DOCKET FILE COPY ORIGINAL

ORIGINAL

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

AUG 2 1999

In the Matter of	)	
	)	
Creation of a Low Power Radio Service	)	MM Docket No. 99-25
	)	
	)	RM-9208
	)	RM-9242
	)	
	)	

Comments of the National Association of Broadcasters

VOLUME THREE OF THREE

Interference Maps

NATIONAL ASSOCIATION OF BROADCASTERS
1771 N Street, N.W.
Washington, D.C. 20036
(202) 429-5430

Henry L. Baumann
Jack N. Goodman
Lori J. Holy

Mark R. Fratrik, Ph. D.
NAB Research and Planning

Richard V. Ducey, Ph. D.
NAB Research and Information

Lynn D. Claudy
John Marino
David E. Wilson
NAB Science and Technology

Eric Whitmore
Jason Pratt
NAB Legal Interns

August 2, 1999

TABLE OF CONTENTS

Volume Three

Summary of Volume Three i

Interference from Low Power FM Stations to Existing Stations 1

APPENDIX A

LP1000 Interference Maps
LP100 Interference Maps

APPENDIX B

LP1000 Interference Maps
LP100 Interference Maps

SUMMARY OF VOLUME THREE

Volume Three of NAB's Comments in MM Docket 99-25 contain 240 maps that show the interference potential for the 60 markets that the Commission analyzed in its *Notice*. A detailed Interference Report describes the methodology for the development of the maps.

There are two sets of maps. The first set of maps, attached as Appendix A to the Report, provide one LP1000 map and one LP100 map for each of the sixty markets tested. The maps show the interference areas for the FCC protection ratios, and the protection ratios for the median values of the receivers examined in the categories of Home Stereo, Clock/Personal, and Portable. The second set of maps, attached as Appendix B to the Report, again provide one LP1000 map and one LP100 map for each of the sixty markets. The same interference areas are plotted on these maps as in Appendix A, but these maps also show the interference area for the "worst radio" tested by Carl T. Jones.

This graphic description of the possible interference areas for the 60 studied markets shows that substantial interference would result from establishment of an LPFM service. Thus, the Commission should not authorize LPFM service.

INTERFERENCE FROM

LOW POWER FM STATIONS

TO EXISTING STATIONS

Mark R. Fratrik
Vice President/Economist
NAB Research and Planning Department

David E. Wilson
Manager, Technical Regulatory Affairs
NAB Science and Technology Department

August 1999

National Association of
NAB
BROADCASTERS®

INTRODUCTION

On January 28, 1999, the Federal Communications Commission adopted a *Notice of Proposed Rule Making* proposing the creation of a low power radio service in the FM broadcast band.[1] In this *Notice* the Commission proposed to adopt rules that would permit low power FM broadcast stations with effective radiated powers ("ERPs") of 100 watts and 1,000 watts to be allocated throughout the United States. The purpose of this report is to provide graphical and tabular data that estimates the impact, in terms of new interference to existing FM broadcast signals, that the proposed new radio service could have.

To investigate the feasibility of its proposed low power radio service, the Commission conducted spectrum availability analyses for sixty communities throughout the United States.[2] Based on these analyses the Commission concluded that "relaxed interference standards for low power FM stations may be the only way to 'find' sufficient spectrum in medium and larger markets to create any new viable service of 100 watts or more."[3] It said that it believes "authorizing LPFM service without a 3rd-adjacent channel protection requirement would entail, at worst, little risk of interference to existing radio service."[4] It also said that "the inclusion or exclusion of 2nd-adjacent channel protection requirements for LPFM stations would greatly affect the extent to which LPFM service

---

1 *Notice of Proposed Rule Making*, MM Docket 99-25, 64 Fed. Reg. 7577 (1999) [hereinafter "*Notice*"].

2 *Notice* at Appendix D.

3 *Id.* at ¶ 44.

4 *Id.* at ¶ 43.

could be introduced and, therefore, to the extent possible, we would prefer not to adopt any such requirements for LPFM stations."[5]

To support its argument that second and third adjacent channel protection criteria can be relaxed for LPFM stations the Commission cited the claims made by two LPFM proponents in petitions for rule making filed with the Commission.[6] The first of these claims, made by J. Rodger Skinner, Jr., is that second and third adjacent channel protection criteria can be eliminated "due to vast improvements in receiver technology since these restrictions were created several decades ago."[7] The second, made by the Community Radio Coalition ("CRC"), is that second and third adjacent channel protection criteria can be eliminated because "the FCC has previously determined that second and third adjacent channel short spacing poses a 'small risk of interference' when permitted for grandfathered short-spaced FM stations."[8]

NAB researched the claims made by Skinner and CRC and could find no basis for either of them. Skinner provided no receiver test data in his petition to support his claim that FM receivers' ability to reject second and third adjacent channel interfering signals has vastly improved over the last few decades. CRC's claim is essentially based on an out-of-context statement from the Commission's *Report and Order* in MM Docket

---

5 *Notice* at ¶ 48.

6 *Id.* at footnote 57.

7 *Petition for Rule Making*, RM-9242, February 19, 1998, at 34.

8 CRC *Petition for Rule Making* filed as comments in the RM-9208 and RM-9242 proceeding, at paragraph 6. CRC cites the *Report and Order* in MM Docket 96-120, 12 FCC Rcd 11840 (1997) at paragraph 29 to support its claim that the Commission has previously concluded that second and third adjacent channel short spacings pose a "small risk of interference."

96-120. The Commission's conclusion about a "small risk of interference" in this *Order* was related only to the *additional* interference that would be caused if existing grandfathered short-spaced FM stations, *which are already causing interference to one another*, were allowed to relocate their facilities. The Commission highlighted the fact that grandfathered short-spaced stations are a special case when, in the same *Order*, it rejected a proposal to apply "contour overlap" criteria to grandfathered short-spaced stations. It said, "contour overlap is an effective method to demonstrate compliance with rules aimed at preventing interference, since lack of contour overlap is sufficient to demonstrate lack of interference. However, it is not effective in controlling interference when prohibited overlap already exists."[9]

In light of the fact that no sound technical basis could be found for the claims made by Skinner and CRC concerning second and third adjacent channel interference, NAB conducted an extensive research program to determine the impact that this interference has on modern FM broadcast receivers. This program had two basic steps: 1) comprehensive laboratory testing of a broad sample of modern FM radio receivers to determine the impact that second and third adjacent channel interference has on these receivers;[10] and 2) tabular and graphical analyses of the impact that the proposed LPFM service could have in the sixty markets studied by the Commission based on actual receiver performance data obtained in step 1. This report presents the results of step 2.

---

9 *Report and Order*, MM Docket 96-120, 12 FCC Rcd 11840 (1997), at ¶ 7.

10 The results of this testing are reported in Volume Two of NAB's comments in MM Docket 99-25.

PROCEDURE

To provide tabular and graphical data illustrating the impact, in terms of second and third adjacent channel interference, that the proposed LPFM service could have on existing FM broadcast signals, several steps are necessary. These are the steps that NAB followed:

1) Identify the geographic coordinates where the LPFM stations would be;

2) Identify how strong, in terms of received field strength, an LPFM signal would have to be in order to interfere with an existing station;

3) Plot the area on a map where each LPFM station's received field strength would exceed the level necessary to cause interference to an existing station's received signal; and

4) Quantify, in terms of both geographic area and population, the amount of interference illustrated in step 3.

RESULTS

Step 1

In its *Notice*, the Commission performed a spectrum availability analysis to investigate the feasibility of its proposed LPFM service.[11] In this analysis the Commission studied sixty cities, twenty with populations greater than 500,000 persons, twenty with populations between 200,000 and 500,000 persons, and twenty with populations between 50,000 and 200,000 persons. Using a computer program that it developed, the Commission identified specific LPFM transmitter locations for each of these sixty cities. This process was repeated nine times for each city to provide an estimate of the total number of LPFM stations that might be available using nine different

---

[11] *Notice* at Appendix D.

sets of assumptions about LPFM allocation criteria. These nine different sets of assumptions were:

1) 1,000 watt LPFM stations are allocated and provide full interference protection to all full service stations;

2) 1,000 watt LPFM stations are allocated and provide full interference protection to all full service stations except any station on a third adjacent channel;

3) 1,000 watt LPFM stations are allocated and provide full interference protection to all full service stations, except any station on a third adjacent channel and any station on a second adjacent channel;

4) 100 watt LPFM stations are allocated and provide full interference protection to all full service stations;

5) 100 watt LPFM stations are allocated and provide full interference protection to all full service stations except any station on a third adjacent channel;

6) 100 watt LPFM stations are allocated and provide full interference protection to all full service stations, except any station on a third adjacent channel and any station on a second adjacent channel;

7) 100 watt LPFM stations are allocated and provide full interference protection to all full service stations and all FM translator stations;

8) 100 watt LPFM stations are allocated and provide full interference protection to all full service stations and all FM translator stations, except any full service or translator station on a third adjacent channel;

9) 100 watt LPFM stations are allocated and provide full interference protection to all full service stations and all FM translator stations, except any full service or translator station on a third adjacent channel or second adjacent channel.

"Full interference protection" in the above context means interference protection to co-channel, first adjacent channel, second adjacent channel, third adjacent channel and intermediate frequency ("IF")-spaced channel stations in accordance with the minimum

distance separation tables for LP100 and LP1000 stations published by the Commission in Appendix B of its *Notice*.[12]

Because the Commission found the spectrum availability analysis in Appendix D of its *Notice* to be supportive of its proposal to eliminate second and third adjacent channel protection requirements with respect to LPFM stations, NAB concluded that it would be appropriate to use the same data from the Commission's analysis to estimate the amount of interference that could be caused to existing full service stations. NAB noted that, while the Commission's analysis appeared to do a reasonable job of *estimating* the number of LPFM stations that *might* be available in the sixty markets studied, it made no effort to estimate the impact, in terms of interference caused to existing radio listeners, that these LPFM stations would have.

At the beginning of its research program, NAB asked the Commission for the computer source code used to identify the potential LPFM transmitter locations used to develop the tables in Appendix D of the *Notice*. The Commission provided this code to NAB,[13] and NAB then contracted with Dataworld, a leading communications database and mapping service provider, to run this computer program and identify the specific geographic coordinates of the LPFM stations listed in the tables in Appendix D of the

---

12 *Notice* at Appendix B.

13 The results obtained by NAB when running this computer program differ somewhat from the results obtained by the Commission as reported in the *Notice*. These differences are caused by two primary factors. First, the Commission's analysis was based on its FM Engineering Database as it existed on December 9, 1998 (*Notice* at footnote 133), while the NAB analysis was based on a more recent version of the database. Second, Commission staff have reported to NAB that, after running its analysis as reported in the *Notice*, and prior to providing NAB with its source code, the Commission made some improvements to this software so it would more accurately predict the number of LPFM stations that might be allocated.

Notice. Because the purpose of this study is to determine the impact of removing certain interference protections, Dataworld identified the specific LP100 and LP1000 coordinates assuming that second and third adjacent channel restrictions were lifted and translators were not protected.

Step 2

NAB hired the engineering consulting firm Moffet, Larson & Johnson to identify the audio signal-to-noise ("S/N") ratio at which an FM receiver would be considered by a typical listener to be experiencing interference. NAB hired the engineering consulting firm Carl T. Jones Corporation to perform extensive tests on 28 FM broadcast receivers to determine the level of interfering signal necessary to cause the S/N ratio of the audio in a desired station to deteriorate to the level specified by Moffet, Larson & Johnson. The receivers tested by Carl T. Jones represented a broad cross-section of the types of receivers on the market in 1999. Table 1 indicates the categories of receivers tested, the number of receivers tested in each category, and the approximate market share, in terms of sales volume, for each category.

Table 1

Radio Type	Number Tested	Approximate Market Share[14]
Automobile	8	21 %
Clock	5	16 %
Component	5	14 %
Personal	5	22 %
Portable	5	27 %

The Carl T. Jones test results indicate that, in order for a second adjacent channel interfering station to cause interference to a desired station when the received signal level of the desired station is -45 dBm (approximately equivalent to the received signal level at the 70 dBu "city grade" contour assuming the FCC-standard receive antenna height of nine meters), the ratio of the desired station's signal strength to the undesired station's signal strength at the receiver must be at or below (*i.e.*, more negative) the values listed in Table 2.

[14] Consumer Electronics Manufacturers Association ("CEMA") market research, and CEMA "OEM Mobile Electronics Market Trends Guide" 1998.

Table 2

Second Adjacent Channel Interference

Radio Type	Desired-to-Undesired Signal Ratio (dB)
Automobile	-44.8
Clock	-15.8
Component	-21.8
Personal	-15.8
Portable	-10.0
Existing FCC Standards	-40 (commercial) –20 (non-commercial)

The Carl T. Jones test results also indicate that, in order for a third adjacent channel interfering station to cause interference to a desired station when the received signal level of the desired station is -45 dBm, the ratio of the desired station's signal strength to the undesired station's signal strength at the receiver must be at or below (*i.e.*, more negative) the values listed in Table 3.

Table 3

Third Adjacent Channel Interference

Radio Type	Desired-to-Undesired Signal Ratio (dB)
Automobile	-50.6
Clock	-27.2
Component	-22.2
Personal	-25.9
Portable	-17.2
Existing FCC Standard	-40.0

After obtaining the receiver test results from Carl T. Jones, NAB concluded that it would be appropriate to combine the protection ratios necessary for clock radios and personal radios for the purpose of predicting the geographic area and population that would receive interference as a result of LPFM operations. This seems appropriate because the second adjacent channel protection ratios for both of these receiver types are exactly the same, and the third adjacent channel protection ratios are only 1.3 dB apart.

It was also decided that, because the test results for automobile receivers showed them to perform somewhat better than the existing Commission protection ratios assume, and because this meant that any interference areas applicable to automobile receivers would be wholly contained within the interference areas predicted when using the existing Commission protection ratios, and because the objective of this study is to determine the impact that relaxing the existing Commission protection ratios would have, there would be no point in plotting the interference areas for automobile receivers.

Step 3

Once the coordinates where the LPFM stations in the Commission's spectrum availability analysis were known, and the signal strength necessary to cause interference in the various classes of receivers was also known, Dataworld was able to write a computer program to analyze each geographic location in each of the sixty markets studied by the Commission to determine the interference impact of the LPFM stations. To identify the interference caused by the LPFM stations in each market, Dataworld applied the appropriate co-, first, second, and third adjacent channel protection requirements for the class of receiver being studied, based on the Carl T. Jones data. It also identified interference areas based on the existing Commission protection ratios.

For each market, Dataworld produced four maps illustrating the areas of interference caused by the predicted LPFM stations. The first set of maps, attached as Appendix A to this Report, provide one LP1000 map and one LP100 map for each of the sixty markets tested. The maps show the interference areas for the FCC protection ratios, and the protection ratios for the median values of the receivers examined in the categories of Home Stereo, Clock/Personal, and Portable. The second set of maps, attached as Appendix B to this Report, again provide one LP1000 map and one LP100 map for each of the sixty markets. The same interference areas are plotted on these maps as in Appendix A, but these maps also show the interference area for the "worst radio" tested by Carl T. Jones.

The "worst radio" interference area is intended to show the worst second and third adjacent channel interference performance found in the Carl T. Jones tests. In these tests, the receiver that had the worst second adjacent channel performance was different from

the one with the worst third adjacent channel performance. Thus, the "worst radio" desired-to-undesired signal ratio is a compilation of these two worst-case situations. The worst case second adjacent channel ratio was +3.2 dB, and the worst case third adjacent channel ratio was -9.7 dB.[15] There may indeed be receivers, either new or old, that do not perform as well as our "worst radio" data. To the extent this is the case, there may be more people who would experience interference than our "worst radio" data predict.

Each of the maps produced by Dataworld has a rectangular box on it labeled "LPFM Allocation Area." This is the area that was studied by the Commission in its spectrum availability analysis (Appendix D of the *Notice*). The potential LPFM stations identified by the Commission's computer program all lie within this box. There are areas of interference located outside the box because it would be possible for an LPFM station inside the box to interfere with an existing station outside the box.

While the Dataworld maps should accurately predict the interference that would occur from LPFM stations located inside the rectangular study area to existing stations, they do not include *any* predicted interference from *any* LPFM stations that could be located outside of the rectangular study area. Thus, these maps are very conservative predictors of the amount of interference that would actually be caused by LPFM stations.

The legend on each map describes the type of receivers predicted to experience interference in each interference area. These areas are cumulative. That is, the area in which component (home stereo) receivers would experience interference includes the area marked "Home Stereo Radio" and the area marked "Existing FCC Ratios." As

---

15 Carl T. Jones Corporation, *FM Receiver Interference Test Results Report*, July 1999, at 23.

another example, portable radios (*e.g.* "boomboxes") would experience interference in the area marked "Portable Radio," in the area marked "Clock & Personal Radio," in the area marked "Home Stereo Radio," and in the area marked "Existing FCC Ratios."

Step 4

After plotting the interference areas for each of the markets included in the Commission's study, Dataworld then calculated the number of people who would be affected by this interference based on 1990 U.S. Census Data. Tables 4 through 9 summarize this data.

TABLE 4

INTERFERENCE ANALYIS OF LP1000 STATIONS[a]

In CITIES ABOVE 500,000

		Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios			
City	No. of LP1000s	FCC Ratios[b]	Clock/Personal[c]	Portable[d]	Home Stereo[e]
New York	0	0	0	0	0
Los Angeles	1	29,158	29,158	57,818	29,158
Chicago	0	0	0	0	0
Houston	5	98,810	161,808	227,721	136,151
Philadelphia	2	0	12,256	29,006	4,632
San Diego	2	8,481	108,997	173,074	69,329
Phoenix	11	685,333	689,093	710,986	686,140
Dallas	2	2	49,283	112,115	20,018
San Antonio	13	166,731	211,474	286,657	218,175
Detroit	0	0	0	0	0
San Jose	2	419,766	434,115	457,488	424,789
Indianapolis	6	13,317	191,201	378,827	100,857
San Francisco	0	0	0	0	0
Baltimore	0	0	0	0	0
Jacksonville	13	21,209	97,846	156,314	56,578
Columbus	9	96,786	341,485	503,021	239,187
Milwaukee	6	13,933	271,486	384,373	171,402
Washington	0	0	0	0	0
Boston	4	119,383	160,020	243,371	155,381
Nashville	10	16,189	54,932	111,938	30,868
Totals		**1,689,098**	**2,813,154**	**3,832,709**	**2,342,665**

[a] Number of LP1000s assumes no 2nd or 3rd Adjacent Channel Interference Protection, NPRM, p. 57.
[b] Corresponds to D/U ratios for 2nd Adjacent = -40.0 dB and 3rd Adjacent = -40.0 dB
[c] Corresponds to D/U ratios for 2nd Adjacent = -15.8 dB and 3rd Adjacent = -26.6 dB
[d] Corresponds to D/U ratios for 2nd Adjacent = -10.0 dB and 3rd Adjacent = -17.2 dB
[e] Corresponds to D/U ratios for 2nd Adjacent = -21.8 dB and 3rd Adjacent = -22.2 dB

TABLE 5

INTERFERENCE ANALYIS OF LP1000 STATIONS[1]

In CITIES Between 200,000 - 500,000

		Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios			
City	No. of LP1000s	FCC Ratios[b]	Clock/Personal[c]	Portable[d]	Home Stereo[e]
Denver	3	85,141	119,927	192,089	114,290
Cleveland	0	0	0	0	0
Oklahoma City	10	994	16,865	43,354	7,971
Charlotte	3	157	25,860	62,399	12,532
Tucson	14	460,077	462,228	466,546	461,528
Albuquerque	16	506,507	506,632	507,478	506,507
Atlanta	11	226,063	316,252	389,080	273,129
Miami	7	0	9,391	34,842	1,380
Las Vegas	19	669,388	670,679	673,105	669,407
St. Louis	12	40,761	99,264	189,569	66,482
Cincinnati	4	10,438	119,087	236,559	65,502
Pittsburgh	1	0	661	2,426	113
Minneapolis	3	0	5,244	12,142	2,600
Omaha	10	315,525	315,814	317,826	316,094
Wichita	14	4,365	47,525	108,272	25,844
Louisville	4	98,870	111,685	127,644	103,841
Raleigh	3	70	14,895	22,783	5,477
Baton Rouge	3	1,161	51,353	82,226	32,369
Mobile	10	4,232	49,979	98,032	26,371
Richmond	19	35,457	145,734	237,551	118,932
Totals		**2,459,206**	**3,089,075**	**3,803,923**	**2,810,369**

[a] Number of LP1000s assumes no 2nd or 3rd Adjacent Channel Interference Protection, NPRM, p. 57.
[b] Corresponds to D/U ratios for 2nd Adjacent = -40.0 dB and 3rd Adjacent = -40.0 dB
[c] Corresponds to D/U ratios for 2nd Adjacent = -15.8 dB and 3rd Adjacent = -26.6 dB
[d] Corresponds to D/U ratios for 2nd Adjacent = -10.0 dB and 3rd Adjacent = -17.2 dB
[e] Corresponds to D/U ratios for 2nd Adjacent = -21.8 dB and 3rd Adjacent = -22.2 dB

TABLE 6

INTERFERENCE ANALYIS OF LP1000 STATIONS[1]

In CITIES Less Than 200,000

		Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios			
City	No. of LP1000s	FCC Ratios[b]	Clock/Personal[c]	Portable[d]	Home Stereo[e]
Montgomery	9	55,175	90,813	119,362	69,630
Spokane	0	0	0	0	0
Des Moines	10	2,680	30,994	65,698	28,041
Grand Rapids	7	26,831	198,994	294,694	146,898
Orlando	5	12,543	74,830	126,890	40,037
Little Rock	6	100,314	109,527	127,563	108,500
Salt Lake City	10	922,971	922,971	922,971	922,971
Boise	12	128,304	134,992	137,788	133,326
Springfield	4	67,715	145,444	209,859	129,409
Kansas City	11	118	8,969	48,669	19,069
Peoria	5	19,416	27,831	54,034	28,960
Midland	16	12,236	21,152	39,702	25,001
Manchester, NH	1	0	91	7,596	1,499
Santa Barbara	18	192,219	193,292	204,498	194,855
Trenton	2	7,044	43,873	105,807	28,184
Harrisburg	4	47,894	96,276	156,670	109,513
Flagstaff	24	56,274	56,274	56,274	56,274
Manchester, CT	4	11,837	110,174	215,353	45,679
Greenville	6	13,292	27,861	42,176	24,821
La Crosse	5	58,716	63,516	66,897	59,358
Totals		**1,735,579**	**2,357,874**	**3,002,501**	**2,172,025**

[a] Number of LP1000s assumes no 2nd or 3rd Adjacent Channel Interference Protection, NPRM, p. 57.
[b] Corresponds to D/U ratios for 2nd Adjacent = -40.0 dB and 3rd Adjacent = -40.0 dB
[c] Corresponds to D/U ratios for 2nd Adjacent = -15.8 dB and 3rd Adjacent = -26.6 dB
[d] Corresponds to D/U ratios for 2nd Adjacent = -10.0 dB and 3rd Adjacent = -17.2 dB
[e] Corresponds to D/U ratios for 2nd Adjacent = -21.8 dB and 3rd Adjacent = -22.2 dB

TABLE 7

INTERFERENCE ANALYIS OF LP100 STATIONS[1]

In CITIES ABOVE 500,000

		Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios			
City	No. of LP100s	FCC Ratios[b]	Clock/Personal[c]	Portable[d]	Home Stereo[e]
New York	0	0	0	0	0
Los Angeles	4	39,032	50,415	89,931	44,024
Chicago	2	732	9,678	19,582	4,114
Houston	17	4,984	9,974	12,815	5,589
Philadelphia	8	277,060	393,186	534,539	346,507
San Diego	6	3,536	92,849	154,839	46,462
Phoenix	47	542,903	574,169	614,155	556,150
Dallas	9	5,201	30,467	51,846	11,491
San Antonio	42	153,040	166,122	186,502	161,253
Detroit	4	4,989	33,921	103,813	49,707
San Jose	4	764,228	764,228	764,228	764,228
Indianapolis	22	5,785	69,113	132,298	48,019
San Francisco	2	916	4,532	15,838	1,981
Baltimore	9	15,652	35,777	69,113	27,036
Jacksonville	38	3,441	18,672	42,706	13,274
Columbus	37	11,438	113,347	217,324	58,582
Milwaukee	18	2,147	66,446	141,565	29,980
Washington	4	850	26,549	33,938	16,988
Boston	4	8,216	60,978	113,966	60,328
Nashville	39	46,242	59,895	76,247	53,599
Totals		**1,890,392**	**2,580,318**	**3,375,245**	**2,299,312**

[a] Number of LP100s assumes no 2nd or 3rd Adjacent Channel Interference Protection, and Translators are not protected, NPRM, p. 58.
[b] Corresponds to D/U ratios for 2nd Adjacent = -40.0 dB and 3rd Adjacent = -40.0 dB
[c] Corresponds to D/U ratios for 2nd Adjacent = -15.8 dB and 3rd Adjacent = -26.6 dB
[d] Corresponds to D/U ratios for 2nd Adjacent = -10.0 dB and 3rd Adjacent = -17.2 dB
[e] Corresponds to D/U ratios for 2nd Adjacent = -21.8 dB and 3rd Adjacent = -22.2 dB

TABLE 8

INTERFERENCE ANALYIS OF LP100 STATIONS[1]

In CITIES Between 200,000 - 500,000

		Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios			
City	No. of LP100s	FCC Ratios[b]	Clock/Personal[c]	Portable[d]	Home Stereo[e]
Denver	9	57,410	91,705	118,644	80,226
Cleveland	25	20,478	175,013	307,843	132,197
Oklahoma City	36	82,064	97,349	107,161	93,179
Charlotte	13	4,467	9,413	16,296	6,936
Tucson	52	54,924	72,415	109,192	59,533
Albuquerque	67	518,884	519,248	521,770	518,933
Atlanta	37	103,152	146,545	193,227	124,274
Miami	30	2,643	14,468	43,510	10,497
Las Vegas	84	703,075	703,264	703,646	703,195
St. Louis	44	28,132	70,622	102,208	52,292
Cincinnati	18	155,566	184,925	216,780	176,675
Pittsburgh	8	56,026	59,842	62,699	57,865
Minneapolis	16	324,275	344,863	375,063	338,982
Omaha	35	154,583	155,219	157,050	155,009
Wichita	54	3,484	13,378	26,944	8,131
Louisville	13	81,700	93,143	113,980	85,018
Raleigh	9	0	3,571	7,594	1,904
Baton Rouge	14	1,161	14,588	24,334	5,464
Mobile	34	1,838	35,457	65,172	23,585
Richmond	62	10,898	46,689	105,947	40,279
Totals		**2,364,760**	**2,851,717**	**3,379,060**	**2,674,174**

[a] Number of LP100s assumes no 2nd or 3rd Adjacent Channel Interference Protection, and Translators are not protected, NPRM, p. 58.
[b] Corresponds to D/U ratios for 2nd Adjacent = -40.0 dB and 3rd Adjacent = -40.0 dB
[c] Corresponds to D/U ratios for 2nd Adjacent = -15.8 dB and 3rd Adjacent = -26.6 dB
[d] Corresponds to D/U ratios for 2nd Adjacent = -10.0 dB and 3rd Adjacent = -17.2 dB
[e] Corresponds to D/U ratios for 2nd Adjacent = -21.8 dB and 3rd Adjacent = -22.2 dB

TABLE 9

INTERFERENCE ANALYIS OF LP100 STATIONS[1]

In CITIES Less than 200,000

		Population Experiencing Interference with Different 2nd/3rd Adjacent Channel Protection Ratios			
City	No. of LP100s	FCC Ratios[b]	Clock/Personal[c]	Portable[d]	Home Stereo[e]
Montgomery	24	65,006	82,349	89,132	73,559
Spokane	14	880	5,390	27,372	11,587
Des Moines	18	125,057	134,137	136,813	126,554
Grand Rapids	10	2,551	76,647	116,694	42,708
Orlando	8	0	12,075	21,322	5,761
Little Rock	24	83,146	87,488	98,560	85,851
Salt Lake City	15	828,533	828,533	828,533	828,533
Boise	29	128,537	129,093	131,992	131,024
Springfield	14	53,939	104,336	168,274	118,381
Kansas City	18	22	4,953	9,684	3,546
Peoria	17	17,146	22,000	34,322	21,681
Midland	34	14,270	30,089	55,298	29,529
Manchester, NH	7	12,454	29,010	41,821	22,051
Santa Barbara	35	187,732	192,592	204,354	192,186
Trenton	4	231,859	281,257	299,582	263,165
Harrisburg	6	8,866	33,468	57,205	38,999
Flagstaff	74	55,990	55,990	55,990	55,990
Manchester, CT	18	14,750	66,031	98,208	60,653
Greenville	12	11,164	12,375	24,469	16,571
La Crosse	13	73,808	73,942	73,948	73,811
Totals		**1,915,710**	**2,261,755**	**2,573,573**	**2,202,140**

[a] Number of LP100s assumes no 2nd or 3rd Adjacent Channel Interference Protection, and Translators are not protected, NPRM, p. 58.
[b] Corresponds to D/U ratios for 2nd Adjacent = -40.0 dB and 3rd Adjacent = -40.0 dB
[c] Corresponds to D/U ratios for 2nd Adjacent = -15.8 dB and 3rd Adjacent = -26.6 dB
[d] Corresponds to D/U ratios for 2nd Adjacent = -10.0 dB and 3rd Adjacent = -17.2 dB
[e] Corresponds to D/U ratios for 2nd Adjacent = -21.8 dB and 3rd Adjacent = -22.2 dB

Totaling across all sixty markets studied by the Commission provides a conservative estimate of the potential population that will experience interference due to the introduction of the proposed LPFM service *in these markets*. The *total* population that would experience interference would clearly be much greater because LPFM stations would not be limited to only these sixty markets.

Total Interfered Population with Different D/U Ratios				
Type of Service	FCC Ratios	Clock/Personal	Portable	Home Stereo
LP1000s	5,883,883	8,260,103	10,639,133	7,325,059
LP100s	6,170,862	7,693,790	9,327,878	7,175,626

Moreover, using the median value for the different categories of receivers, as we did, may actually understate the population affected by interference. Using information from the worst receivers tested, the population affected increases dramatically. For example, instead of 35,457 people in the Richmond market facing interference with the introduction of an LP1000 service under the existing FCC protection ratios, there would be 528,961 people facing interference using the worst receiver information. It should be noted again that there may very well be receivers, either new or old, that do not perform as well as our "worst receiver" data, and thus more people, i.e. persons who own those radios, would experience interference.

CONCLUSION

This NAB research project demonstrates that the Commission's existing protection criteria for second and third adjacent channel interference do not reflect current receiver performance. More significantly, it shows that, if the Commission were to allocate LPFM stations without regard for second or third adjacent channel interference protection, as it has proposed, millions of Americans would suffer new interference to their existing radio service. Thus, the Commission's assumption that it can introduce LPFM service without harming existing radio service is unjustified.