Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Creation of a Low Power Radio Service	)	MM Docket 99-25
	)	
The Mitre Corporation's Technical Report, "Experimental Measurements of the Third-Adjacent-Channel Impacts of Low-Power FM Stations"	))))	
	)	
Localism Task Force	)	RM-10803
	)	

COMMENTS OF PROMETHEUS RADIO PROJECT, MEDIA ACCESS PROJECT, NATIONAL LAWYERS GUILD COMMITTEE ON DEMOCRATIC COMMUNICATIONS, OFFICE OF COMMUNICATION, INC., UNITED CHURCH OF CHRIST, NATIONAL FEDERATION OF COMMUNITY BROADCASTERS, FUTURE OF MUSIC COALITION, AND FREE PRESS

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SUMMARY

The Comments first highlight the success of low power radio, showing the vibrant sparks on the dial now available in hundreds of communities across the country, including in Opelousas, LA, Temperance, MI, Oroville, CA, and Ocean City, MD. The Comments show how the third adjacent channel restriction prevented the Center for Hmong Arts and Talent, in Minneapolis, Minnesota from getting on the air.

The Comments applaud the independent testing of LPFM, which has already wasted significant tax-payer dollars proving what we already know: that LFPM stations on third adjacent channels will not harm current broadcasts. The Mitre report finds no significant LPFM-related degradation to a full power station at more than 333 meters from an LPFM transmitter, and the vast majority of what little degradation was discovered only occurred at distances less than a hundred meters from the transmitter site. Mitre also concluded there was no conceivable scenario in which more than 0.13% of the area within the protected contour of a full power station could be disturbed. No further testing is needed.

The Comments below show that Mitre's analysis was conservative, and that it attributes all interference in the study to third adjacent interference when much of it is likely to have been caused by blanketing interference. The FCC already has rules in place for LPFM and full power broadcasters to protect against blanketing interference.

The Comments also show that the Mitre testing criteria far exceed criteria used by the FCC and the NRSC to evaluate IBOC. In particular, both receiver selection and noise interference were evaluated and were found sufficient to approve IBOC using much less stringent tests that those employed by Mitre. Although the LPFM Advocates represented here fully expect that LPFM's historic opponents will critique the study, the fact remains that those who lobbied Congress against LPFM are responsible for the study's design.

Finally, LPFM Advocates offer suggestions for the Commission both in the Low Power Radio docket and in the new Localism Task Force docket to promote localism through improving the operation and implementation of LPFM. In particular, LPFM Advocates explain how non-local translators are eviscerating any chance for adding LPFM stations, even under the present, overly-restrictive, interference limits.

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Comments of Prometheus Radio Project; Media Access Project, National Lawyers Guild Committee on Democratic Communications; Office of Communication, Inc. United Church of Christ; National Federation of Community Broadcasters; Future of Music Coalition; and Free Press

These comments are respectfully submitted in response to the FCC's Public Notice seeking comment.[1] The commenters represented here ("LPFM Advocates") represent the core nonprofit advocates assisting with implementation and advocacy on low power radio.[2]

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[1] Public Notice, MM Docket No. 99-25, DA 03-2277 (July 11, 2003).
[2] These comments were jointly drafted by Peter Fischbeck, Jaclyn Ford, Amanda Huron, Alan Korn, Cheryl Leanza, Jeremy Lansman, Carl Reeverts, and Pete Tridish .
The **Prometheus Radio Project**, founded to ensure that grassroots community-based groups gain access to the airwaves through the LPFM service, provides direct services to applicants and to new stations, as well as conducting research on technical and policy issues related to LPFM.
The **Media Access Project**, is a non-profit, public interest law firm, which advocates for diversity of voices in the nation's electronic mass media and is a lead advocate and resource for LPFM.
The **National Lawyers Guild Committee on Democratic Communications** represented early proponents of microradio throughout the 1980s and 1990s, and today provides legal services to LPFM applicants.
The **Office of Communication, Inc., of the United Church of Christ** has been a long-time proponent of responsive broadcasters and of low power radio. UCC, OC Inc. founded the Microradio Implementation Project in order to assist new LPFM stations.
The **National Federation of Community Broadcasters**, an alliance of non-commercial community stations, advocates on behalf of its membership, which includes LPFM stations, and provides services to empower and strengthen community broadcasters.

I. LOW POWER RADIO TODAY.

In 1999, low power radio was an idea. Today, low power radio is a vibrant service growing stronger every day. Low power radio is bringing the excitement and community or broadcasting to thousands of ordinary citizens every day. About 220 of these stations, broadcasting at 100 watts or less, and over a radius of just a few miles, are now on the air serving communities across the country. As of this filing, over 700 construction permits have been issued.

In the places where it has been allowed to flourish, low power FM has been an enormous success. These new stations include:

> **KOCZ-LP, 103.7 FM: Opelousas, Louisiana: The Southern Development Foundation.** In Opelousas, Louisiana, the Southern Development Foundation (SDF) works for school reform, community supported agriculture, and neighborhood economic development. They also host the world's largest traditional Zydeco music festival. The SDF is the first civil rights organization in the United States to own its own radio station. They host current affairs talk shows with major politicians from around the state, musical events, and religious programming. Their executive director, John Freeman, says, "We pride ourselves on being part of this democratic project."
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> **WMLZ-LP, 107.9 FM: Temperance, Michigan: Bedford Public Schools.** "Blend 107.9" started as an introduction to radio class at Bedford High School in 1997. Operating out of studios located in the high school, Blend 107.9 was originally known as Bedford Cable Radio, operating its programming on the local public access cable channel. In August 2000, Blend 107.9 applied for a LPFM construction permit. The new studio was completed in time for WMLZ's March 16, 2002 official sign-on. Since then, WMLZ has operated 24 hours a day, broadcasting music, high school sports events, and public service programming.
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> **KRBS-LP, 107.1 FM: Oroville, California: The Bird Street Media Project.** KRBS-LP uses a variety format to highlight the diversity of their small California community. Oroville is a town of 13,000 that is losing much of its population to

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The **Future of Music Coalition**, which seeks to educate the media, policymakers, and the public about music and technology issues, advocates for LPFM from the perspective of independent musicians.
Free Press is a national organization working to increase informed public participation in crucial media policy debates, including the debate over LPFM, and works to generate a range of policies that will produce a more competitive and public interest-oriented media system.

> suburban sprawl. Clear Channel recently bought Oroville's only radio station, dismantled it and moved the license to another town. The organizers see KRBS-LP as a keystone in their plans to bring people back to the downtown district. Weekly programming includes a call-in legal advice show, two shows dedicated to veterans' issues, radio theater, children's stories, and a wide variety of music.
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> **WEES-LP, 107.9 FM: Ocean City, Maryland: The Edinboro Early School.** WEES-LP's goal is to recreate the flavor of an early '50s radio station, with family-oriented programming focusing on music of the 1950s and early 1960s. They feature three hours of programming a day for children ages 3-5 years old. Other programming includes: real estate and finance talk shows; an inter-faith church news bulletin board; field broadcasts from historical sites; and a music show hosted by a former ABC executive who plays records dating back to the 1920s. The station was built under the leadership of a retired electrical engineer who worked for the federal government for 33 years.

Despite these success stories, hundreds (if not thousands) of other groups have had experiences similar to those of The Center for Hmong Arts and Talent, based in Minneapolis, Minnesota. Under the FCC's original LPFM service, five frequencies were available in Minneapolis for low power radio. Although they applied and were eligible under the FCC's initial rules, Congress eliminated all frequencies in Minneapolis when it passed the Radio Broadcast Preservation Act. Lee Vang, the group's director, had hoped that an LPFM station could serve the large Hmong community in Minneapolis. "The airwaves belong to all, and an LPFM station would give voice to those who have no voice," Vang says. "We are the only Hmong organization in Minnesota that focuses exclusively on the arts. Radio is extremely important to our community because 95% of Hmong are illiterate."

Because they have such limited broadcast range, low power radio stations are uniquely suited to serving densely populated urban communities like the neighborhoods of Minneapolis. The issue before the FCC, and before Congress, is whether this vibrant new service will be limited to the rural areas of the country, or whether the many niche communities living in America's cities will also benefit from low power radio. If, as the Mitre report recommends, restrictions are lifted on third channel adjacency for new frequencies, The Center for Hmong Art and Talent – and thousands of other groups like it in cities across the country – could receive LPFM licenses to broadcast to their communities.

II. THE MITRE REPORT

A. Background

In 2000, in response to intensive lobbying by incumbent broadcasters and lead by the National Association of Broadcasters, Congress passed the "Radio Broadcasting Preservation Act." 114 Stat. 2762, Sec. 632 (2000). In response to a high-pressure and highly publicized campaign, Congress responded to the NAB's concerns that LPFM would harm incumbent broadcasts. The NAB and LPFM's other opponents opposed LPFM and sought to delay and impair its implementation through Congressional action.[3] As a result of the NAB's lobbying, Congress ordered the FCC to hire an independent contractor and provided a very detailed plan describing the tests that must be conducted.[4] Today, over three years after the RBPA's passage,

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[3] *See, e.g., Statement of NAB President/CEO Edward O. Fritts Regarding Legislation Barring FCC Authorization of Low Power FM Radio*, November 19, 1999 available at http://www.nab.org/newsroom/pressrel/STATEMENTS/s1999.asp *"NAB TO FCC: MICRORADIO IS A BAD IDEA"*, Press Release, April 27, 1998 available at http://www.nab.org/newsroom/PressRel/Releases/1698.asp.

[4] *"(b) FURTHER EVALUATION OF NEED FOR THIRD-ADJACENT CHANNEL PROTECTIONS-*

> (1) PILOT PROGRAM REQUIRED- The Federal Communications Commission shall conduct an experimental program to test whether low-power FM radio stations will result in harmful interference to existing FM radio stations if such stations are not subject to the minimum distance separations for third-adjacent channels required by subsection (a). The Commission shall conduct such test in no more than nine FM radio markets, including urban, suburban, and rural markets, by waiving the minimum distance separations for third-adjacent channels for the stations that are the subject of the experimental program. At least one of the stations shall be selected for the purpose of evaluating whether minimum distance separations for third-adjacent channels are needed for FM translator stations. The Commission may, consistent with the public interest, continue after the conclusion of the experimental program to waive the minimum distance separations for third-adjacent channels for the stations that are the subject of the experimental program.
>
> *(2) CONDUCT OF TESTING- The Commission shall select an independent testing entity to conduct field tests in the markets of the stations in the experimental program under paragraph (1). Such field tests shall include--*

the public finally received obtained the information that was ordered to be completed by the FCC *before February 1, 2001*. *See* 114 Stat. 2762, Sec. 632 (2000). Congress directed the FCC to hire an independent contractor. The FCC remained several steps removed from the process. The FCC hired Mitre, which in turn hired Comsearch Corporation to conduct the Congressionally-mandated tests.[5] This methodology ensures that, subsequent to the study's design by Congress when it was being lobbied by the NAB, the study has not been driven by the FCC's policy objectives.

Attached to these comments is the technical evaluation of the Mitre report, conducted by David Maxson, a professional broadcast engineer, of Broadcast Signal Labs.[6] Generally, the Mitre report confirms that the FCC was correct when it authorized LPFM on third adjacent channels, and confirms what LPFM advocates previously proved three years ago. The amount of

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(A) an opportunity for the public to comment on interference; and
(B) independent audience listening tests to determine what is objectionable and harmful interference to the average radio listener." 114 Stat. 2762, Sec. 632 (2000) (emphasis added).

[5] The Mitre Corporation is a not-for-profit organization chartered to work in the public interest, has been in existence for nearly fifty years, and has a long contract history with many governmental agencies. Mitre currently manages three Federally Funded Research and Development Centers: one for the Department of Defense, one for the Federal Aviation Administration, and one for the Internal Revenue Service. The company has 4,700 employees supporting hundreds of projects for numerous government organizations. Mitre is an independent organization that has conducted the LPFM study with care and reliability. For the LPFM study, Mitre used a competitive bidding process to select an independent subcontractor, Comsearch, to perform and collect test data. Comsearch has been providing spectrum allocation and management solutions to the wireless industry for more than twenty-five years. With this report, the Mitre Corporation has fulfilled the mandate directed by Congress to thoroughly examine the effect of LPFM stations on existing broadcasters. See www.mitre.org. (visited October 14, 2003).

[6] David Maxson is co-founder and managing partner of Broadcast Signal Lab, LLP, Cambridge, Massachusetts since its inception in 1982. He was Vice President, Director of Engineering of Charles River Broadcasting Company, whose flagship radio station in Boston is the highest-rated classical music station in the nation. He served with Charles River Broadcasting for twenty years. Broadcast Signal Lab is actively involved in the development of new digital communications technologies. Mr. Maxson is a member of the National Radio Systems Committee and has contributed his expertise to the NRSC Digital Audio Broadcasting Subcommittee as it oversees the testing, evaluation & standards-setting for the new IBOC, In-Band, On-Channel broadcasting technology. He has provided expert testimony in many federal state and municipal cases on subjects including broadcasting, wireless safety, regional planning, wireless facility application review and other subjects.

interference from 100 watt LPFM stations on third adjacent channels is negligible and is certainly not any threat to full power incumbent broadcasts.

The Mitre report concluded "LPFM stations can be operated on third-adjacent channels with respect to existing 'Full Power' FM (FPFM) stations provided that relatively modest distance separations are maintained between any LPFM station and receivers tuned to the potentially affected FPFM station." Mitre Executive Summary at xxvii. Specifically, for example, the Mitre report found that interference was not heard outside of small radius in the immediate vicinity of the transmitter. No significant LPFM-related degradation to a full power station was ever identified at more than 333 meters from an LPFM transmitter. The vast majority of what little degradation was discovered only occurred at distances less than a hundred meters from the transmitter site. Mitre concluded there was no conceivable scenario in which more than 0.13% of the area within the protected contour of a full power station could be disturbed, and generally it is expected that degradation would have orders of magnitude less effect.

The Mitre report, however, was conservative in a number of assumptions and techniques. Mitre's favorable conclusion is therefore extremely cautious. LPFM will cause even less harm than Mitre believes.

B. Overview of Mitre report

Mitre selected six locations where LPFM applications had been submitted. Mitre then listened to adjacent full power stations while a test LPFM transmitter was in operation. Expert engineers listened to the full power station before and after the low power station was transmitting. The engineer would verify whether the full power signal was not experiencing significant interference, if not, they entered a "N" for no, if it was experiencing interference, they entered a "Y." The LPFM signal would then be initiated and the engineer would make the same determination – on a N/Y scale-- whether the full power signal was suffering from significant interference. Comsearch Field test plan, LPFM third-adjacent channel interference analysis, at 53. Results that are supposed to reflect LPFM interference are N to Y transitions, *i.e.,* when the full power signal did not have interference before the LPFM transmission, but did experience interference during the LPFM transmission. See generally Mitre report at 2-7.

In addition, Mitre made available a toll free number and advertised in local newspapers to determine whether any of the listening public noticed a problem when the LPFM transmissions were occurring. Mitre Report, Part 1, §1.3.3.12.3. While there were some responses to those toll-free numbers, none of them coincided with an actual LPFM transmission. *Id.* Mitre did not conduct panel tests of non-expert listeners because Mitre concluded such work would be wasteful given the small incidence of interference. *Id.* at § 1.3.3.15.

C. The Mitre Report Demonstrates LPFM on Third Adjacent Channels Creates Less Interference than Other New Services the FCC has Approved.

1. The Interference Identified is Blanketing Interference, which is Minor, and is Fully Covered Under Existing FCC Regulations.

While the Mitre accurately conducted much of its testing, it did not carefully distinguish between interference caused from third adjacency and interference caused by other phenomena. This is particularly important with respect to blanketing interference.

Blanketing interference occurs when a nearby transmitter's signal is so strong that a receiver's sensitivity is affected, not just on third adjacent channels, but over a large part of the dial. The FCC currently employs regulations to protect listeners and signals from blanketing interference.[7] LPFM signals must comply with the FCC's blanketing rules, and thus today listeners are protected from blanketing interference by LPFM signals. As the BSL report explains, "blanketing interference is a limit on receiver performance, and is an acknowledged and accepted part of the environment of full power radio service." BSL Report at 11. BSL also notes that blanketing interference is addressed by the Commission's rules within a specified, hypothetical contour "regardless of actual received signal level, and ignored beyond" the contour prescribed by the Commission's rules. BSL Report at 11. Thus, the Commission has developed a standard that is practical, but not based on anything as detailed as the Congressionally-prescribed listening tests used to identify third adjacent interference.

Broadcast Signal Labs concluded that Mitre mis-attributed blanketing interference to third adjacent interference because the test sites were within the blanketing contour. BSL Report at 9-11. This mis-attribution is inappropriate because, as BSL explains, Mitre did not distinguish interference tests inside the blanketing area and outside of it, making it difficult to know when third adjacency or blanketing was the culprit. BSL Report at 10.

To ignore this difference would hold LPFM to a higher standard than full power broadcasting. Specifically, BSL concludes, "Together, the lack of good references to the manner in which FPFM stations already cause or receive interference on less selective radios creates a possible double standard, one for perfect LPFM interference immunity, and one for the incumbent degree of acceptable interference and poor reception for Full Power stations."

The established solution to blanketing interference is the interference remediation remedies required of all radio stations. 47 C.F.R. § 73.318. These standards have been considered effective and sufficient for all radio broadcasting, full and low power alike.

[7] FCC regulations define blanketing interference as that occurring in the presence of a 115 dBµ or greater signal in the area of a broadcast station. 47 C.F.R. §73.310, §73.318. For a 100-watt station the blanketing area is 125 meters in radius. Broadcast Signal Report at 10-11.

Blanketing interference is remediable through well-established techniques of relocating radios and providing free filters, antennas or upgraded radios to affected listeners. Interference within the blanketing area is easy to fix. Moreover, blanketing problems cannot be addressed by any form of adjacent channel protection.

In order to examine the impact of Mitre's analysis on their results, BSL undertook its own analysis of Mitre's data. After excluding observations that were either blanketing or anamolous phenomenon (such as full power signal improving after the introduction of the LPFM signal), BSL concluded that there were only 14 true examples of a LPFM third adjacent interference out of the thousands of observations. In all other instances, the interference observed could not be attributed to third adjacent channel interference with any certainty. BSL Report at 10-15, Appendix 1.

2. The Mitre report Was More Comprehensive Than Similar Tests for IBOC and other Services which the FCC has Approved.

(a) IBOC Background.

In-Band-on-Channel ("IBOC") broadcasting is designed to deliver new digital audio services simultaneously with existing analog radio broadcasts. In August 2000, the NRSC released a request for proposals to conduct FM IBOC laboratory and field-testing. iBiquity Digital Corporation was the only company to respond to this request. The NRSC developed FM IBOC tests in late 2000, and the testing was conducted by iBiquity in 2001, and released the results in August 2001.[8] In October 2002, the FCC approved the technology, announcing it had

[8] iBiquity Digital Corporation, "Report to the National Radio Systems Committee: FM IBOC DAB Laboratory and Field Testing," August 2001 at 2-6.

selected IBOC "as the technology that will bring the benefits of digital audio broadcasting to AM and FM radio broadcasters efficiently and rapidly."[9]

iBiquity's August 2001 analysis tested the compatibility of their new IBOC digital radio system with existing analog stations. iBquity tested the effects of adding digital sidebands into the emission mask of a radio station both on the host station and upon adjacent channel stations. iBiquity conducted its tests according to standards set out by the National Radio Systems Committee ("NRSC"), tested both in a laboratory setting and in the field, using methods similar to the testing of adjacent channel testing for LPFM.[10] iBiquity's analog compatibility testing sought to establish the level of impact that the implementation of IBOC could have on the host channel, first adjacent channels, and second adjacent channels. Thus, the testing of IBOC is extremely relevant to the questions at issue in LPFM.

(b) Receiver Selection.

The Mitre report used a sample of five receivers to analyze potential interference. As the BSL Report concludes, this selection is adequate to assess interference. BSL Report at 4. Moreover, it exceeds the number and range of receivers selected by iBiquity and the NRSC in their studies of IBOC. In the IBOC testing, only four receivers were tested -- two automobile models (one OEM and one aftermarket), a portable model and a home hi-fi receiver. BSL Report at 5. The IBOC testing used one receiver from each of three generally accepted quality categories of receivers. The IBOC testing used two "very selective" receivers, one "selective"

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[9] Federal Communications Commission, "FCC Selects Digital Radio Technology: Authorizes AM and FM Interim, Voluntary Digital Operation," October 10, 2002. At this time, AM broadcast stations are permitted to engage in digital operation only during daytime hours. See http://www.fcc.gov/mb/audio/digital/index.html (visited Oct. 14, 2003).

[10] iBiquity Digital Corporation, "Report to the National Radio Systems Committee: FM IBOC DAB Laboratory and Field Testing," August 2001, pp. 2-6.

receiver, and one "moderately selective" receiver. BSL Report at 5. Mitre also used a range of receivers from the three categories.

The empirical findings of LPFM signals in the field validated results from virtually all the receiver studies conducted by and submitted to the FCC in 1999 and 2000. BSL Report at 5-9. Generally, all tests by all parties found that most variation of receivers was by type and all types were tested by Mitre. The differences between types of receivers is greater than the differences among various products within the type. Thus, most automotive receivers, component stereos performed well, and the least quality receivers experience a great range of performance. Overall, the Mitre sample included the best and worst performing receivers. The Mitre report thus affirmed prior predictions and used a greater number of receivers than the IBOC testing for similar questions. The sample in Mitre was more representative of the breath of receivers tested for first adjacent analog compatibility by iBiquity, despite the fact that the implementation of IBOC will have much broader implications for the future of the FM broadcast band than the implementation of LPFM.

(c) Acceptable Interference as Determined by Listeners.

The Mitre report, and previous technical LPFM studies, demonstrate that LPFM stations on third adjacent channels surpass tests set for IBOC. Whereas LPFM interference tests designed by LPFM opponents have often used unreasonably high thresholds, *see, e.g.*, UCC, *et al.* Comments at 19-20, MM Docket 99-25 (filed Nov. 5 1999)(over half of radios tested failed interference threshold selected by NAB in the absence of any interference), tests for IBOC have been much more reasonable. The criteria for determining interference in the IBOC testing was not whether audio quality dropped when the analog station was exposed to first adjacent channel interference (which it did). Using subjective evaluations, the IBOC tests evaluated "at what point do half of listeners in subjective testing turn the radio off or switch channels."[11] iBiquity was concerned when lab results showed significant likelihood for interference (20 out of 82 tests suggested a potential impact inside the protected contour). iBiquity therefore adjusted the testing environment to simulate the normally noisy RF environment by adding 30,000 K of noise on top of the original signal. After making these and other adjustments for "real world listening conditions," iBiquity found that 99.36% of the listeners in a first adjacent analog stations coverage area would be unaffected and that just .6 % of listeners might experience impairment.

The IBOC outcomes are less protective of listeners that the conservative estimates of interference found by Mitre from LPFM stations on third adjacent channels. In particular, whereas the IBOC .6% measure is an average measure, the LPFM .13% measure is an outer boundary.

3. LPFM Interference is Substantially Less than Interference Deemed Acceptable in Other Services.

Mitre concluded that 0.13% of potential listeners inside a protected contour might lose service with the placement of LPFM stations on third adjacent channels. This trade off is greater than that found acceptable for waivers for digital television stations.

Section 73.623 of the Commission's rules lay out the standards necessary to obtain a waiver of the Commission's technical digital television rules. Section 73.623(c)(2) states that the change must not "result in more than an additional 2 percent the population served by another station being subject to interference; provided, however, that no new interference may be caused to any station that already experiences interference to 10 percent or more of its population or that

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[11] "Evaluation of the iBiquity Digital Corporation IBOC System: Part I – FM IBOC," November 29, 2001, DAB Subcommittee, National Radio Systems Committee, sponsored by the National Association of Broadcasters and the Consumer Electronics Association at 54.

would result in a station receiving interference in excess of 10 percent of its population." 47 C.F.R. §62.623(c)(2). Thus, the Commission's rules accept interference with 2 percent of a television signal in digital television. This compares extremely generously with the .13% predicted by Mitre for LPFM.

Similarly, the FCC has delegated authority to the Mass Media Bureau to approve overlap interference in a number of circumstances. For example, the Commission's rules state that the Bureau may approve waivers for AM broadcasting that cause interference to less than 1 percent of the population served by another station, regardless of whether the other station approves. 47 C.F.R. § 0.263(10). In addition, the FCC has authorized Bureau approval for second and third adjacent interference in non-commercial broadcasting when the increase in service outweighs the loss to interference. *See In Re Applications of Educational Information Corporation*, 6 FCC Rcd 2207 (1991) (finding second or third adjacent channel overlap may result in the replacement of one signal by another, but not the complete loss of service, and is confined to a very small area around the transmitter of the interfering station). Additional criteria adopted by the FCC support far greater trade-offs between increased service and interference than supported by those opposed to LPFM. *See, e.g., Noncommercial Comparative Standards*, 18 FCC Rcd 6691, 6703 (2003) (affirming relaxed reservation standards for noncommercial radio if 10% of an applicant's service contour provides first or second service).

4. The Mitre report's Treatment of Listening Tests is Adequate to Evaluate Interference.

Mitre opted not to perform the subjective study of recorded examples of the LPFM tests because it found there were not enough examples to make such testing worthwhile. BSL Report at 9 (citing Mitre Report at § 1.3.3.15). As explained above, BSL's analysis shows there were only 14 examples of LPFM third adjacent channel interference. Convening a panel of listeners for only 14 samples would not be worthwhile. Mitre did utilize a hearing-tested engineer to listen to the broadcast recordings. The use of such an expert is likely to over-represent interference when compared to the listening experience of the average population. In average popular listening, people listen in various conditions of ambient noise (in automobiles, at work situations, or while performing other tasks). The average population is also not trained in the detection of interference artifacts. If anything, the results as presented by a hearing certified technician would overstate interference problems, as compared to subjective listening tests.

5. Translator Inputs are Protected From Interference.

The Mitre report found some limited effects in translators' input signals. Similar to the effects on other receivers, Mitre found a relatively limited zone where an LPFM on a third adjacent could cause interference to the input signal. The main difference between the interference for receivers and translators was that the directional antenna on a translator's receiver section extended the zone of interference in some directions, and reduced the zone in others. As described below, Mitre recommended a formula that took into account the receiving antenna pattern.

LPFM rules currently provide a remedy for interference to the input signal of translators. LPFM stations are must remedy interference to input signals of translators the same way new translators are required to protect the input signals of existing translators. This rule is set forth in Section 73.827. 47 C.F.R. §73.827. Section 73.827 requires a LPFM station to cease transmission if it receives a complaint under that section until any interference questions are resolved. This is an extremely protective provision, and should be adequate to protect translators.

However, if necessary, LPFM advocates might support some further measures to protect translator input signals, though we feel any legitimate concerns are more than adequately addressed under existing rules. Such measures could include modifying the interference procedure in 73.810, 47 C.F.R. §73.810, to give special consideration to translator input signals;[12] or, to grant commercial translators waivers so that they would not be required to receive signals over the air.[13]

6. The Mitre report's Proposal for More Complex Regulation With Respect to Translators is Unnecessary.

Mitre proposes some additional protections to forestall even the smallest amount of interference. Mitre Report at 5-4; BSL Report at 15-16. The BSL Report concludes that these proposals, while well-intentioned, are too complex for the LPFM service. In fact, the original policy analysis supporting LPFM concluded that the service must operate by simple, bright-line rules rather than more nuanced or complex rules. The LPFM service is intended to be more accessible to non-technical members of the population because of its relative simplicity. Adding an additional layer to identify where LPFM stations may be located will only increase the expertise needed to receive an LPFM license, and increase the burden on the FCC to implement

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[12] If the commission were to modify Section 73.810 of its rules, it would allow LPFM stations to be authorized in the many places where, in the real world, no interference will be experienced by the translator input signal. These rules would reaffirm the requirement that LPFM stations resolve any interference-to-input-signal complaint by a translator on a third adjacent, at the LPFM licensee's expense. If interference were not solved to the satisfaction of the complainant, the FCC could revoke the construction permit or force a change in facilities. In such a case, LPFM Advocates recommend that LPFM stations receive the opportunity to make major changes in channel and location to their facilities to help ameliorate potential interference. We would further recommend that in this case, LPFM stations be allowed to use contour overlap methodology and directional antennas, opening possibilities of creative solutions to interference problems.

[13] Under this option, if interference were found, the LPFM licensee would be required to suspend operations and pay for the installation of an improved reception antenna, a microwave, or other form of link for the affected station. The LPFM licensee would not be allowed to resume operations until the affected signal was safely operating without interference.

a more complex regulatory scheme. These new additional spacing rules to residential populations would greatly complicate the siting of transmitters, and force technical showings that are expensive and unduly burdensome for LPFMs and the FCC staff that would be required to review them.[14]

Moreover, the FCC's present rules for blanketing interference and rules for addressing LPFM third adjacent interference are more than sufficient to address any anamolous LPFM third adjacent interference. As explained above, Section 73.318, which applies to all radio stations including LPFMs, establishes responsibilities in remediating blanketing interference.

The LPFM rules adopted in September 2000, have extensive interference remediation procedures that include stronger measures that can be taken against an LPFM than any other sort of radio station causing minor interference. 47 C.F.R. §§ 73.309, 73.310. These rules establish a complaint system and can force the LPFM station off the air if complaints are not appropriately remediated. These procedures also gives consumers and incumbent broadcasters an unprecedented level of protection from interference – far greater assurance of remedy than when a full power station changes facilities.[15] Present rules are sufficient to protect listeners and incumbents.

[14] If the Commission decides to use the additional spacing formula developed by Mitre, LPFMs should be allowed to make use of policies in place for translators. Should it be found that LPFM stations are mandated to use this unnecessary additional formula for interference spacing, the law and Commission rules should at the least allow an applicant to demonstrate lack of population within the area that would receive interference consistent with rules and policies applied to new FM translator applications. LPFM is secondary to FPFM stations in much the same way as translators are, so the rule for translators at Section 74.1204(d) should be applied similarly to LPFM if the commission unfortunately decides to adopt the additional spacing based on the formula.

[15] Full power stations do not have to go off the air if a change in facilities causes unremediable interference to a nearby neighbor. The worst conceivable result for a full power station out of compliance with this rule is a fine, whereas a low power station must stop transmitting.

III. ANY STEPS NECESSARY TO PROTECT READING SERVICES FOR THE BLIND SHOULD BE TAKEN.

No interference attributable to the LPFM was found to any receiver for reading services to the blind at more than 80 meters from the LPFM transmitter site during Mitre testing. Mitre Executive Summary at xxvi. Moreover, the FCC fully addressed protections for reading services for the blind in its *Reconsideration Order*. Creation of a Low Power Radio Service, Memorandum Opinion and Order on Reconsideration, 15 FCC Rcd. 19208, 19219 (2000). Under existing rules set forth in the Reconsideration Order, no LPFMs can be allocated on a third adjacent channel to a station that carries a radio reading service. *Id.*; 47 C.F.R. 73.807(a)(2).[16]

Low power advocates do not believe reading services to the blind are endangered in any way, and advocate for an LPFM service that is fully compatible with reading services for the blind. In order to assuage the concerns of those who continue to fear interference with reading for the blind services, low power advocates have always supported full grandfathering protections for all reading for the blind services, and continue to do so. Moreover, to assuage their concerns, LPFM Advocates fully support permanent protection of all existing reading for the blind services. In the opinion of LPFM broadcasters, the issue is closed and we have no interest in any changes to the protections given in the September 2000 Reconsideration Order. We encourage the Commission to reiterate and clarify that these protections are permanent rules that will not be revisited.

[16] "LP100 stations must satisfy the second adjacent channel minimum distance separation requirements of subsection (a)(1) with respect to any third adjacent channel that, as of September 20th, 2000 …broadcasts a radio reading service via a subcarrier frequency." 47 C.F.R. § 73.807(a)(2).

IV. PRESENT TRANSLATOR REGULATIONS ARE A SIGNIFICANT THREAT TO PROPER LPFM IMPLEMENTATION AND TO LOCALISM IN NONCOMMERCIAL RADIO.

The operation and regulation of translator radio service greatly impacts the ability of ordinary Americans to communicate across public airwaves through LPFM. The translator licensing system was originally designed in 1970 to help a full power station fill-in the coverage that was blocked by hills and other topographical features that prevent full power stations from reaching their full city of license. Technically, translators are very similar to LPFM stations, in that they can be located on many of the same potential frequencies. The major difference between LPFM stations and translators is that translators are designed to extend the reach of another station and cannot originate their own programming, whereas LPFM stations must originate their own programming (and in many cases LPFM stations must transmit locally-originated programming).

Translators are now being used, however, as a tool to dominate control of the airwaves. A loophole exists in the current rules, which allows noncommercial translators to be fed by satellite. Therefore, these stations are not extending the reach of a local station, rather, they are receiving far distant signals and transmitting them in a local area. Commercial translators, in contrast, must receive their inputs over the air, and therefore they are limited to expanding a local signal in a local area. There is currently no limit on the number of translators that an applicant can own.

Unfortunately, the exception for noncommercial translators has lead to abuse. These organizations are able to use the satellite-fed translators to gain an exceptional share of the airwaves. The combination of no ownership limits and no obligation for a local connection means that certain organizations have used the loose rules regarding translators to build gigantic radio empires. A conflict arises between these two services because low power radio and translators compete for the same spectrum. When allocating frequencies, translators are essentially on par with LPFMs, on a first-come, first-serve basis. Every new translator that does not originate local programming takes the place of a potential LPFM station is rooted in its community and that will originate local programming.

In March of 2003, the Commission opened a window for applications for translator licenses. While the Commission's decision to open a translator window was well-intentioned, the outcome has been disastrous for LPFM and for localism. The translator window opened in the major cities before a full LPFM window opened, with the result that many potential frequencies for LPFMs have already been applied for. The applications filed this year will eliminate virtually all opportunities for new LPFM stations in the top-25 markets in the U.S.

Appendix B provides a rough estimate of the impact of the translator window.[17] *In the 51 cities studies, only 4 channels remained available out of the 279 that the FCC predicted would be available in 1999.* While a few of these can be explained by major changes to facilities of full power broadcasters, the vast majority of the now unusable slots are the result of translator applications. Additionally, it is important to note that applications are not being filed by members of the community, but instead by organizations applying for large quantities of translator licenses. Of the 13,000 translator applications received by the Commission this spring, *over 50 percent have been submitted by just 15 organizations—one applicant, the Radio Assist Ministry, submitted 2454 applications.*

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[17] While the chart is not a rigorous scientific analysis, it shows the general impact of the translator applications with accuracy. The chart was prepared using the FCC' s projected spectrum availability numbers from Appendix D of the original LPFM NPRM, and research from REC's top 1000 LPFM cities website. *See* http://www.recnet.com/. It is important to note that these cities are not the top 50 cities in population, but they were the cities chosen for study by the FCC 1999. It is also important to note that the two charts use different grid methodologies for selecting the spots in a given city to check whether the location meets the spacing criteria. However, the comparison of the results is broadly indicative of the extent to which third adjacent channel translators have eaten into previously unoccupied spectrum that was believed to be usable by LPFM stations in the beginning of the rulemaking.

LPFM Advocates therefore petition the Commission to reassess the interaction between its translator policies and LPFM. LPFM Advocates urge the Commission to adopt policies that will promote localism. One point bears emphasis. With or without LPFM, new services will be installed in thousands of locations in the United States. The question is whether these new services will be offered by local entities with connection to their communities, or by organizations that own vast numbers of outlets essentially offering a national radio service exploiting an exception for noncommercial translators.

Specifically, LPFM Advocates ask that the Commission:

?? Freeze all translator applications until after the low power proceeding is completed, and the LP 100 window is opened and closed.

?? Give locally controlled and operated LP100s clear spectrum priority over distant translators.

?? Use the definition recommended by REC networks: a distant translator is any translator that is more than 400 kilometers and in a different state from the originating signal. *See* http://www.recnet.com/fcc/.

?? Grant UCC, *et al.*'s petitions for reconsideration to tighten the LPFM rules so that only truly local organizations can apply.

?? Allow low power stations to apply under the contour method set forth in the translator rules, giving additional technical flexibility to LPFMs, as recommended in the original LPFM proceeding.

V. FURTHER RECOMMENDATIONS TO FULFIL LPFM'S PROMISE TO PROMOTE LOCALISM IN BROADCASTING.

LPFM Advocates welcome Chairman Powell's recent recognition of the importance of localism and his recognition that low power radio furthers those goals. While the Commission took one important step to improve the implementation of LPFM, a number of other similarly simple steps could improve LPFM much more. For example, LPFM Petitions for Reconsideration are still pending before the agency after three years, including proposals that would limit the number of LPFM stations a single entity can control, and that would require all LPFM stations to originate at least some local programming.

We encourage the Commission to start with this of suggestions to improve the low power radio service and thus improve radio broadcasting's fulfillment of its historic mission to be a local medium.

1. Communicate more consistently with LPFM applicants.

Notify LPFM applicants in writing of the status of their application, when the application is received and when major events occur. Keep LPFM applicants apprised if more than 6 months go by without any action. Develop an easy means for them to check on the status of their application. Because the LPFM service was intended to provide grassroots community organizations access to the airwaves, it should be administered in a way that is accessible to such groups, many of whom have little or no experience in dealing with FCC procedures. By establishing a system of consistent communication with applicants, the LPFM service will be rendered more accessible.

2. Process LPFM applications more quickly.

Some applicants have been waiting since May 2000 – over three years – to hear if they will receive a license. Many applicants are community organizations with small budgets, and extended delays can damage or destroy their ability to plan for establishing such stations.[18]

3. Act on the pending Reconsideration Petitions in the docket.

A number of pro-localism proposals are awaiting action, including prohibiting ownership of multiple stations by a single entity, and requiring all LPFM stations to carry some locally-originated programming. The FCC must act on these proposals in a timely manner in order to ensure that the LPFM service is truly meeting its local mandate.

4. Give mutually exclusive LPFM applicants adequate information and time to work out agreements to share stations.

The ability to make major amendments to channels during the settlement was helpful, but it would also be helpful to be able to move the transmitter site by more than 2 kilometers when looking for simple ways to alleviate competitions.

5. Adopt new rules addressing the reality of changes in personnel on non-profit boards.

[18] For example, in October 2003, one LPFM applicant in Arizona wrote the Prometheus Radio Project, "Since our application sooo long ago our supporters are losing interest thinking it's never going to happen. The building we had is scheduled to be torn down by a big developer and we haven't heard a thing on our construction permit from the FCC… I'm the only one left with any enthusiasm for a station. Did the FCC actually think that people could hang on to a location for this long? … Not hearing one single word from the FCC is discouraging."

If the service is to be accessible to community groups, its regulations must take into account that board personnel changes are part of the nature of the existence of non-profit community groups.

6. Provide extensions for LPFM stations that cannot construct stations within 18 months for good cause.

Again, because many new licensees have little or no prior experience with broadcast regulations and the FCC, it is important to allow certain flexibility in meeting certain LPFM requirements. Considering the long funding cycles of charitable organizations and local governments, and the difficulty involved in the permitting process for small towns, the Commission should grant greater flexibility to LPFMs that are having trouble raising the money to build within the limit.

7. Reevaluate radio translator policies to eliminate non-commercial translators that do not originate locally broadcast programming.

These satellite-fed translator chains are the antithesis of localism and are harming both full power and low power non-commercial radio. As set forth above, translator policies must be reevaluated in order to ensure that locally-operated LPFM stations are given spectrum priority over distant translators.

8. Evaluate IBOC (terrestrial digital radio) to identify policies that will promote the carriage of LPFM stations digitally.

Adopting policies that will allow carriage and preserve the independence of LPFM stations as we move to a digital future is critical.

9. Allow LPFM stations to use less expensive Emergency Alert System equipment.

When the LPFM service was established, the FCC anticipated that lower cost EAS equipment would appear on the market; however, such equipment has not materialized. Given the fact that most LPFM stations have very small budgets, the FCC should act to make complying with EAS requirements more affordable. Several options are possible. The FCC could change the certification for LPFM decoders or the obligation to use certified equipment. The Commission could reinstate its temporary waiver for all LPFM stations until appropriate EAS equipment becomes available.

10. Clarify LPFM station's obligations to use type-certified equipment.

The Commission should allow low power radio stations to use the same type verified equipment that full power radio stations use.

VI. CONCLUSION AND RECOMMENDATIONS.

The FCC should make a strong recommendation to Congress to lift the prohibitions on third-adjacent channel licensing of LPFM stations. The FCC should not remain neutral about an unprecedented and unsound encroachment in an extremely technical area the FCC was created to regulate. Any flaws in the study's design demonstrate the error of allowing Congress to design engineering studies.

The FCC should also quickly move to fulfill the promises of Chairman Powell to take steps to promote localism through the strengthening of LPFM. Several issue areas, including translator regulation which is a significant threat to localism throughout noncommercial broadcasting, can be quickly remedied by the FCC. Such action would demonstrate that the FCC's commitment to LPFM and to localism is meaningful and is not a side-show intended to distract from public outcry with respect to media concentration regulation.

Respectfully Submitted,

___/s/______________________

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October 14, 2003

Appendix A

Commentary on the Mitre Report Evaluating Third Adjacent Channel LPFM Interference Potential:

Experimental Measurements of the Third-Adjacent Channel Impacts of Low-Power FM Stations, Mitre Corporation, May 2003

October 2003

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Medfield, MA 02052
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Broadcast Signal Lab

Commentary on the Mitre Report Evaluating
Third Adjacent Channel LPFM Interference Potential:
Experimental Measurements of the Third-Adjacent Channel Impacts of Low-Power FM Stations, Mitre Corporation, May 2003

This report is prepared in response to the Mitre LPFM study of third adjacent channel interference from LPFM facilities.

Broadcast Signal Lab performed a receiver interference analysis in 1999 that was submitted to the FCC in the Low Power FM (LPFM) rulemaking proceeding at that time. In response to the 2003 report from Mitre Corporation on the third-adjacent channel interference study, Prometheus Radio Project asked Broadcast Signal Lab to review and comment on the report. This document contains our comments on the Mitre study. This report is not intended as a full evaluation of the Mitre study. Instead, it contains observations on salient points related to our previous work with LPFM interference analysis and with other interference analysis with which we are familiar.

In summary, the Mitre report errs consistently in favor of incumbent full power FM stations in its methods and recommendations in the following ways:

1) **Mitre-identified LPFM interference events are based on careful listening by engineers, rather than by a more representative sample of casual radio listeners.** The engineers were tasked to listen for any compromise to the received audio, causing them to be more sensitive to minor changes in reception than the casual listener.

2) **Mitre automatically assumes that an observed impairment is caused by third-adjacent channel interference of an LPFM station, without regard to other potential causes.** Interference was defined as a transition from no impairment before activating an LPFM signal to an impairment of received audio after activation (based on the judgment of a field engineer listening to the source) with no apparent effort made to characterize the modality of the post-activation impairment. Because five FM radios were being tested at once, there is a time lag between the listening to each radio before and after LPFM activation. During this time it is not unlikely that some change in reception quality could have occurred to the tuned full power station. This is particularly true where many of these transitions from No interference before, to Yes interference after activation (N/Y transitions) were recorded among other samples with unusable Full Power FM (FPFM) reception. It is highly likely at locations with poor FPFM reception that events registering as LPFM interference could have been the result of variations in reception quality of the FPFM rather than the actual turn-on of the LPFM. Other factors may also have caused any given transition.

3) **Mitre's method of marking transitions has an inherent sampling bias against the LPFM.** The field engineer listens to the initially-received audio from the FPFM and decides without any reference whether it is impaired. Then after the LPFM is turned on the engineer decides whether the audio is now impaired. Thus, a *change* in the audio can be noted as an impairment on the second sample, no matter how minor. Also the report shows no attempts to listen in reverse, first to audio with the LPFM, then without the LPFM, and identify whether an *improvement* in audio is noted. In essence, the field engineer is *looking for interference* to log, assuring maximum sensitivity to any artifact in the audio with LPFM on.

4) **Mitre analysis skews the interference ratio data by treating blanketing interference as 3rd-adjacent channel interference.** The result is that Mitre has created an excellent map of blanketing interference. Thus, when the Mitre analysis attempts to filter out what it calls "insignificant" impairment to received audio in N/Y transitions, most if not all cases of "significant interference" are a result of blanketing interference mechanisms (receiver overload). Blanketing is an inherent part of radio station allotment, and is already addressed in FM regulations, including LPFM service.

5) **Mitre recommends rules to control 3rd-adjacent channel interference that are unnecessarily complex and based on interference that does not apply.** The minimum separation curves and the interference area curves rely on thresholds that are skewed toward receiver overload events close to the LPFM's and toward noisy FPFM reception at greater distances from the LPFM. Actual cases of third adjacent channel interference, if any, are in a substantial minority among these other causes.

Even in the presence of methodology favoring the incumbent full power station, Mitre's analysis demonstrates conclusively that selective radios, such as automobile radios and home component receivers, do not receive third adjacent channel interference from LPFM signals. Worst-case analysis by Mitre shows that any interference that occurs to these radios occurs within the already-protected blanketing area defined in 47 CFR §73.318.

Inexpensive radios are substantially less selective and are shown in the Mitre study to be susceptible a host of problems, the least of which is third adjacent interference. These radios exhibited symptoms of overload outside the blanketing area and had difficulty receiving the FPFM station under test at numerous test locations. These radios are obviously built with cost as a compromise to performance and should not be employed as the reference for acceptable and unacceptable interference. In support of this observation, §73.318 excludes non-fixed ("mobile") radios from blanketing interference protection. Portables such as boomboxes and personal radios such as the Sony Walkman fall into the non-fixed category (as do auto radios, which seem not to need such protection).

Mitre's analysis, while an interesting exercise in deriving general rules mathematically from data, concludes with a set of protection criteria that are based on assumptions that all interference observed was third adjacent interference, and that all radios should be 100% protected from LPFM's. Mitre's proposed protection criteria are unnecessarily strict, and are incompatible with a simple-to-license low power radio service.

The Mitre study confirms our observations in 1999 that the primary concern with LPFM, and with any new radio station, is receiver overload near the transmitter. This concern is already addressed in an equitable manner for all FM radio stations.

Discussion

Receiver Selection is Sufficient

The Mitre study utilized a limited population of five consumer receivers [1], which under the circumstances, is sufficient to characterize interference potential in a general way. The characteristics of receiver susceptibility to interference have been studied in great depth and breadth. In the 1999 proceeding, NAB evaluated 28 receivers, CEA/NPR evaluated 17, FCC evaluated 21, and National Lawyers Guild (BSL) evaluated 11. An independent opinion solicited by the NAB [2] after the submission of these studies indicates the common receiver performance measured by the four entities, "The significant differences among the studies were not in the measurements or in the performance of the receivers tested…" (p. iii) but in the interference criteria applied to make conclusions. The opinion says further, "Taking the information reported in all of the studies and displaying it in a consistent format…shows that the measurements [of the receivers] were quite consistent." (p. 28)

A common characteristic of the previous studies is that receivers were generally grouped into several classes— automobile, home (also called Hi-Fi, component), portable (also called boombox), table top (or clock radio), and personal (such as the Sony Walkman). Because of their special architecture and applications, the automobile and home receiver radios consistently performed better than the others. Among the other radios, there was a common range of performance revealed in each of the studies.

The National Radio Systems Committee (NRSC) 2001 FM IBOC System Evaluation report[3] discussed the use of a small receiver sample in evaluating another proposed addition to the FM band:

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[1] A sixth receiver, designed for reception of FM subcarrier audio, is not included in this receiver count because of its different mission and reception characteristics.

[2] A Review of Four Studies of FM Receiver Adjacent-Channel Immunity, Pickholtz and Jackson, November 1999, submitted by NAB as Appendix B to the Reply Comments of the National Association of Broadcasters, MM Docket No. 99-25.

[3] Digital Audio Broadcasting Analog Main Channel Compatibility and Digital Performance of the iBiquity Digital IBOC System in the FM Band Summary of Test Results, July 31, 2001, Advanced Television Technology Center.

3.4 Analog FM receivers

Four commercially-available analog FM receivers were used for compatibility testing of main channel audio services (see Table 6 below). These receivers were chosen to be representative of the vast majority of receivers used in the U.S. In December, 2000, CEA's Market Research Department provided the NRSC with the names of three of the top five brands, listed alphabetically, for each of three general receiver categories (Table 5), indicating that any model of radio from one of the brands indicated in Table 5 would represent one of the top-selling models in the U.S. in December, 2000.

Table 5. CEA AM/FM receiver market research results – December 2000

RECEIVER TYPE	TOP 3 BRANDS
Home (hi-fi)	Pioneer, Sony, Technics
CD boom box	Aiwa, Philips, Sony
Auto aftermarket CD	Kenwood, Pioneer, Sony

To determine if a single radio from each category would be sufficient to predict the performance of all radios in that category, advice was sought from Mr. Jon Grosjean, an expert on radio receivers who frequently provides consulting services to radio receiver manufacturers. According to Mr. Grosjean, the tuning circuitry inside modern FM radios generally falls into three categories that are defined by selectivity, specifically: moderately selective" receivers, "selective" receivers, and "very selective" receivers. Mr. Grosjean said that clock, personal, and portable radios marketed in the U.S. are generally moderately selective, and as a result are least adept at rejecting adjacent channel interference. Regarding home stereo receiver s, Mr. Grosjean said these are generally selective and are good at rejecting adjacent channel interference, though he noted there may be a few inexpensive home stereo receivers on the market that are only moderately selective, and there may be a few very e xpensive home stereo receivers on the market that are very selective, though these would be the exception for this category. And for automotive radios, Mr. Grosjean indicated these are generally very selective, though there may be some models on the market that are simply selective.

Four radios were employed in this IBOC test—two automobile models (one OEM and one aftermarket), a portable model and a home hi-fi receiver. These radios were employed to make recordings for subjective listener tests of the im pact of in-band digital signals on them.

The NRSC evaluation observed a characteristic difference between the moderately selective portable radio and the Home and Auto radios. The charts below are taken from section 4.12.3 of the NRSC FM IBOC Evaluatio n. They show how the portable radio is already compromised with a –20 dB D/U interferer on second adjacent channel, while the Home receiver begins to show material degradation with 30 to 40 dB greater undesired signal level. The Auto radios appear to handle even greater undesired signal levels.

NRSC IBOC Evaluation Data
Showing Greater Susceptibility of Portable Radio to 2 nd Adjacent Interference

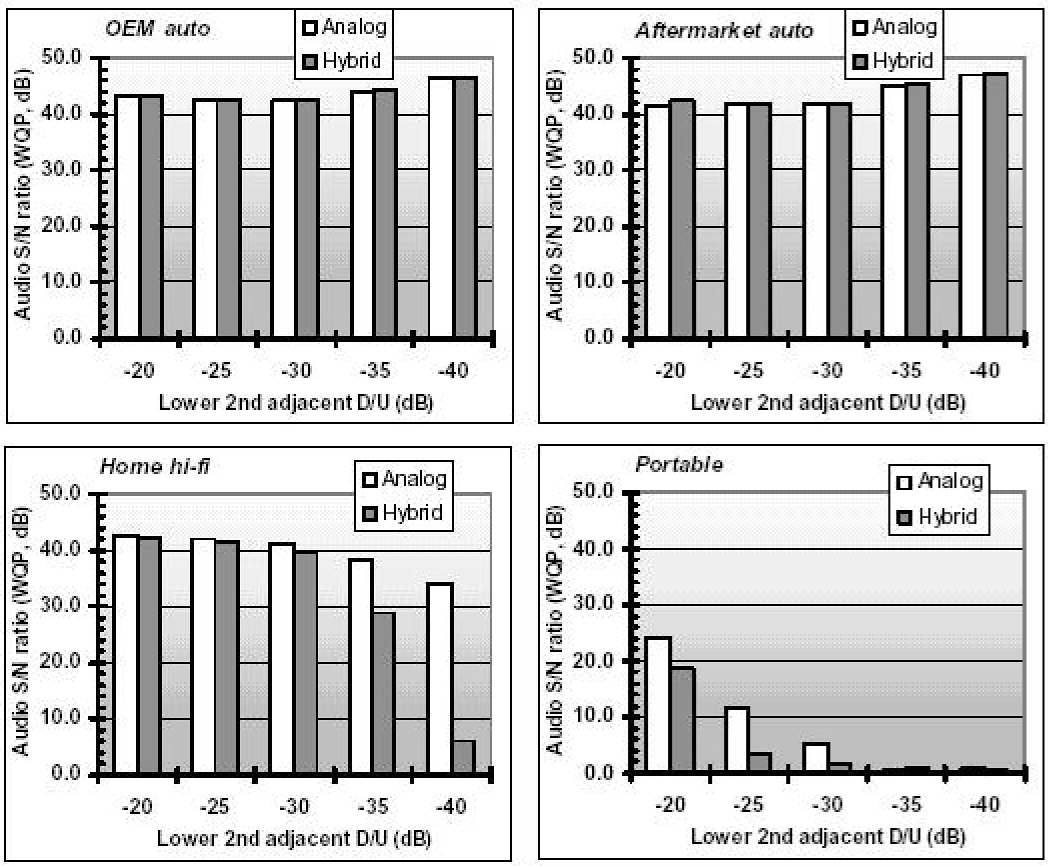


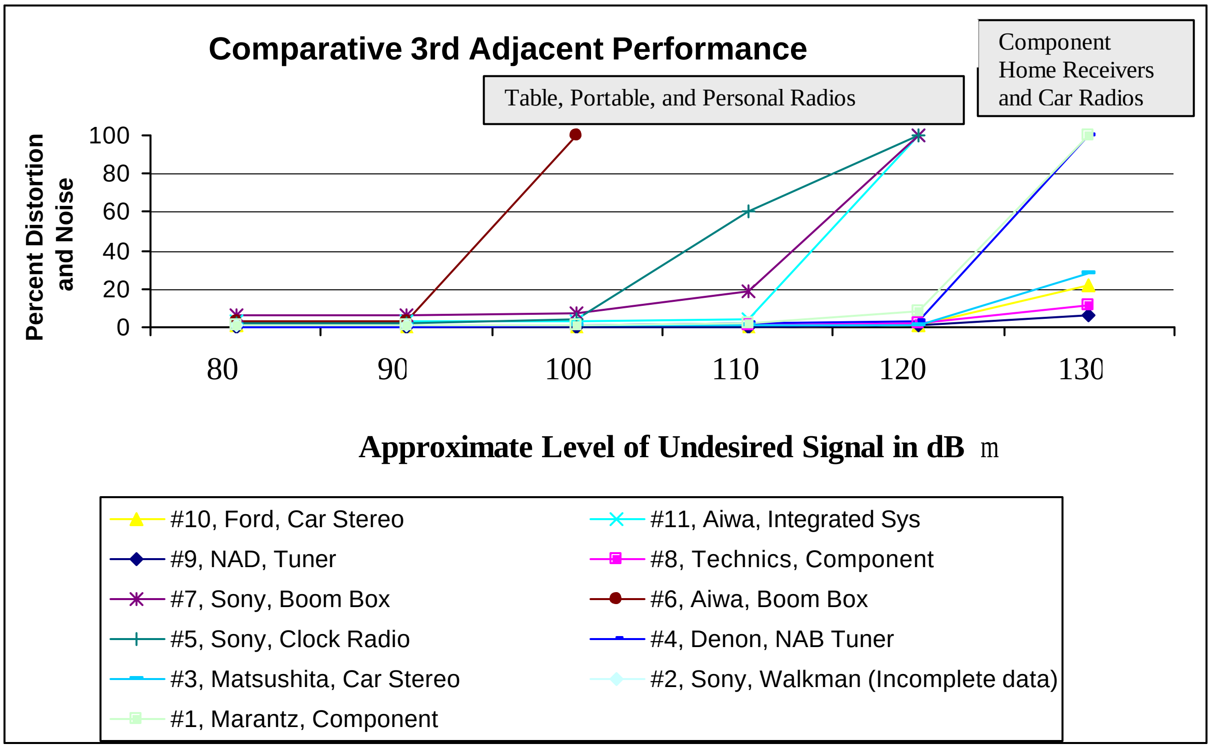
Figure 20. 2nd-adjacent compatibility – objective test results with analog and hybrid interferers (lower 2nd-adj., with 30,000K noise)

White bars represent measured audio signal to noise ratio of desired station in the presence of an analog 2nd adjacent station at various desired-to undesired (D/U) ratios. The gray bars represent interference from a 2nd adjacent station using hybrid IBOC transmission and are not germane to this discussion. –40 dB D/U is a higher level of undesired signal than –20. Note how the automobile radios obtain *less noise* at higher levels of interference. This is probably due to the automatic switching from stereo to mono and the reduction of high frequency response that auto radios customarily employ in the face of poor reception. The Home receiver shows a steady decline in signal to noise ratio beginning at about –30 dB D/U. The portable radio appears to be performing not too well at –20 dB and declines rapidly from there.

This class distinction among ra dios is evident in the Mitre data, BSL 1999 data as well as the other studies in the 1999 proceedings. In all cases, the automobile radio and home receivers were consistently more sensitive to weak full power FM station signals (FPFM) and less prone to receiver overload and interference than the boombox, personal and clock radios. Meanwhile, the personal radio and the boombox often suffered from common poor reception and overload issues in a given test, with the clock radio often not far off.

Below is a graph of the performance of the various radios tested by Broadcast Signal Lab for the 1999 report. It shows a steep bend in the line for each radio in the range where the radio begins to be unable to withstand the high levels being thrust upon it. Note how all the radios marked as table, portable, and personal radios overload between 90 and 120 dBµV/m (dBµ) equivalent field strength. In contrast, the home receivers and the automobile radios were more resistant to overload, with a range of 120 to 140 dBµ.

Graph based on 1999 LPFM Receiver Interference Study, Broadcast Signal Lab



In comparison, the table 2-7, *ID Codes of N/Y Transitions and Perceived Significant Degradation* in the Mitre Report, Volume One, reports the number of N/Y events for each radio in the closest five locations to the LPFM sites. The automobile had the least, 18, closely followed by the home receiver, 21. In contrast, the three other radios, clock, boombox and personal, produced 46, 50, and 43 events respectively; more than double that of the other two radios.

The class distinction between auto/home receivers and the less expensive clock/boombox/personal receivers is shown in the Mitre data in other ways as well. For instance, the less expensive radios were more likely to succu mb to poor FPFM reception and they showed consistently less rejection of blanketing interference in those locations within the blanketing area of the test LPFM. The Mitre receivers were clearly performing as representative samples of the installed base of consumer radios.

Mitre developed a set of interference thresholds (albeit based on both blanketing and adjacent interference) that reveals the same relationship between receiver types.

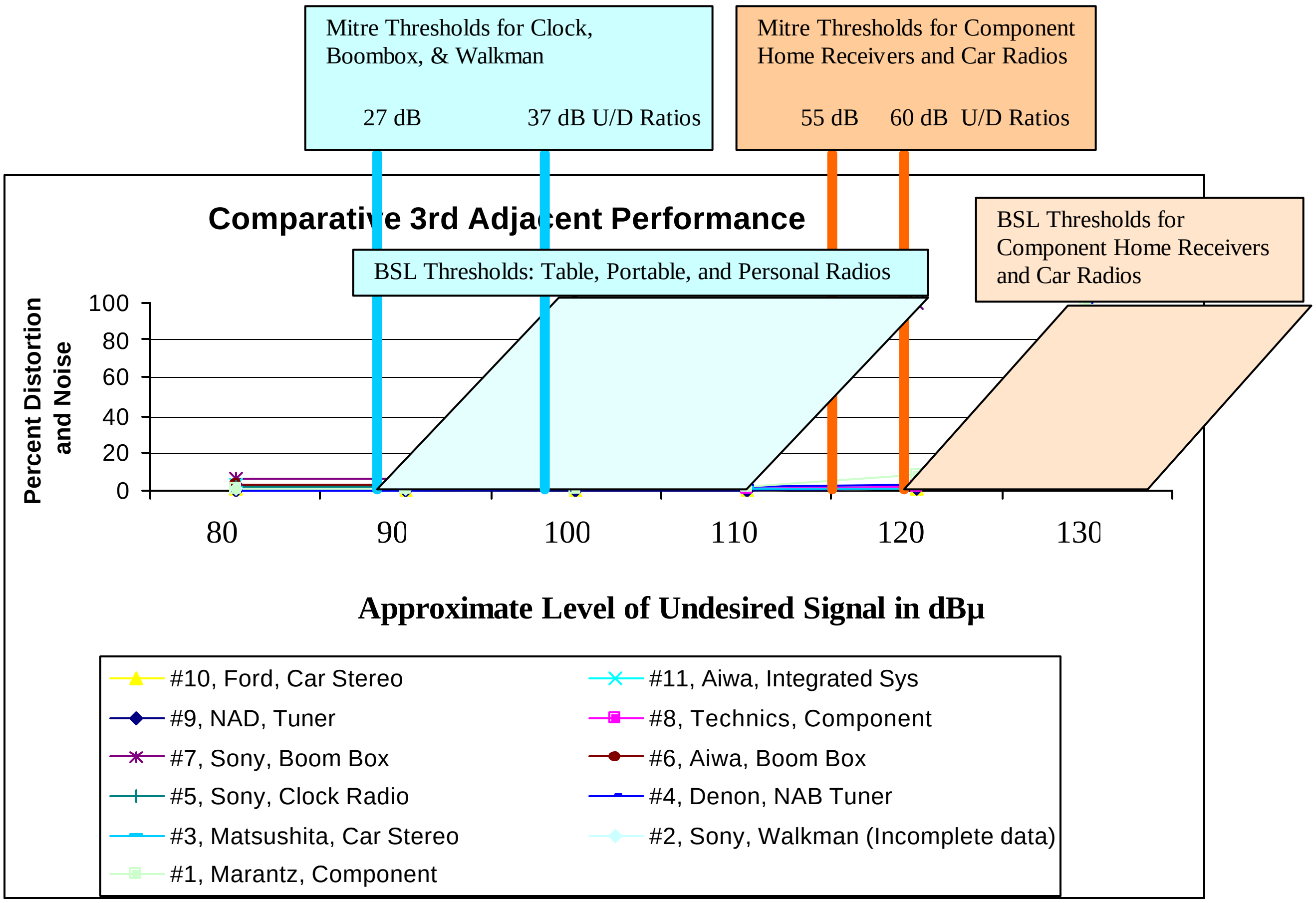
Table from Mitre Report, Volume 1

Table 2-5. Estimated Threshold D/U Values (in dB)

	Auto	Home	Clock	Boom Box	Walkman	RSVI
Case 1	-60	-55	-37	-27	-27	-26
Case 2	-60	-55	-37	-27	-27	-26
Case 3	-61	-56	-37	-30	-30	-26
Average	-60	-55	-37	-28	-28	-26

Below, the threshold values of the Mitre study are positioned on the BSL chart at their equivalent U/D ratios (at the 60 dBµ contour of the desired station).

Comparison of Mitre -derived Threshold U/D Ratios and BSL -Measured U/D Thresholds Showing Comparable Receiver Susceptibility in the Two Studies



The above comparison of Mitre thresholds and BSL thresholds shows two key facts. First, the performance of the Mitre receivers split into two groups in the same manner that the BSL receivers did, consistent with the NRSC analysis. Second, the Mitre methodology attempted to weight the degree of interference received and establish a threshold for the beginnings of "significant interference." This resulted in Mitre threshold points that are at the leading edges of the BSL receiver response curves, and therefore approximately equal to the "knees of the curves" or thresholds in the BSL study.

There is a clear difference of 20 to 35 dB between the selective radios and the moderately selective radios in the Mitre and BSL data. This difference is also reflected in the results of the CEA/NPR study, the FCC OET study, and the NAB study. Although these studies employed different thresholds for testing interference, they consistently showed the same class distinctions between the moderately selective radios and the selective radios.

Subjective Testing

Mitre opted to defer the subjective study of the recorded samples of the LPFM tests because there were not enough examples of interference to make the effort worthwhile. (Mitre Final Report section 1.3.3.15) After culling the data more rigorously than Mitre, we find that the available samples of likely 3rd-adjacent channel induced interference is even smaller in number than Mitre presumes. It would be difficult to produce meaningful results on such a small sample of interference examples. See below for more discussion on this data scrubbing.

Blanketing

In our report for the 1999 LPFM proceeding, Broadcast Signal Lab addressed a key concern about interpreting receiver interference tests—blanketing interference. As the undesired LPFM signal increases above 100 dBµ it enters a range where it may be overloading the receiver under test. This overload, described succinctly in the Mitre report in its Volume One, Section 2.1.1, Interference Mechanisms, manifests first as compression in the receiver and extends to extreme intermodulation products.

Unfortunately, the Mitre report field work lumps receiver overload interference (blanketing) in the same category as 3rd adjacent interference. This tends to skew the resulting U/D ratio calculations because receiver overload is not a result of the ratio between desired and undesired signals. Rather, it is a result of the absolute level of the undesired signal.

This fact is apparent in the Mitre conclusions about worst case interference protection as illustrated by Table 4.4 from the report:

Mitre Report Table
Showing How Far a Clock Radio (@ -35 D/U) and a Home Receiver (@ -60 D/U) Must Be from the LPFM to Ensure It Will Not Exhibit an N/Y Transition

Table 4-4. Minimum Separation Distance at Edge of FPFM Coverage (m)

Radio D/U	Avon	Brunswick	East Bethel	Owatonna	Winters	Benicia
-35	602	482	393	423	590	582
-60	123	91	66	67	122	121

This table is derived by Mitre from its chosen threshold D/U ratios for two basic receiver classes (-60 for Home and –35 for Clock radios). The distances are computed based on simple D/U ratios of a hypothetical LPFM at the outer edge of the FPFM covera ge area.

Even Miter' s excessively conservative estimation of interference areas places all of the Home receiver protection distances within the 125-meter limit of the blanketing interference rules (for 100-watt stations). Home receivers therefore do not need third adjacent protection from LPFM stations as they are already protected to the same degree as Home receivers near other radio stations.

Mitre' s overly conservative estimation of the protection distance required for the Clock radio (and by extension, the personal radio and the boombox) includes data sets with substantial faulty reception of the FPFM station as well as a higher incidence of receiver overload than with the more selective radios. The faulty FPFM reception is not addressed in Mitre's analysis—what is the probability that an LPFM may (or ay not) increase an already large amount of unusable FPFM reception at a given location?—as Mitre' s results are only from a comparison of the unimpaired reception samples to the N/Y transitions that are assumed to be LPFM interference. The role of impaired FPFM reception is conspicuously absent from the Mitre analysis.

Also, the receiver overload data, occurring inside and outside the official blanketing area, skews the results. There is no compariso n to the amount of receiver overload outside the blanketing areas of FPFM stations that is tolerated by the current rules. Based on the overload data of the LPFM case, the overload potential for moderately selective receivers near full power stations is substantial. Hence, to demand 100% protection of the public against LPFM overload (or other interference for that matter) is not consistent with the manner in which inexpensive radios already perform around full power stations and the manner in which prote ction from such interference is permitted. Together, the lack of good references to the manner in which FPFM stations already cause or receive interference on less selective radios creates a possible double standard, one for perfect LPFM interference imm unity, and one for the incumbent degree of acceptable interference and poor reception for Full Power stations.

To refine the Mitre analysis and demonstrate how the Mitre data overstate third adjacent channel interference mechanisms, we tabulated all the i nterference events listed in the Mitre report and filtered them for blanketing interference (Appendix 1). FCC regulations define Blanketing (interference) as that occurring in the presence of a 115 dBμ or greater signal in the area of a broadcast station (§73.310). The rules describe a "blanketing area" in 47 CFR §73.318. This area is defined by a simple contour calculation based on free space propagation and the Effective Radiated Power (ERP) of the blanketing station, regardless of the height of the blanketing station's antenna above ground. Hence, the blanketing area is a rather arbitrary circle around a station within which stations have certain obligations to remedy interference for a limited time after installation of new facilities. This area is based on the 115 dBμ contour. For a 100-watt station the blanketing area is 125 meters in radius.

Based on the receiver overload failure data in our 1999 receiver study, receivers other than home-type and auto appear to be more susceptible to blanketing than the 115 dBμ contour would suggest. Exposing some of these receivers to levels even lower than the equivalent of 100 dBμ sometimes resulted in overload-characteristic response. In particular, the less expensive units, including portable, clock, and boombox radios, were more sensitive to overload than the home and auto radios, as discussed above.

Recall also that the FCC definition of the blanketing area is based on free space radiation, and does not account for path losses to the receiver. Hence, a receiver could be within the 115 dBμ contour but receiving, say, 100 dBμ signal and exhibiting overload symptoms. Within this area, the actual signal level of the interfering station is irrelevant. Any interference within this area must be addressed according to the FCC protocol in §73.318, regardless of the actual interference mechanism. [4]

Based on our 1999 study, it appears not only possible, but likely that outside the 115 dBμ contour the less robust receivers can experience blanketing interference. We suggest a secondary level of about 100 dBμ as a threshold for likely blanketing interference to those radios with no pre-detection filtering and/or limited dynamic range (although some radios are likely susceptible at even lesser levels).

Blanketing interference is a limit on receiver performance, and is an acknowledged and accepted part of the environment of full power radio service. The fact that it is already addressed by §73.318, to the 115 dBμ contour, regardless of actual received signal level, and ignored beyond the 115 dBμ contour, even if it is likely to occur in less sophisticated radios, suggests that blanketing should be addressed in the Mitre analysis as well. It stands to reason that if inexpensive radios are already susceptible to blanketing interference inside and outside a FPFM station's blanketing radius, LPFM potential interference should be evaluated in the same light — or, so to speak, on a "level playing field."

[4] As an example of the manner in which the FCC already willingly underestimates blanketing areas, the aggregate power of stations at multi-station sites is not used to adjust blanketing area size. Each individual station has a specified blanketing area defined by its ERP, yet a group of, say, six stations on a shared structure has a potential six-fold increase in power over the individual stations with no corresponding increase in the blanketing area. Hence, it is clear that the choice of 115 dBμ per station as the blanketing area is only a simple guide for establishing responsibility in the most likely area of concern. It is not a guarantee that there will be no blanketing interference outside this radius.

In Appendix 1, we accumulated totals of interference events from the Mitre receiver data sheets and sorted by site, location and LPFM power. Those locations within the blanketing radius of ten and 100-watt LPFM sources were excluded, regardless of signal level. OF the 194 N/Y transitions, 133 were within the blanketing ra dius.

Next, a receiver overload threshold for the boombox, clock and personal radios was set at 100 dBµ, based on the discussion above. These interference events are not qualified as to cause (blanketing or adjacency interference or other causes [5]), but have a strong likelihood of receiver overload. To prevent erroneous analysis, remaining transitions with levels ≥ 100 dBµ were excluded from the data set.

Also, some of the Mitre interference events occurred on data sheets with substantial numbers of unusable data points, due to poor FPFM reception. There is no qualification made of the lower LPFM level transition events as to whether each event is indeed an interference event or a simply a variation in the reception of the FPFM station. Some U/D ratios are so low that it seems unfathomable that they are LPFM interference related. Further, the Mitre report Appendix C, Figures C-22 through G-28, contains totals of transition counts by transition type and receiver type. A most telling indication of the magnitude of FPFM instability is in the amount of compromised FPFM reception, reflected as blue Y/Y transitions, in comparison with alleged interference events, reflected as orange N/Y transition bars. (examples below) Therefore, any transition events that occur at locations with significantly compromised FPFM reception were excluded from our data because of the likely corruption of the data from causes other than 3rd adjacent channel interference.

The charts above reveal one overlooked fact about reception anywhere in the protected service area of any station—the prediction of coverage is statistical, as witnessed by the use of f(50,50) contours to represent reception quality. If 50% of the locations at a contour are able to obtain the stated signal strength 50% of the time, then there is a probability of unusable signal at some percentage of the locations for some percentage of the time. As one moves away from a station to its protected contour, the probability of a given location having not only low signal, but also unusable signal, increases. Hence, an evaluation of the Y/Y transitions is likely to reveal this characteristic of FM reception. Similarly, the probability of a N/Y transition is dependent on the probability of a N as a starting point.

[5] Indeed, Mitre reported one audio sample that was corrupted for half its duration by a mysterious hum that sounded like no other iterference heard. This obviously different inter ference modality was taken from the Mitre analysis, as were a couple of clearly "anomalous" events at ridiculously low U/D ratios.

Figures from Mitre Report Appendix C

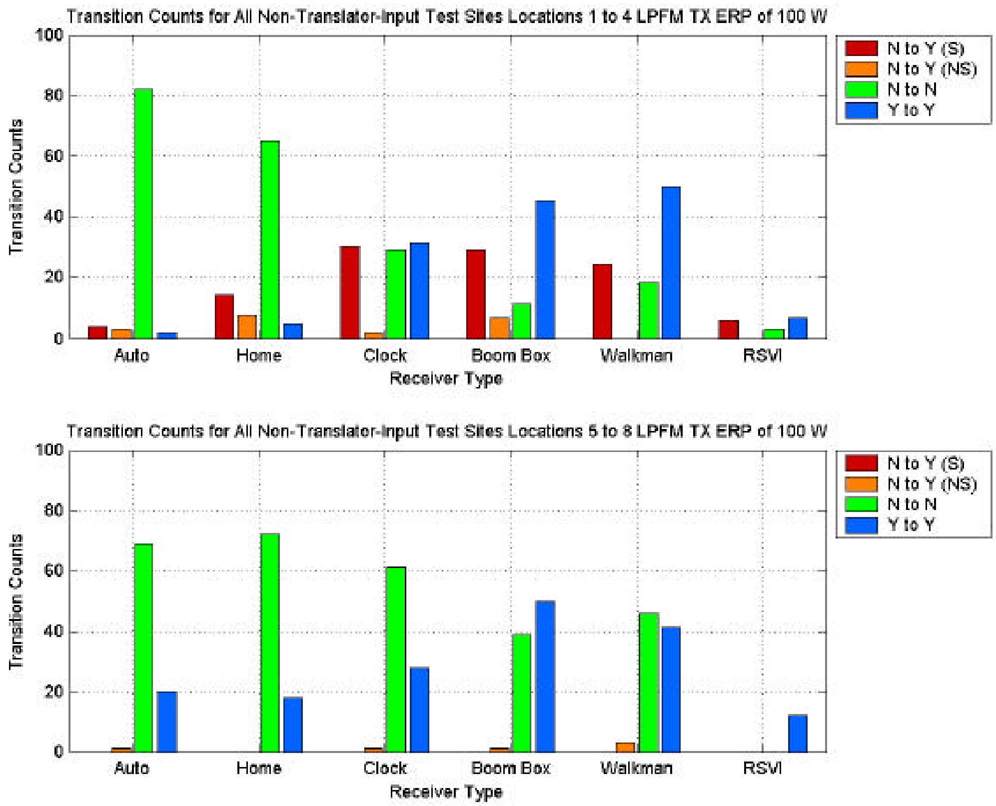


Figure C-27. Transition Counts for All Non-Translator-Input Test Sites, LPFM ERP Value of 100 W and Separating Locations 1 to 4, and Locations 5 to 8 in Two Subplots

The above charts, taken from the Mitre report, show how the close-in locations (1-4) are dominated by the blanketing interference described above, resulting in large numbers of red significant N/Y transition counts, assumed by Mitre to be 3rd-adjacent interference. Despite a few prominent red bars, which would be nearly nonexistent if the blanketing area were excluded, the blue bars indicating poor FPFM reception (Y/Y transitions) strongly outweigh the red. Orange not-significant transition counts are shown to be dwarfed by the blue poor reception counts. In the more distant locations (5-8), there are no significant transitions and miniscule not-significant transition counts. In contrast, the FPFM reception flaws were substantial in number.

For some of its analysis, Mitre adjusted its data for insignificant and significant interference. To determine whether the contribution of the not significant events to the results had any significant bearing, Mitre performed a weighted analysis. Mitre indexed the not-significant events three ways, to bracket possible ranges of outcome — 0, 0.2 and 0.5 with respect to significant events indexed at 1. This methodology revealed in a simple way how lesser interference does not have a large impact on transition probability.

Our analysis overlooks the differences among the N/Y transitions in order to focus on the receiver overload aspects and the noisy FPFM aspects of the study.

One of Mitre's Conclusions in Section 5 of the report states:

- Since LPFM-induced third ACI appears to occur only in close proximity to LPFM transmitters, it follows that if reasonable transmitter emission standards are established, and reasonable restrictions are observed when siting LPFM transmitters, then third-adjacent channel interference will have relatively little impact on the listening audiences of neighboring incumbent FPFM stations.

We suggest rewording this conclusion,

- Since LPFM-induced third ACI appears to occur only in close proximity to LPFM transmitters, and *since it is predominately due to receiver overload*, it follows that if *reasonable blanketing interference protection rules are established (and they are)*, then interference from a new 3rd-adjacent LPFM will have relatively little impact on the listening audiences of neighboring incumbent FPFM stations.

Mitre Volume One, Section 4.6, Assessment and Conclusions, discusses the increasing size of the potential interference area as the LPFM is moved away from the FPFM toward the FPFM protected contour. Mitre then computed the largest potential interference area based on its interpretation of the results and arrived at an interference area ratio, "Table 4-4 shows that the largest radius (at edge of coverage) for the scenarios tested is about 600 meters. In the worst case examined, the relative interference area ratio is 0.13% of the FPFM station's coverage area." In its Summary of Conclusions, Mitre adds that this is the worst case, and otherwise the figure is "orders of magnitude smaller."

As a point of reference, iBiquity Digital Corporation made the following observation about its digital technology in its report *Impact of National Rollout of IBOC in Analog Radio Listenership,* September 2000, "On average, 99.36% of an FM station's radio listeners will not be impacted by the introduction of IBOC." iBiquity amplifies, stating that this is a worst case estimate mitigated by the actual rate of digital transmitter and receiver rollout over time.

The impact figures from these two tests in different arenas of FM reception are both worst case numbers; are both based on interference ratios, such that actual interference is not guaranteed for all listeners within a given predicted interference area; and are both figures representing significantly less than 1% of the area of the protected station. There is no significant difference in the impact of a digital rollout and a 3rd-adjacent Low Power FM rollout on coverage of incumbent full power broadcasters.

Conclusions

We comment on each of Mitre's Conclusions by incorporating the conclusions below:

Mitre says,

5-4

- No LPFM station should be licensed within x_{min} meters of any location that is likely to have a high density of receivers that lie within the FPFM protected area. The quantity x_{min} is defined [under a complex formula]

This completely contradicts the intent of LPFM. In addition to its unnecessary layer of new complexity in the validation of a license application, this "keep-it-from-radios" criterion presents logistical obstacles to the fair use of the spectrum. Anyone who has attempted to identify a crescent of territory within which a valid LPFM frequency could be implemented and then attempted to locate a viable site for installation of a transmitter is aware that the nature of LPFM siting is already heavily constrained by the distance separation criteria within the highly developed FM band.

Since the vast majority of the identified interference is related to blanketing interference and already covered by the rules, this additional regulatory burden is unnecessary.

Mitre says,

- No LPFM station with an ERP of P_{eu} dBW should operate within d_u kilometers of an FM translator receiver on the third adjacent channel, where d_u is defined in 5.1.2. Any LPFM applicant who is allowed to operate at a smaller distance than d_u kilometers from a third-adjacent-channel FM translator receiver should be required to perform preliminary interference testing and then to pay for any necessary mitigatory measures, such as a more selective bandpass filter for the translator receiver.

It is reasonable to expect an LPFM to protect an incumbent translator's input from interference (although, a subsequent translator input frequency change should not be protected). It is also reasonable to provide a mechanism for determining when an LPFM should work proactively with a translator owner to prevent interference. A distance limit for LPFM action would be helpful, but the proposed limit is based on a single case with an unidentified translator receiver. To prevent unreasonable mitigation demands from being placed on the LPFM applicant, a means for adjudicating disputes as to whether the applied mitigation is sufficient should be established. The translator should not have unreasonable veto power over the LPFM.

Mitre says,

- The FCC should impose, for LPFM transmitters, a more stringent limit on third adjacent-channel emissions than the –35 dBc that CFR Sec. §73.317 (c) currently allows at frequency offsets up to and including 600 kHz. The total energy emitted by the transmitter in the third adjacent channel, in the form of phase noise spread across the channel and/or discrete tones within the channel,

> should not exceed the level of -55 dBc that was emitted by the LPFM transmitter used in the analog field tests. However, the existing Sec. §73.317 (d) limitation of –43 dBW on discrete tones offset more than 600 kHz from the carrier should not be relaxed.

Using the test transmitter's specifications as the reference for a new emissions standard is simplistic. While it is always desirable to minimize out of band noise, more study is necessary on this question. For instance, if transmitters are already regularly meeting this objective, then there may be no benefit to the addition of a regulatory control and potential added cost to the LPFM service. Also, if a phase noise criterion is advisable for LPFM service, it may be advisable for the entire FM band. While Mitre's objective is the third-adjacent interference potentially caused by phase noise (which has not been demonstrated, only postulated), the addition of digital waveforms in the future will require careful attention to spurious out of band energy. It would be advisable to incorporate the phase noise discussion in a full discussion of the issue for the entire band, at a later time.

Mitre says,

> - **5.2.2 Listening Tests and Economic Analysis**
>
> The FCC should *not* undertake the additional expense of a formal listener test program or a Phase II economic analysis of the potential radio interference impact of LPFM on incumbent FPFM stations. Other economic impacts are outside the scope of this effort. Perceptible interference caused during the tests by temporary LPFM stations operating on third-adjacent channels occurred too seldom, especially outside the immediate vicinity of the sites where the stations were operating, to warrant the additional expense that those follow-on activities would entail.

While some parties may quibble about the lack of such tests, or assail the recordings with which such tests would be conducted, we concur that there is not sufficient cause to pursue subjective testing. Interference is clearly limited to the immediate area of the LPFM. Also, Mitre's area probability analysis, although based on the most extreme interpretation of LPFM interference possible, reveals a low probability of interference and a low potential percentage of population affected. Mitre's area probability does not account for an additional mitigating factor in the assessment of LPFM potential interference. In general, radio stations have only single-digit percentages of the entire listening audience, such that in any area in which third-adjacent interference might occur, it would have to occur to a radio that is tuned to the affected station. This further diminishes the probability that a listener will suffer interference.

In summary, the Mitre Study errs in numerous ways in favor of the incumbent FPFM station and against the LPFM. Despite this conservatism, Mitre concludes the evidence is overwhelmingly in favor of relaxation of third-adjacent protection for low power stations. Mitre overlooks the impact of blanketing interference, which is regulated separately by the Commission. Mitre also did not attempt to screen out the actual mechanisms of interference in each case, thereby ensuring that some non-third-adjacent interference was counted as third-adjacent interference. Based on extremely conservative overestimations, Mitre recommends arcane and possibly draconian methods to prevent all possible interference. These methods are actually unnecessary and would burden what was intended to be a simple-to-define service with unnecessary complication. It is time to relax the third-adjacent protections to enable more LPFM service.

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Appendix 1.

Exploration and Tabulation of N/Y "Interference" Events Table

Discussion.

The table below is a compilation of N/Y events from the Mitre report Receiver Data Sheets for all locations at all cities tested. The translator input test and the subcarrier receiver are not included in this tabulation due to their separate purposes. The table consists of three general groups, 100-Watt LPFM, 10-watt LPFM, and zero-watt LPFM operation. In the 10 and 100-W groupings there is data on the apparent Undesired-to-Desired signal ratio, the absolute level of the LPFM signal, and the number of N/Y events logged for that power at that site.

Because blanketing interference is not an Undesired-to-Desired ratio problem, but an absolute level problem largely addressed by blanketing interference regulations, data taken within the blanketing areas of 10 and 100-W LPFM's should be set aside from the U/D computations. Those groups of data that were taken in a blanketing area are shaded in gray.

Measured LPFM levels greater than 115 dBu are highlighted yellow for comparison to the gray blanketing area restrictions. All the yellow highlighted values of 115 dBu or greater appear within the blanketing area locations.

Blanketing interference can occur at lesser levels than the nominal 115 dBu level that defines a blanketing area Hence, there remains a potential for the undesired signal to cause blanketing interference at lesser levels both inside and out side the blanketing area. A second blanketing level of 100 dBu was selected to represent this reality, based on prior tests. All remaining samples above 100 dBu were highlighted green.

Green highlighted samples also appear within the blanketing areas, as well as outside blanketing areas. These samples are of sufficient LPFM level that they must be considered suspect for the purpose of 3rd adjacent channel interference analysis. Many, particularly those collected on the inexpensive radios, are likely to be caused by blanketing overload rather than by U/D ratio problems.

Another confounder in the study is the fact that many of the locations had obviously corrupted desired channel reception. In some cases a substantial quantity of corrupted desired station reception data points were accompanied by an equal or lesser number of what appear to be LPFM interference data points. However, with the prospect of unstable reception of the desired signal, the transition reported as a potential interference event could be a time-variation in reception of the desired station. Hence, it is not advisable to include transitions from already-corrupted reception sites in the final interference data sample. Blue highlight is placed on all N/Y transition counts that were recorded among substantial corruption of the FPFM reception (Y/Y events). These are considered "noisy" data.

To obtain the most reliable interference samples from the entire data set, the blanketing area locations are removed, the LPFM signal levels greater than 100 dBu are removed and the noisy event samples are removed. What remain are only 14 transition events with a strong likelihood of being real third-adjacent interference events — 5 considered significant and 9 considered not significant. These events are from two East Bethel locations (4 & 5) and one Winters location.(4) and relate only to the Boombox, clock, and personal radios..

One East Bethel location registered U/D ratios of 22 and 32 dB, while the Winters location registered 27 and 37 dB (with the 10 and 100-watt LPFM powers, respectively). The other East Bethel location had completely manageable –1 to 9 dBu U/D ratios and should be considered anomalous.

While the data sample of interference events is very small, leaving no room to effec tively subjectively test the recordings and derive meaningful general rules and interference curves, the results can be looked at in the converse—no interference was noted at moderate U/D ratios. With U/D ratios of less than 40 dB, the likelihood of inter ference to an incumbent station is extremely small, and relegated to the least expensive, least selective radios.

Meanwhile, the Mitre study demonstrated that to obtain interference ratios greater than 40 dB, one must be in or near the blanketing area of the LPFM, where blanketing interference takes precedence over U/D ratio interference.

Table of N/Y Interference Transitions

City	Measurement Location	Within Blanketing Contour?	Number of N/Y Transitions, Undesired to Desired Ratio, and LPFM Signa l Strength (dBuV/m)—Sorted by LPFM Power						
LPFM Power			@ 100 W			@ 10 W			0 W
		10 W & 100, or 100 W only	Undesired to Desired Ratio (dB)	LPFM Strength (≥ N dBu)	# of N/Y Transitions	Undesired to Desired Ratio (dB)	LPFM Strength	# of N/Y Transitions	# N/Y Trans.
Avon	1 Note 1	10 & 100	37-39	120	4				
	2	10 & 100	35-45	120		25	113	1	
	3 Note 2	100	29-30	FPFM poor		18 (10 m)	101	3 (NS)	
	7 Note 3								1
Brunswick	1 Note 3, also	10 & 100	80	120 (one at 105)	5				1
	2 Note 4	100		114	2				
	3 Note 5	100	60 (est)	97	1	50 (10 m)	87	1 (S)	1
E. Bethel	1 Note 6	10 & 100	49 (est.)	114	13	39	104	13	
	2	10 & 100	45 (est)	106-109	12	35 (30m)	96-99	9	
	3	100	39 (est)	110	12	29 (10 m)	100	14 (S)	
	4 Note 7		32 (est)	93	1 NS, 1 S	22	83	1 (NS)	
	5 Note 8		9 (est)	80-90	2 (NS)	-1	70-80	3 NS, 1 S (Mitre: “anomaly”)	
Benicia	1 Note 9	10 & 100							
	2	100	48 (est)	116	3	38	106	1 (S)	
	3 Note 10	100 @contour+5 ft	47 (est)	97	3	37	87	2 (NS)	
	4 Note 11		42 (est)	81	2 S, 2 NS				

City	Measurement Location	Within Blanketing Contour?	Number of N/Y Transitions, Undesired to Desired Ratio, and LPFM Signa l Strength (dBuV/m)—Sorted by LPFM Power						
	5 Note 12		12		3 (NS)				
	6 Note 13		13 (est)		1	3			
Winters	1	10 & 100	50	110-120	14	40	100-109	7	
	2	10 & 100	42 (est)	110-118	8	32	100-108	17	1
	3 Note 14	100	46	114	8	36 (est)	103	6 S, 4 NS	1
	4		37(est)	Six >100	9 (S)	27	90	2 (NS)	
	5 Note 15		17 (est)			7			
Owatonna	1 Note 16	10 & 100	61 (est)	120	1		51		
	2 Note 17	100	61 (est)	108-122	6		51	3 (S)	1
	3 Note 18	100		106	1		96	1 (NS)	
	4, 5 Note 19								
	6 Note 20		8	69	1				
Tally:			114 N/Y transitions			80 N/Y transitions			
			93 in blanketing area			40 in blanketing area			
			11 non blanketing & significant			26 non-blanketing & significant			
			8 non blanketing & non significant (and 2 anomalies in locations 6)			14 non blanketing & non significant			
			26≥115 38≥110, <115 23≥100, <110			0>110 66≥ 100			
			7 non-blanketing area & non -noisy & ≤100 (3 NS, 4 S)			7 non-blanketing -area & non-noisy & <100 (6 NS, 1 S)			
			16 with serious FPFM reception corruption			20 with serious FPFM reception corruption			6 known false transitions

Key: Yellow highlight indicates value of LPFM greater than official blanketing level in FCC regs (115 dBu)
Green highlight indicates LPFM level greater than 100dBu.
Blue Highlight indicates “noisy data” manifest by N/Y events occurring among substantial numbers of Y/Y events.
Gray cells indicate data sets within the FCC blanketing area for the power indicated, per §73.318.

Notes

Note 1 Mitre narrative describes only one of these events to be significant degradation

Note 2 The 10-m height tests are mostly corrupted by poor FPFM signal. All 3 N/Y transitions appear on the 10-m height tests as well, suggesting that these 3 events are the result of poor and variable FPFM reception.

Note 3 This location has highly corrupted FPFM reception, to the extent that a N/Y LPFM transition is shown as occurring with no LPFM operating (0 W). Clearly, this transition does not count as LPFM interference, and it underscores the fact that between the on and off times of the LPFM test signal, reception of the FPFM signal may vary . This could apply to any location where a large number of poor FPFM signals are evident.

Note 4 This location had much FPFM corruption. It also had one event in which the FPFM signal improved from Yes to No with the activation of the LPFM. This is also likely to be the result of variability of FPFM reception over time.

Note 5 Highly corrupted FPFM, with Y/Y events for all non automobile radios and all scenarios, except one set of three N/Y transitions in one scenario with the Home receiver, including one N/Y transition without LPFM. The other two transitions should be ignored.

Note 6 24 of these transitions are distributed among the clock, boombox and walker radios. One transition is 10 m, 100 W, unprocessed audio supposedly affecting the Home receiver, while the other transition is 10 m, 100W processed audio supposedly affecting the Auto radio. The lack of complementary effects between formats or between radios suggests more reception artifacts that may be independent of the presence of the LPFM.

Note 7 The walkman was affected only at 10 W LPFM power, not 100. This seems contradictory and suggests this transition may have been anomalous.

Note 8 The Clock radio only showed a transition with 10 watts LPFM and unprocessed audio (2 events) while the walkman responded only to unprocessed audio and power levels of 10 and 100 W (4 events). One would expect processed audio and 100-w power to produce similar results in these radios, but it did not. The results are therefore probable anomalies. This is particularly evident because the undesired -to-desired ratios are at very manageable levels of 9 to –1 dB. The significant 10 -watt event is reported as an anomalous hum for half the recording and is discounted in the Mitre report (Section 2.5 and 2.10, Volume 1)

Note 9 Poor FPFM reception on Clock, Boombox and Walkman radios. Home and auto radios trouble free with and without LPFM. This is in the face of 100 to 113 dBu LPFM energy and 50 to 60 dB U/D ratios. Clearly, the home and auto radios are demonstrating their ability to reject LPFM interference from both blanketing and U/D ratio effects. This is reflected in other samples of these radios at other sites, suggesting that some of the N/Y transitions for these radios with less demanding circumstances at other locations may be more related to reception anomalies of the FPFM than to the introduction of LPFM energy.

Note 10 Home radio not affected in Location 2, just as it was not in Location 1, yet in Location 3 5 transitions recorded for just this radio, while reception of the less expensive units was a complete failure. Indeed, FPFM signal was measured at 50 dBu, considerably less than the protected level of any FM station. This suggests the Home receiver was exhibiting variable reception of the FPFM that was not necessarily related to the LPFM activation. In fact, one of the 10-watt transitions did not have a complementary 100 -w transition with the same antenna height and programming content, which is counter to the proposition that as the U/D ratio increases the interference should increase.

Note 11 Four N/Y transitions among the Boombox and Clock radio data are confounded by five Y/Y conditions in the same group of data, suggesting poor and variable FPFM conditions. The Walkman was unable to receive the FPFM well in any of the tests at this location.

Note 12 These three transitions occurred among the Boombox, Clock and Walkman radios specifically in the 10 m, 100 w, unprocessed audio class. The 10 m, 0 w, processed audio class yielded FPFM reception faults with Y/Y events for these radios. The other classes tested revealed no Y values at all. This suggests FPFM reception was faltering during this portion of the test, and that the perception of LPFM interference may have been more of an FP FM reception artifact than an LPFM -induced problem. Further, the U/D ratio for the 100-watt, 10-meter LPFM was 12 dB, not a likely cause of third adjacent interference.

Note 13 This lone transition was with the Boombox, which also exhibited nine Y/Y eve nts, again suggesting the radio was not receiving the FPFM reliably.

Note 14 several of these transitions are intermingled with Y/Y events, particularly on the Boombox and Walkman (18 N/Y intermingled with 12 Y/Y events and one bogus O -Watt event). Note the 0-W LPFM interference in this and the previous site.

Note 15 This location had no FPFM trouble and no LPFM transitions, except for the Boombox, which had trouble getting a clean FPFM on ten of the twelve tests.

Note 16 FPFM reception was overall highly corrupted without LPFM turned on. The single transition event noted was on one of the auto radio samples, the remainder of which were all had corrupted FPFM signals to start with. Therefore, this transition is likely anomalous.

Note 17 This site had one N/Y transition in the LPFM 0W category. All transitions were for the Clock radio, as the Boombox and Walkman had corrupted FPFM signals throughout.

Note 18 No U/D ratio available, but probably close to Location 2 values. Similar to Location 2 , this location exhibited corrupted FPFM reception for the Boombox and Walkman, and the transitions were with the Clock radio.

Note 19 This location had no N/Y transitions with 3 radios, yet Boombox and Walkman remained unable to receive clean FPFM throughout. The clean reception occurred in spite of the 27 dB U/D for ten watts and an estimated 37 U/D for 100 watts. Location 5 results had the same characteristics as Location 4.

Note 20 This location has 48 FPFM corruptions on contrast with the one N/Y transition. This transition is a likely anomaly unrelated to LPFM action. All eight locations had substantial corruption of the FPFM without the LPFM activated, such that the limited number of N/Y transitions is not necessarily causally related to the LPFM activation.

Appendix B
Analysis of LPFM Stations Lost to Translator Applications

City	FCC 2000	REC 2003
New York, NY	0	0
Los Angeles, CA	0	0
Chicago, IL	0	0
Houston, TX	1	0
Philadelphia, PA	0	0
San Diego, CA	0	0
Phoenix, AZ	3	0
Dallas, TX	0	0
San Antonio, TX	13	0
Detroit, MI	0	0
San Jose, CA	2	0
Indianapolis, IN	8	0
San Francisco, CA	0	0
Baltimore, MD	4	0
Jacksonville, FL	8	0
Columbus, OH	13	0
Milwaukee, WI	6	0
Washington, DC	0	0
Boston, MA	2	0
Nashville, TN	7	0
Denver, CO	3	0
Cleveland, OH	2	0
Oklahoma City, OK	13	0
Charlotte, NC	0	0
Tucson, AZ	13	0
Albuquerque, NM	6	0
Atlanta, GA	6	0
Miami, FL	0	0
Las Vegas, NV	14	1
St. Louis, MO	13	0
Cincinnati, OH	9	0
Pittsburgh, PA	4	0
Minneapolis, MN	6	1
Omaha, NE	13	0
Wichita, KS	9	0
Louisville, KY	2	0
Raleigh, NC	1	1
Baton Rouge, LA	6	1
Mobile, AL	12	0
Richmond, VA	23	0
Montgomery, AL	12	0
Spokane, WA	3	0
Des Moines, IA	6	0
Grand Rapids, MI	3	0

Little Rock, AR	3	0
Salt Lake City, UT	0	0
Springfield, MA	6	0
Kansas City, KS	1	0
Peoria, IL	10	0
Manchester, NH	2	0
Santa Barbara, CA	11	0
Trenton, NJ	0	0
	279	4

Table drawn from original fcc notice of proposed rulemaking 99-25, 99-6 1999, appendix d Available spectrum analysis, p.59 and rec networks top 1000 low power radio communities, http://www.recnet.com/cgi-bin/lpfm/top1000.cgi?low=1