Press, 1985); Susan J. Douglas, *Inventing American Broadcasting, 1899–1922* (Baltimore: Johns Hopkins University Press, 1987); Sungook Hong, *Wireless: From Marconi's Black Box to the Audion* (Cambridge, Mass.: MIT Press, 2001). Among the best histories of radio and telephone technology are M. D. Fagen, *History of Engineering and Science in the Bell System: The Early Years (1875–1925)* (New York: Bell Laboratories, 1984), and S. Millman, *History of Engineering and Science in the Bell System: Communications Sciences (1925–1980)* (New York: Bell Laboratories, 1984). Another useful source is G. G. Blake, *History of Radio Telegraphy and Telephony* (London: Chapman & Hall, 1928).

Secondary sources about the regulation of radio broadcasting during the 1920s include Susan Smulyan, *Selling Radio: The Commercialization of American Broadcasting, 1920–1934* (Washington, D.C.: Smithsonian Institution Press, 1994); Slotten, *Radio and Television Regulation*; Marvin R. Bensman, *The Beginning of Broadcast Regulation in the Twentieth Century* (Jefferson, N.C.: McFarland, 2000); and Robert W. McChesney, *Telecommunications, Mass Media, and Democracy: The Battle for the Control of U.S. Broadcasting, 1928–1935* (New York: Oxford Press, 1993). For a history of clear-channel broadcasting, see James C. Foust, *Big Voices of the Air: The Battle over Clear Channel Radio* (Ames: Iowa State University Press, 2000).

Other secondary sources are available at the IEEE History Center, which provides transcripts of interviews with communications pioneers. Numerous Web sites replicate primary sources dating back to the nineteenth century. Especially helpful is

Thomas H. White's "United States Early Radio History" at <http://earlyradiohistory.us/>, although many of this site's articles lack volume numbers required to make complete scholarly citations. Susan Douglas's *Inventing American Broadcasting* examines gender and the origins of amateur radio. For a study of the growth of American corporate research, see David F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Oxford University Press, 1977).