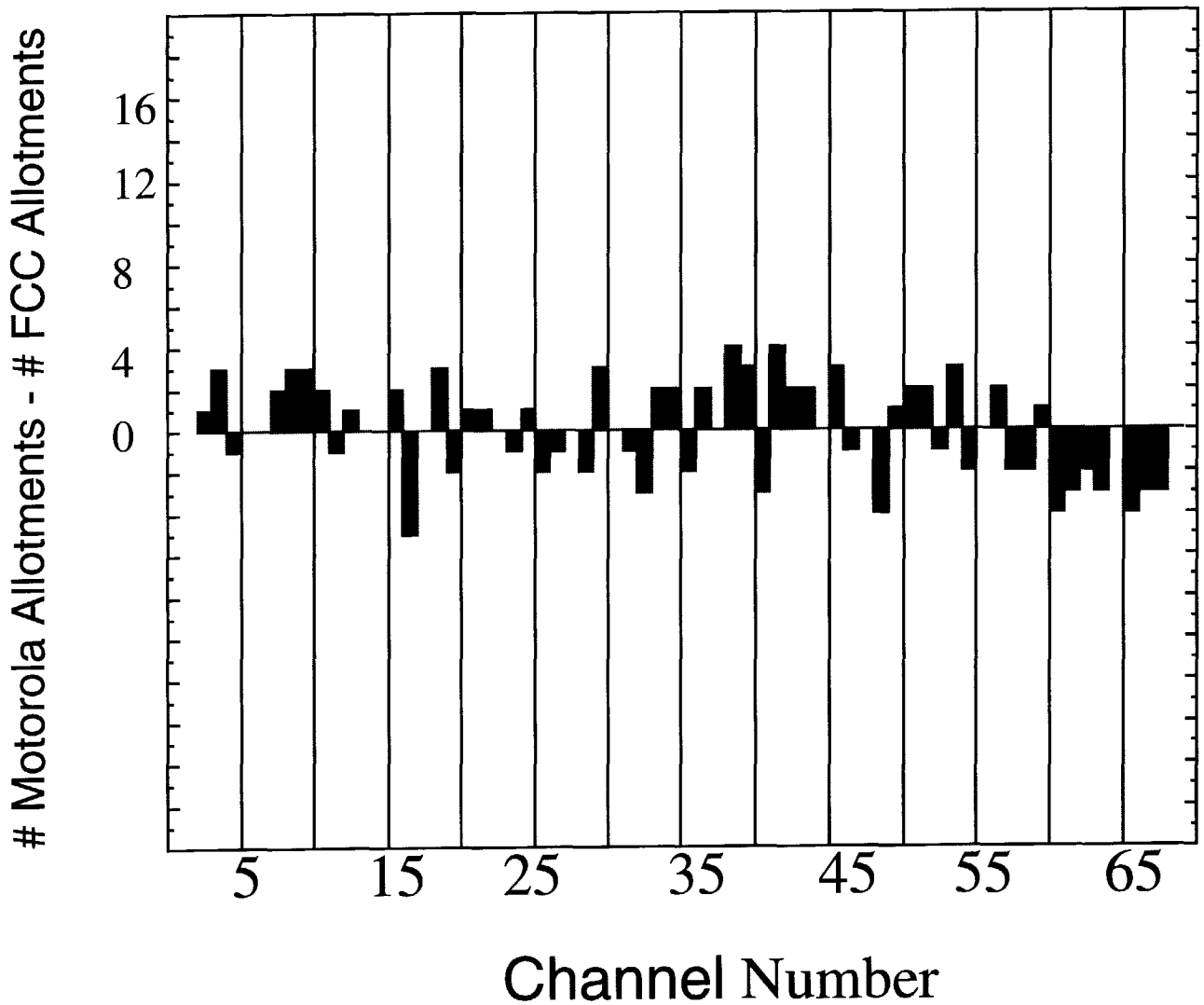
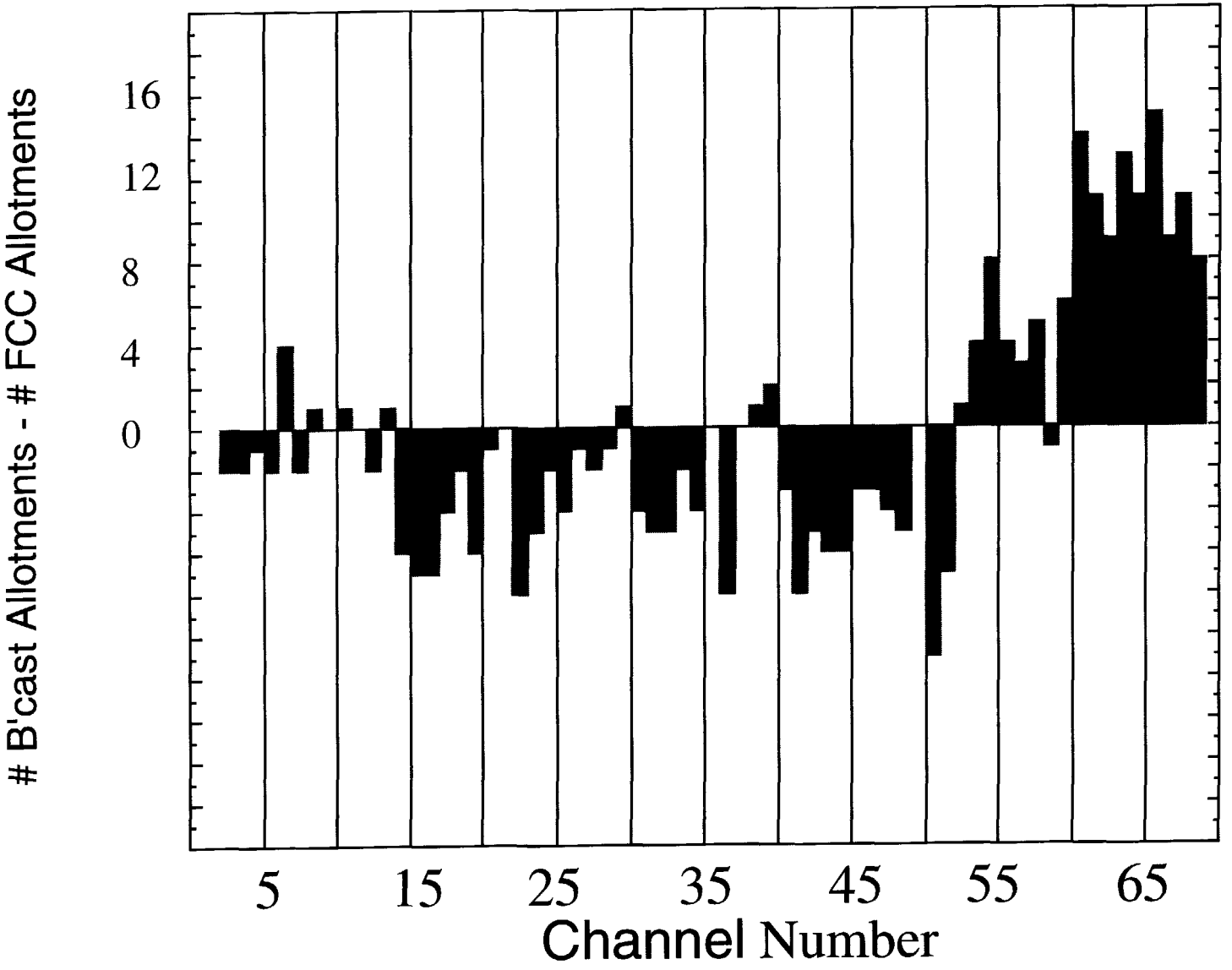
Comparison of Motorola's and FCC's DTV Allotment Tables



Comparison of Broadcast Coalition's and FCC's DTV Allotment Tables



APPENDIX

Appendix
DTV Allotments - Motorola Results
MM Docket No. 87-268

INTRODUCTION

Since receiving the Comments pertaining to the FCC's *Sixth Further Notice*, Motorola has continued to work to further improve the method used to allocate DTV channels and to refine the resulting allotment table. Among other tasks, we have implemented the terrain based Longely-Rice routines which enable us to evaluate area and population coverages for a particular solution. In this appendix, we will discuss the latest work and the results that have been obtained.

SERVICE AREA AND POPULATION

Our position is largely unchanged after seeing the other comments to the FCC's proposal. As mentioned in Motorola's comments, there is no drawback in terms of penalty function as calculated by the annealing program when comparing our suggested solution to the FCC's published solution. We have now performed a full interference calculation using the terrain dependent Longley-Rice calculations provided to us by the FCC to compare coverages. In the FCC's published solution, the average reduction in the service area of an NTSC station was 4.6% due to interference from other NTSC stations, and 1.6% from the proposed DTV stations. The reductions in covered population were 4.9% from other NTSC stations, and 1.3% from the proposed DTV stations. This is summarized in the following table:

FCC Proposed Solution	
Loss in served area due to NTSC interference	4.6%
Loss in served area due to DTV interference	1.6%
Loss in served population due to NTSC interference	4.9%
Loss in served population due to DTV interference	1.3%

The Motorola solution has the following result:

Motorola Proposed Solution	
Loss in served area due to NTSC interference	4.6%
Loss in served area due to DTV interference	1.8%
Loss in served population due to NTSC interference	4.9%
Loss in served population due to DTV interference	1.4%

This increase in average interference is minimal. The benefits (as discussed in our Comments and including five channels free of DTV allotments) far outweigh this small increase in interference.

In the FCC's *Sixth Further Notice,* the allotment table has two columns which show the interference effect on the area and population inside the noise limited contour. This is the so-called Grade B contour. However, there are regions inside this contour which are shadowed and, so, are not served by the station. The detailed Longley-Rice calculation can take these regions into account, and it is the region which is not shadowed which has been used in the above tables (referred to as the "served area" or "served

population".) If the noise limited, or Grade B, contours had been used instead, the tables would have looked like the following:

FCC Proposed Solution	
Loss in noise limited area due to NTSC interference	4.3%
Loss in noise limited area due to DTV interference	1.4%
Loss in noise limited population due to NTSC interference	4.5%
Loss in noise limited population due to DTV interference	1.2%

Motorola Proposed Solution	
Loss in noise limited area due to NTSC interference	4.3%
Loss in noise limited area due to DTV interference	1.6%
Loss in noise limited population due to NTSC interference	4.5%
Loss in noise limited population due to DTV interference	1.3%

The differences are minimal and do not change our conclusions. However, we consider the "served area" a more appropriate measure, and will continue to use it for the remainder of this appendix.

As for the solution proposed by the Broadcast Coalition[1], the results are:

Broadcast Coalition Solution	
Loss in served area due to NTSC interference	4.6%
Loss in served area due to DTV interference	1.5%
Loss in served population due to NTSC interference	4.9%
Loss in served population due to DTV interference	1.2%

These results are only a slight improvement over the FCC's solution, obtained at a cost of 300 stations allocated into channels 52-69, compared to the FCC's 161 and Motorola's 135. When looking at only channels 60-69, the comparative numbers are, again, 139 for the Broadcast Coalition solution, 30 for the FCC solution, and 5 for Motorola's solution. We do not consider the Coalition's solution to be a worthwhile tradeoff.

EXISTING SHARING

As discussed in our earlier Comments, there are 13 allotments in Motorola's proposed plan which present some possible problems[2] to existing land mobile sharing stations in channels 14-20. The table listing the problems is reproduced here.

LOCATION	NTSC Channel	DTV Allotment	Interfered LM	Separation (km)

[1] See Appendix E2 of the Comments of the Broadcast Coalition.

[2] A 'problem' is defined, at this time, to be a DTV-to-land mobile adjacent channel spacing distance of less than 110 miles (175 km).

LOCATION	NTSC Channel	DTV Allotment	Interfered LM	Separation (km)
CA Los Angeles	13	15	LA (14&16)	25 km
CA San Mateo	60	15	SF (16)	10 km
MA Marlborough	66	15	BOS (14&16)	36 km
OH Youngstown	27	15	PITT (14)	88 km
MD Frederick	62	16	DC (17)	52 km
WI Kenosha	55	16	CHI (15)	76 km
CT New Haven	8	16	NY (15)	111 km
NH Manchester	9	17	BOS (16)	82 km
NJ Secaucus	9	18	PHI (19)	129 km
CA San Francisco	9	18	SF (17)	4 km
CA San Bernardino	18	19	LA (20)	52 km
NJ Vineland	65	21	PHI (20)	37 km
CA Los Angeles	22	21	LA (20)	25 km

As we have mentioned before, this list is virtually identical to the FCC's list, with the exception of the addition of Youngstown, OH with a separation to Pittsburgh city center of 88 km.

The question has been raised as to what is the impact of reducing the 60-69 channel allotments to the channel 14-20 land mobile sharing channels. The concern is that, by attempting to keep DTV allotments out of the 60-69 band, more allotments will go into the 14-20 band and these allotments will cause problems in the regions where land mobile sharing occurs.

On its face, this argument seems plausible. If allotments are preferentially not made in the 60-69 band, the allotments must go somewhere. (The total number of allotments is constant.) Therefore, it is reasonable to question where the allotments will go.

The functional relationship that exists between the 60-69 allotments and the 14-20 allotments given the complex nature of this assignment problem is extremely difficult to determine. However, by the simple method of observing some specific cases, we can get a feeling for the coupling between the assignments in these two ranges.

We use as our baseline for comparison the FCC's proposed allotment table. This solution had 30 DTV allotments in the 60-69 range, and 12 allotments in the 14-20 range which were classified as problems for land mobile. (The adjacent channel spacing was less than 110 miles.) Now we look at Motorola's proposed solution. This solution was generated solely by trying to clear out the 60-69 assignments. No special attention, above that used by the FCC, was paid to the 14-20 band whatsoever. In this solution, there are only five allotments in the 60-69 band (a decrease of 83%), and there are 13 allotments which are land mobile problems (an increase of 8.3%.) The changes appear to make sense (a decrease in the 60-69 allotments leads to an increase in the 14-20 allotments), but the coupling factor appears to be very small. We have another data point which we can examine. The Broadcast Coalition solution contains 139 allotments in the 60-69 band (a 363% increase over the FCC's solution.) In the 14-20 band, there are 14 allotments which would be labeled as land mobile problems (a 16.7% increase over the FCC's solution.) This time, the directions of the changes do not conform to our original expectation. That is, an extremely large increase in the number of 60-69 allotments has not led to a decrease in the number of 14-20 problems, but, rather, a small increase again.

Therefore, it seems most reasonable to conclude that the change in the number of 60-69 allotments is extremely weakly coupled to the number of problem allotments which will occur in the channel 14-20 band.

IMMEDIATE USE OF CHANNELS 60-69 POSSIBLE

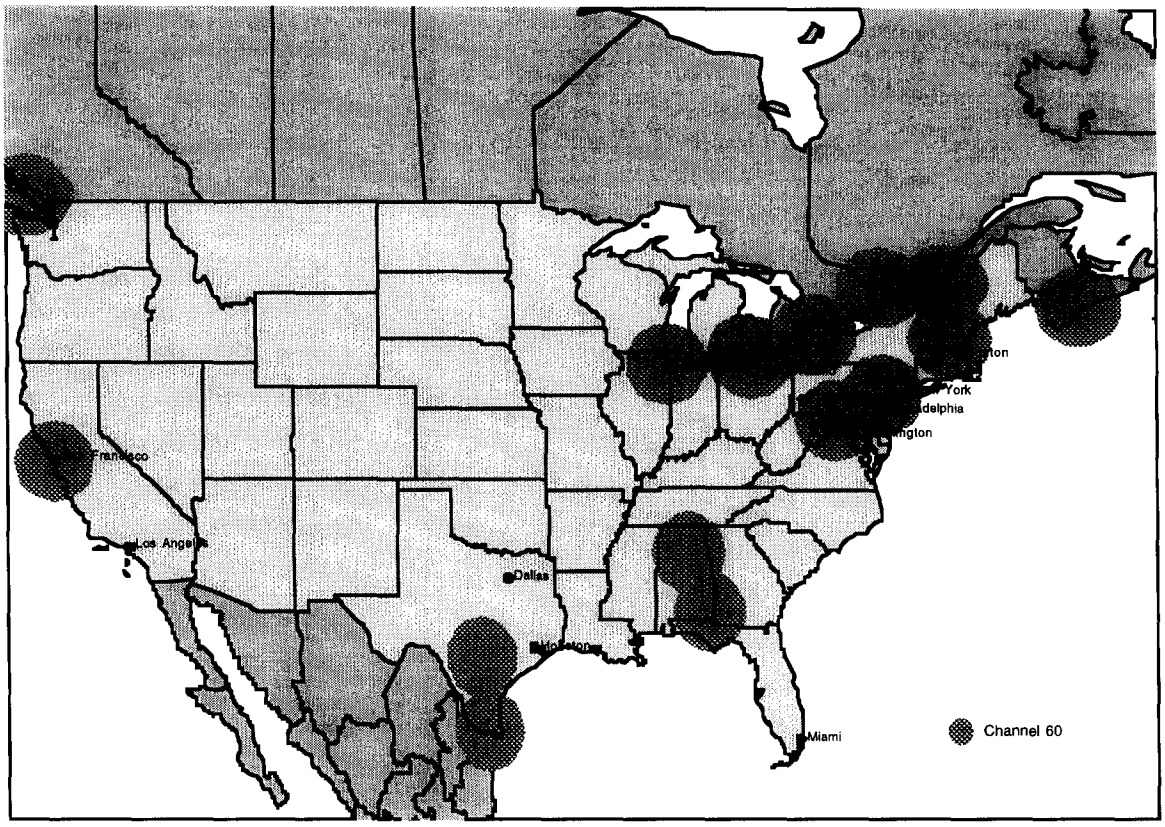
The argument has also been made that, even if there are few DTV channel allotments in the 60-69 band, the existing NTSC occupancy will make it difficult, if not impossible, to use that spectrum for some other purpose. We can show, however, that if spectrum in the 60-69 range is freed of DTV allotments, it can be immediately useful for other purposes (for example, land mobile), even with the NTSC incumbents.

For example, channels 60 and 65 in our plan, have no DTV allotments in the continental U.S. In the Code of Federal Regulations, Part 47 (Telecommunication), section 90.309 of subpart L (Authorization in the Band 470-512 MHz), Table A gives the base station - co-channel frequency separations needed to maintain 50 dB protection to the grade B contour. The largest possible distance, used for tall antennas of maximum radiated power, is 162 miles. However, evolutionary improvements in interference rejection performance of television receivers should allow use of the Table B 40 dB protection levels instead[3]. With 40 dB of protection the maximum distance is reduced to 130 miles. Furthermore, this 130 mile distance represents an exclusion zone for the 470-512 MHz band. Due to propagation differences in the 746-806 band, we estimate that exclusion zones which are 10 miles less, that is 120 miles, are appropriate in the 746-806 MHz band. The following figure shows the incumbent NTSC channel 60 stations at their location in the United States with a circle of radius 120 miles drawn around each one. Any city which falls outside of the exclusion zones is immediately available for use by services other than broadcast television in the frequency range encompassed by channel 60[4].

---

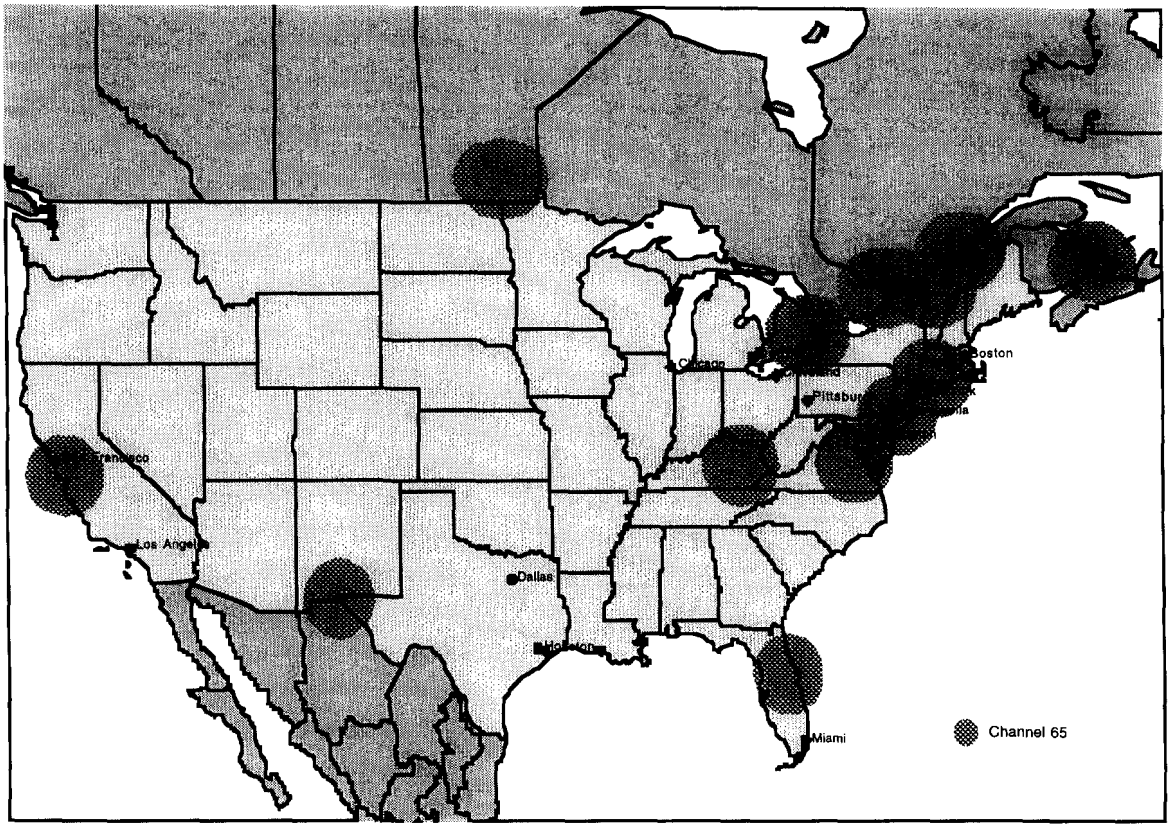
[3] Indeed, they are already in use today.

[4] In fact, the exclusion circles may be even smaller for services of lower power than that used to establish the 470-512 MHz reference distances.



Under these conditions, within the main markets, Los Angeles, Dallas, Miami, Houston, Pittsburgh, and the entire central area of the country are available at this frequency.

Similarly, results for channel 65, another channel for which we have no DTV allocations are shown below.



In this case Chicago, Los Angeles, Boston (119.6 miles), Dallas, Houston, Miami, Pittsburgh, Atlanta, Seattle, and again the central U.S. all lie outside the maximum protection region for cochannel NTSC stations.

These maps show that, with no up front work to clear the spectrum required, major U.S. cities would have channel 60/65 spectrum available for use, providing that no DTV allocations are made to those channels, as accomplished by the Motorola solution[5].

CONCLUSION

Further analysis of the problems and opportunities of DTV allocations has been performed, and our conclusion remains the same. With minimal impact on television usage, fewer DTV assignments can be made into channels 60-69 than were proposed by the Commission. It has also been shown that it is possible for immediate usage of channels 60-69 spectrum, for instance by public safety, contrary to what has been stated in the Comments filed in this proceeding.

[5] Additional adjacent channel interference restrictions are deemed to be minimal due to the ability of any new services to exercise flexibility in avoiding very close-spaced adjacencies, where necessary, during the transition period.

CERTIFICATE OF SERVICE

I, Tanya R. Mason, of Motorola Inc. do hereby certify that on this 24th day of January, 1997 a copy of the foregoing "Comments" was sent to each of the following by hand:

Tanya R. Mason

William F. Caton, Acting Secretary
Office of Managing Director
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, DC 20554

Rudy Baca
Office of Commissioner Quello
Federal Communications Commission
1919 M Street, N.W. Room 802
Washington, DC 20554

James Coltharp
Office of Commissioner Quello
Federal Communications Commission
1919 M Street, N.W., Room 8802
Washington, D.C. 20554

Julius Genachowski
Office of Commissioner Chong
Federal Communications Commission
1919 M Street, N.W. Room 844
Washington, DC 20554

Jane Mago
Office of Commissioner Chong
Federal Communications Bureau
1919 M Street, N.W., Room 844
Washington, D.C. 20554

David Siddall
Office of Commissioner Ness
Federal Communications Commission
1919 M Street, N.W., Room 832
Washington, D.C. 20554

Jackie Chorney
Chairman's Office
Federal Communications Commission
1919 M Street, N.W., Room 814
Washington, D.C. 20554

Richard M. Smith, Chief
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, N.W., Room 480
Washington, D.C. 20554

Bruce Franca, Deputy Chief
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, N.W., Room 480
Washington, D.C. 20554

Robert Eckert
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, N.W., Room 230
Washington, D.C. 20554

Gordon Godfrey
Mass Media Bureau
Federal Communications Commission
2000 M Street, N.W., Room 566
Washington, D.C. 20554

Saul Shapiro
Mass Media Bureau
Federal Communications Commission
1919 M Street, N.W. Room 310
Washington, D.C. 20554

David Wye
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W., Room 5002
Washington, D.C. 20554

Richard Parlow
NTIA
Main Commerce Building
1401 Constitution Avenue, N.W.
Room 4099
Washington, D.C. 20230