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

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In the Matter of	)	
	)	
Advanced Television Systems	)	
and Their Impact Upon the	)	MM Docket No. 87-268
Existing Television Broadcast	)	
Service	)	

To: The Commission

PETITION FOR RECONSIDERATION
OF HAMMETT & EDISON, INC.

Date: June 13, 1997

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In the Matter of	)	
	)	
Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service	)	MM Docket No. 87-268
	)	
	)	Petition for Reconsideration of Hammett & Edison, Inc.
	)	

To: The Commission

Summary

The firm of Hammett & Edison, Inc., repectfully submits this Petition for Reconsideration regarding issues in the Fifth and Sixth Reports and Orders to MM Docket 87-268, concerning the new advanced digital television ("DTV") service.

Hammett & Edison has studied the Fifth and Sixth Reports, and has obtained a copy of the computer software used by the FCC to allot new DTV channels to existing analog NTSC broadcast facilities. Further, Hammett & Edison has prepared a modified, "forward looking" DTV analysis program, to study potential interference that could be received by existing NTSC facilities and allotted DTV facilities, as a result of the decisions made within the Fifth and Sixth Reports. Potential deficiencies in technical areas are identified in this Petition, as they affect the ability of a DTV station to replicate its NTSC coverage. Technical issues requiring clarification by the Commission have been identified, and suggested revisions related to technical areas in the new FCC Rules related to the DTV service are requested.

Elements related to a DTV station's ability to replicate its NTSC coverage include the issues of errors in the terrain-sensitive calculation methods utilized within the FCC's allotment program, inappropriate modeling of receiving antennas, and improper projection of an NTSC station's Grade B contour. Issues requiring Commission clarification include protection of fully-spaced facilities, protection of area, population, or both factors, distance limits applied by the FCC, trade-off of interference areas, and antenna directionality limits. Finally, issues recommended for revision include application of consistent dipole factors, proper reporting of significant figures, documentation related to coverage of city of license, and the removal of unnecessary limitations placed on DTV facilities as a result of the Commission's antenna pattern replication procedures.

Comments of Hammett & Edison, Inc.

1. The firm of Hammett & Edison, Inc., Consulting Engineers, respectfully submits this Reconsideration Petition regarding several issues in the Fifth Report and Order ("5RO") and the Sixth Report and Order ("6RO") to MM Docket 87-268 concerning new, advanced television service ("Digital Television" or "DTV"). Hammett & Edison, Inc. is a professional service organization providing consultation to commercial and governmental clients on communications, radio, television, and related engineering matters.

I. Qualifications of Hammett & Edison, Inc.

2. Hammett & Edison, Inc. ("H&E") is well qualified to make comments on this matter, its professional staff having been involved for over 45 years with the design of individual TV broadcast stations, their applications for FCC authorization, and various assessments of station performance. H&E has participated over the years in many rulemakings involving the television broadcast service. Finally, H&E has within the last 30 days completely analyzed the software relied upon by the FCC for the development of its DTV allotment table; H&E has implemented that software on its own computer system and written new, proprietary software that applies the FCC's new DTV rules to modified and/or new NTSC and DTV transmitting facilities.

3. H&E commends the Commission's pro-active efforts to establish a new service for advanced television broadcasting. H&E seeks with this Petition to assist the Commission in that effort by a) identifying in the Commission's recent actions in the Docket 87-268 proceedings certain elements that serve to overstate the ability of FCC television broadcast licensees to achieve DTV coverage that "replicates" their present, NTSC coverage, b) raising for Commission clarification certain issues that are not adequately defined in the 5RO or the 6RO, or the Commission's software, and c) providing specific proposals for the Commission's reconsideration.

II. Analysis by Computer of DTV Coverage, Interference, and Allotment

4. New §73.623(c)(2) of the FCC Rules references Appendix B as providing the procedure used to evaluate proposed modifications to allotted DTV facilities, along with Office of Engineering and Technology (OET) Bulletin No. 69, which, as of this date, has not been released by the FCC. Appendix B provides a five-page summary of the procedures used to develop the allotment table. Neither source provides adequately thorough guidance for conducting interference evaluations involving the newly-allotted DTV channels, with regard

to potential interference to/from existing authorized NTSC facilities, or to/from other allotted DTV facilities. In fact, many details are contained only in the actual computer code and input files used by the FCC and so could be subject to substantial change with just a few keystrokes.

5. The 6RO encourages DTV stations to "maximize" their facilities,[1] with coverage up to that of the largest station within each market, such that no new interference is caused to other stations. In order to provide guidance to our many television clients, we obtained, directly from the FCC's Office of Engineering Technology, a copy of the computer software program used to generate the DTV allotment table. Once that software was running properly and generating data consistent with that found in Appendix B, Table 1, presenting DTV allotment pairings with analog NTSC stations, the program was modified to serve as an analysis tool to study potential DTV facility changes. This "forward looking" analysis program, as we have dubbed it, is described more fully in Figure 1 attached.

III. Elements in 5RO and 6RO Serve to Overstate Stations' Ability to Achieve Replication

6. Experience gained by using the program has led to the identification of several factors that are, at least, unusual, and do raise significant concerns about the validity of some of the assumptions made by the FCC allotment program. In its efforts to satisfy the goal of "replication," certain steps were taken in the development of the FCC's computer program, steps that, if they had been intentional, would have amounted to "cooking the books." In any case, full disclosure here of those elements and others will serve to alert FCC TV licensees that the reach of their new DTV facilities, even if individually maximized in accordance with the new Rules, may not approach the reach of their present NTSC facilities.

III.a. Suspect Service Areas Claimed "Interference-Free"

7. The interference analysis technique employed by the FCC and specified for study of proposed DTV facility changes employs terrain-sensitive calculation methods based on Version 1.2.2 of the ITS Irregular Terrain Model, also known as the Longley-Rice model. The model is used to analyze paths between the transmitter and assumed receiver locations that are contained within a grid of 2-kilometer-square cells that fill the entire protected service area. However, the Longley-Rice model is not always capable of determining, within certain

[1] 6RO, at ¶31.

confidence limits, whether a particular cell has service.[2] Specifically, in cases where the actual horizon from a given cell or transmitter location is less than 0.1 times or greater than 3 times the distance to the smooth earth horizon, the Longley-Rice algorithm will return an "Error Code 3" that, according to the program documentation, means internal program calculations show parameters out of range, and any reported results are dubious or unusable. Incredibly, the procedure used by the FCC when such a Longley-Rice error occurs, whether during determination of potential service or potential interference, is to mark that cell as enjoying "interference-free service."

8. While this assumption appears not to introduce significant overall errors in areas of relatively flat terrain, it has been found that the error code is returned much more often for studies involving mountainous or even hilly terrain. For example, the attached Figure 2 shows predicted interference to the coverage area of the DTV Channel 8 allocation assigned to Station KABC-TV, Los Angeles, from the existing NTSC transmitting facilities of Station KFMB-TV, Channel 8, San Diego, California. While the FCC DTV analysis returned a result of interference to nearly 294,000 persons, it simply ignored possible interference to over 1.1 million persons within the KABC-TV DTV coverage area, due to Longley-Rice errors, considering all of that area to be "interference-free."

9. This problem is not isolated to a few markets, although its obvious failure just in the Los Angeles market should have been enough to question its usefulness. The table below summarizes for a number of top markets the tremendous arbitrary designation of service occurring due to Longley-Rice errors:

Market		Example Station	Longley-Rice Errors (as % of Grade B)			
			Area, sq. km		Population (1990)	
#2	Los Angeles, CA	KABC(N07/D08)	9,845	*29.8%*	1,165,174	*8.1%*
#5	San Francisco, CA	KDTV(N14/D29)	6,134	*32.5%*	990,688	*15.8%*
#6	Boston, MA	WGBH(N02/D19)	6,697	*27.1%*	1,373,952	*19.7%*
#12	Seattle, WA	KTZZ(N22/D25)	7,360	*37.3%*	385,679	*13.0%*
#17	Phoenix, AZ	KPHO(N05/D17)	7,862	*16.5%*	40,830	*1.8%*
#18	Denver, CO	KCNC(N04/D35)	9,211	*22.0%*	204,553	*7.8%*
#19	Pittsburgh, PA	KDKA(N02/D25)	17,074	*50.5%*	2,041,954	*52.3%*
#24	Portland, OR	KOPB(N10/D27)	13,739	*35.8%*	121,680	*5.8%*
#29	Raleigh, NC	WLFL(N22/D57)	3,964	*12.6%*	239,358	*11.3%*

[2] This is one of the reasons that H&E uses TIREM (Terrain-Integrated Rough Earth Model), a more sophisticated propagation loss algorithm of which the Longley-Rice routine is only a part.

Thus, there are situations within the top 30 markets where Longley-Rice errors are the only justification for classifying over half of the area or over half of the population with "interference-free" service.

III.b. Receive Antennas Inappropriately Modeled

10. The DTV replication program assumed that the consumer antennas used for reception of the DTV signals would be better-performing than the ones used for reception of the NTSC signals, despite the fact that both operations are on the same general frequencies and that no one, in fact, had suggested that consumers would be at all inclined to replace their existing antennas or to install second, larger antennas just for DTV. Evidently, these alternate patterns, included as Figure 3, proved necessary in order to achieve the desired replication numbers. The off-axis rejections (front-to-back ratios)of the DTV antennas are higher, as follows:

	low-band VHF	high-band VHF	UHF (all)
rejection improvement	4 dB	6 dB	8 dB

However, such antennas would not necessarily be purchased and installed by consumers viewing the DTV stations off-air. In fact, a more reasonable assumption is that they will *not*. Therefore, DTV service will be more interference-limited than assumed and the replication of service will not, in practice, be achieved.

III.c. NTSC Grade B Not Properly Established

11. Elevation Plane Pattern. The method by which the FCC projected NTSC Grade B contours for the DTV allotment project does not comply with Rule §73.684, which defines prediction of coverage for NTSC facilities. First, the requirements of §73.684(c)(2) were not followed, such that full radiation is to be assumed whenever the radiation toward the radio horizon is at least 90% of the maximum. This would tend to understate the distance to the Grade B contour. Of course, without the actual elevation plane pattern employed by the station, the determination of radiation toward the radio horizon would be expected to be in error. Even though a standard elevation plan radiation pattern was used, it may not be appropriate for high-gain antennas, for which it would overstate the radiation, and certainly would not be appropriate when electrical beam tilt and/or mechanical tilt is employed, for which the error could be in either direction.

12. Azimuth Plane Pattern. Second, the horizontal plane azimuth pattern, as taken from the FCC database, was employed with an assumed standard elevation radiation pattern, to generate a protected NTSC Grade B contours for an associated DTV facility. However, the database contains only the projection of the actual azimuth pattern onto the horizontal plane and so may significantly understate the radiation in particular directions if mechanical tilt is employed.

13. HAAT. Third, the FCC program did not truncate, as required by §73.684(d), radials used to determine height above average terrain (HAAT) when they extended over large bodies of water or over foreign territory.

14. Example. Figure 4 attached shows the projection of the Grade B contour for TV Station KZKI, NTSC Channel 30, San Bernardino, California, in accordance with the FCC Rules (dashed line) and as determined by the FCC's DTV replication program (solid line). The obvious errors represent the cumulative effect of the three problems identified above and have a significant affect on the station's DTV replication power and pattern.

III.d. Scaling Down of Patterns Inadequately Protects Grade B

15. The FCC replication program used a procedure by which the associated Grade B contour for an existing NTSC station was derived, and then that contour was redefined as the limit of protected service for the DTV facility (27.8 dBu for Channels 2–6, 35.8 dBu for Channels 7–13, and 40.8 dBu, with a dipole factor applied, for UHF channels). Using the appropriate curves from Figures 9 and 10 of §73.699, the DTV power necessary to reach the NTSC Grade B contour location was determined radially. When the maximum calculated power was found to be above the maximum power allowed for a given channel, the pattern was scaled to that maximum. However, the scaling process will necessarily reduce the directional replication pattern to power levels below that maximum for all other azimuths, even though the replication power at those azimuths may not have exceeded the maximum power. Therefore, by scaling the pattern instead of truncating it at the maximum power level, the DTV station is further limited from replicating its Grade B coverage.

III.e. Some Protected Areas Not Studied

16. The FCC replication program studied for interference protection only those stations within certain distances, which are the specified "Maximum Analysis Distance" limits called for in the "read_input" subroutine of the program. The sample input file supplied to H&E contained distances that were often not sufficient to allow the entire Grade B area of a station

to be studied. This effect is illustrated on attached Figure 2, which shows the truncation in the northern area of the station's Grade B contour, and shows that there may be areas of further interference within the Grade B contour that have not even been checked, leading to further exaggeration of the degree of replication.

III.f. Suspect Signal Levels Used for Low-Band VHF

17. The FCC's DTV replication protocols have assumed that DTV service on the low-band VHF channels would be equivalent, out to a field strength of only 28.0 dBu, to DTV service at higher signal levels on other channels. Such an assumption may not be warranted for these channels, whose basic suitability is already questioned by the FCC[3] because of susceptibility to interference. This interference comes both from natural sources, *e.g.*, atmospheric noise, and from man-made sources, *e.g.*, ignition noise. Other phenomena, such as tropospheric ducting in coastal markets, can provide additional sources of interfering signals; this is especially true during the summer months. As a result, those FCC licensees receiving DTV assignments on Channels 2–6 may be subject to signal variations and losses that 1) cause their NTSC service not to be replicated and 2) do not apply as much to their competitors on higher channels.

IV. Elements Needing Specific Clarification for Use in Developing Improvements in Existing NTSC and New DTV Stations

18. It is important to note that H&E does <u>not</u> object to the foregoing items *per se*, even though they generally serve to overstate the degree to which the goal of "replication" has been met. H&E applauds the adoption of any <u>definitive</u> allocations scheme, so that all parties should derive the same answers and so that the constraints are well established under which we can conduct optimization studies for our clients. The next items discussed below require clarification from the FCC staff in order to have a truly definitive allocations scheme, so that potential improvements may be analyzed on their merits alone. Certain of these items may require changes in the language of the new FCC Rules or their supporting documentation, and those are summarized at the end of this Petition.

IV.a. What Is It That Needs to be Protected

19. The new §73.623(d) of the FCC Rules establishes minimum (and maximum) spacing requirements for DTV stations with each other and with NTSC stations. We presume that

[3] 6RO at ¶83.

stations meeting those spacings requirements need not be studied for interference protection, too, else why bother having spacing requirements, at all? Definitive statement of this interpretation, which has been confirmed with OET staff, would seem appropriate.

20. For short-spaced (and long-spaced) stations, interference studies do need to be performed, and the question arises as to what it is that requires protection: the area within the Grade B protected contour, the population, or both? Put another way, if a change is proposed to a DTV assignment that does not cause any increase in the population receiving interference but the interference area is increased, is that okay? What if the increased area is entirely over water?

21. In cases where the replication pattern did not reach the minimum DTV power for that channel assignment, with the pattern scaled up so that its maximum equals the minimum power, the replication contour will certainly extend beyond the Grade B. Is it, in such a case, only the Grade B or the replication contour that is protected?

22. When the DTV replication pattern is developed, Appendix B of the 6RO specifies that the HAAT used to establish Grade B contour is determined every five degrees (72 radials).[4] However, within its allotment computer program, the FCC utilized only eight radials, spaced every 45 degrees, and interpolated between them. Confirmation is requested that the actual FCC Rules take precedence so that, in this situation, one is to interpolate from all 72 radials.

23. The limitation on modifications of assignments is that "no increase in the amount of interference"[5] is allowed. Clarification is requested on whether the interference is fungible. That is, if a station with its replication pattern is short-spaced to two stations, causing interference to A but not to B, would a revised pattern be allowed (or other parameter) that removes all interference to A but causes interference to B (of lesser total amount, of course)?

IV.b. Treatment of Longley Rice Errors

24. We request confirmation that interference studies for possible facilities modifications should be performed with "interference" and "interference-free" retaining their definitions acquired during the replication and allotment process, that is, any study cell that returns a Longley-Rice error is 1) presumed to have service, 2) not studied for interference from other stations, and 3) presumed not to cause interference to other stations.

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4 6RO at Appendix B, Page B1, beginning of fourth paragraph.

5 §73.623(c)(2)

IV.c. Transmitting Antenna Directionality Limits

25. Do the maximum-to-minimum directional antenna limits specified in §73.685(e) of the existing Rules, and which has not been proposed to be changed by either the 5RO or the 6RO, apply to DTV antennas?

IV.d. Ramp

26. New §73.623(c)(2) of the new DTV Rules requires that, at the DTV threshold, the desired-to-undesired ("D/U") ratio must be +2 dB for DTV-into-NTSC and +15 dB for DTV-into-DTV. However, the Note following that section states that these co-channel D/U ratios are only valid where the signal-to-noise ("S/N") ratio is 28 dB or greater. At the edge of the noise-limited service area, defined as a S/N ratio of 16 dB, the required D/U ratios are instead 21 dB for DTV-into-NTSC and 23 dB for DTV-into-DTV. The question is whether, in the 16 dB to 28 dB S/N noise region, should the transition from 21 dB to 2 dB D/U for DTV-into-NTSC, and the transition from 15 dB to 28 dB D/U for DTV-into-DTV, be modeled using a step (and at which end), a ramp, or a curve function? We believe that a linear ramp transition may be the appropriate method and request clarification.

IV.e. Correct Projection of Grade B Contours

27. Is there any condition under which the Commission would accept, or prefer to receive, projection of Grade B contours in strict accordance with §73.684(c) for the purpose of DTV facility replication pattern determination and/or studies of interference to affected DTV and NTSC facilities? If so, must all studied NTSC and DTV facilities employ Grade B areas so projected?

V. Elements of New Rules Recommended for Revision

V.a. Typographical Errors

28. New §73.623(c)(2) specifies a threshold desired-to-undesired (D/U) ratio of -34 dB for DTV channels operating seven channels above an NTSC facility, while Appendix A of the 6RO specifies -43 dB for this taboo and the FCC DTV allotment computer program applied -43.22 dB. It appears that -43 dB D/U should have been applied in Rule §73.623(c)(2) and correction, or clarification, is requested.

V.b. Dipole Factor Consistency

29. There are several aspects of the dipole factor that should be reconsidered. First, Appendix B of the 6RO states that a dipole factor should be applied for UHF DTV stations, yet this is not reflected in the new §73.622(e) in Appendix E; if a dipole factor is to be applied, it should be properly reflected in the new Rules. Second, what frequencies should be used when calculating the dipole factor: 1.25 MHz above the lower channel edge for NTSC channels and mid-channel for DTV channels, mid-channel for both, or some other arrangement? Third, does the UHF dipole factor also apply to UHF NTSC stations; that is, does the protected NTSC Grade B contour similarly get adjusted by up to ±2.3 dB?

30. Finally, the geometric mean for VHF lowband channels is 69 MHz. The dipole factor for Channel 2 would therefore be -2.0 dB, and the dipole factor for Channel 6 would be 1.6 dB. The geometric mean for VHF highband channels is 194 MHz. The dipole factor for Channels 7 and 13 are therefore ±0.8 dB. It is illogical to apply dipole factors of as small as 0.1 dB at UHF but to ignore dipole factors of up to -2.0 dB at VHF. The Commission should consider extending the dipole factor to VHF channels, for consistency, or dispense with them, as not significant.

V.c. Significant Figure Reporting

31. Appendix A to the 6RO lists D/U ratios to the <u>hundredth</u> of a dB, whereas the new §73.622(e) rounds the threshold field strengths to the nearest <u>integer</u> dB. Neither seems appropriate, but they should certainly be consistent. Since dipole factors range from 0.1 dB to 2.3 dB, we recommend calculating ratios and field strengths to the nearest <u>tenth</u> of a dB.

V.d. LOS Requirement over City of License

32. New §73.625(a)(2) requires DTV transmitter sites to be free of "a major obstruction in the path over the principal community to be served" but did not require the corollary requirement that "line-of-sight can be obtained from the antenna over the principal community to be served," as is additionally required for NTSC TV transmitter sites. This appears to be an inadvertent oversight in the wording of §73.625(a)(2), and we urge the Commission to include the "line-of-sight" text long required for NTSC transmitter sites. While engineers may reasonably differ in their opinions whether an obstruction is, or is not, "major," there is no ambiguity in the line-of-sight requirement. Inclusion of this important requirement in addition to the "no major obstruction" requirement does not mean that transmitter sites

lacking line-of-sight to a station's principal community cannot be proposed; rather, it simply means that Question 3 ("Pursuant to 47 CFR §73.625, the DTV coverage contour of the proposed facility will encompass the allotted principal community" YES/NO) of the new FCC Form 301§V-D would have to be answered in the negative and that a supplemental engineering exhibit would have to be prepared, demonstrating that the terrain obstruction(s) causing the lack of line-of-sight are not so severe as to cause lack of service to the principal community. In this regard, we also suggest that Question 3 be revised to make it similar to Question 11 of Form 301§V-C, which asks "Will the proposed facility satisfy the requirements of 47 CFR §73.685(a) and (b)?" and then goes on to instruct, "If No, attach as an exhibit justification therefore, including amounts and percentages of population and area that will not receive City Grade service." If Question 3 of Form 301§V-D is similarly restructured, to ask "Will the proposed DTV facility satisfy the requirements of §73.625(a)(1) and (2)?" and to add the instruction "If No, attach as an exhibit justification therefor, including amounts and percentages of population and are that will not receive threshold service," then it would be clear just what the Commission expects for DTV transmitter siting.

V.e. Definition of *de minimus* Interference

33. We understand that MMB staff has tentatively adopted a "1 percent" criteria for evaluating NTSC minor-change modifications. This policy has been described to us as allowing modifications to NTSC facilities that cause no more than a 1% decrease in the "interference-free" population served by a DTV station. Confirmation of this policy is requested.

V.f. Truncation of Directional Patterns, rather than Scaling

34. We recommend the Commission consider allowing DTV stations whose replication patterns would have a maximum greater than the channel maximum to utilize a replication pattern truncated at the maximum, rather than one merely scaled down.

V.g. Limit DTV Antenna Directionality for Stations Presently Employing Omnidirectional Antennas

35. The FCC replication program sometimes generates patterns that are markedly different from the station's NTSC antenna pattern. For example, for Station KREZ-TV, N6/D17, Durango, Colorado, which has average terrains varying from -176 m to +401 m, the DTV replication pattern differs wildly from the station's omnidirectional NTSC pattern, as

shown in the attached Figure 5. We suggest the Commission consider that, where the NTSC antenna is omnidirectional, the replication pattern be limited to no more than 3 dB below the omnidirectional NTSC pattern in any particular direction, even if the DTV threshold contour extends beyond the NTSC Grade B in certain directions.

VI. Offer

36. In order to further the common goals of the Commission and its licensees to serve the public interest, H&E is willing to make available for Commission use the programs that H&E has written for evaluation of new and/or modified NTSC and DTV stations.

continued ...

VII. List of Figures

37. The following attached figures have been prepared under the supervision of the undersigned engineers as a part of this Petition for Reconsideration:

1. DTV.IXSTUDY™ Analysis Methodology
2. Map showing calculated interference to Station KABC-TV, N07/D08, Los Angeles, California
3. Plots showing assumed consumer receive antenna patterns
4. Map showing Grade B contour discrepancy at TV Station KZKI, N30, San Bernardino, California
5. Plot showing DTV replication pattern for Station KREZ-TV, N06/D17, Durango, Colorado.

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DTV.IXSTUDY™ Analysis Methodology

Implementation of FCC's Interference-Based Allocation Algorithm

On April 21, 1997, the Federal Communications Commission released its Sixth Report and Order to Mass Media Docket No. 87-268, establishing a final Table of Allotments for the transition from analog NTSC television service to a digital television ("DTV") service. The Commission utilized a complex set of computerized analysis tools to generate the DTV allotment table and added FCC Rules Section 73.623(b)(2), requiring that similar tools be employed to analyze individual DTV station assignments with regard to their potential interference to other DTV stations, DTV allotments, and existing or authorized NTSC facilities. Hammett & Edison has developed computer software to perform this function, based on an examination of the FCC software source code.

For any given NTSC or DTV station to be studied, the FCC analysis model first determines the location of the conventional F(50,50) Grade B contour of the NTSC station, or of the NTSC station associated with an assigned DTV station, using pattern information contained in the FCC engineering database and an assumed antenna elevation pattern. The model assumes that contour as an envelope, outside of which no protection from interference is implied or afforded. The location of the Grade B contour is also used to determine the assigned power for the DTV station, once again using conventional methods found in FCC Rules Section 73.699, Figures 9 and 10, but determining the power necessary on a radial basis to generate the associated DTV coverage contour (41 dBu for UHF, 36 dBu for high VHF Channels 7–13, and 28 dBu for low VHF Channels 2–6), for the assigned DTV channel. The maximum power determined using this method was assigned as the DTV operating power, provided it was calculated to be above established minimum power levels; otherwise, a minimum power level was assigned. Note that the use of this method usually creates a directional antenna pattern, even for DTV assignments to presently omnidirectional NTSC TV stations. The FCC requires that a DTV facility employ an antenna design that meets the calculated pattern, or that a nondirectional antenna be employed that does not exceed the directional pattern envelope in any direction, unless the creation of no new interference can be demonstrated.

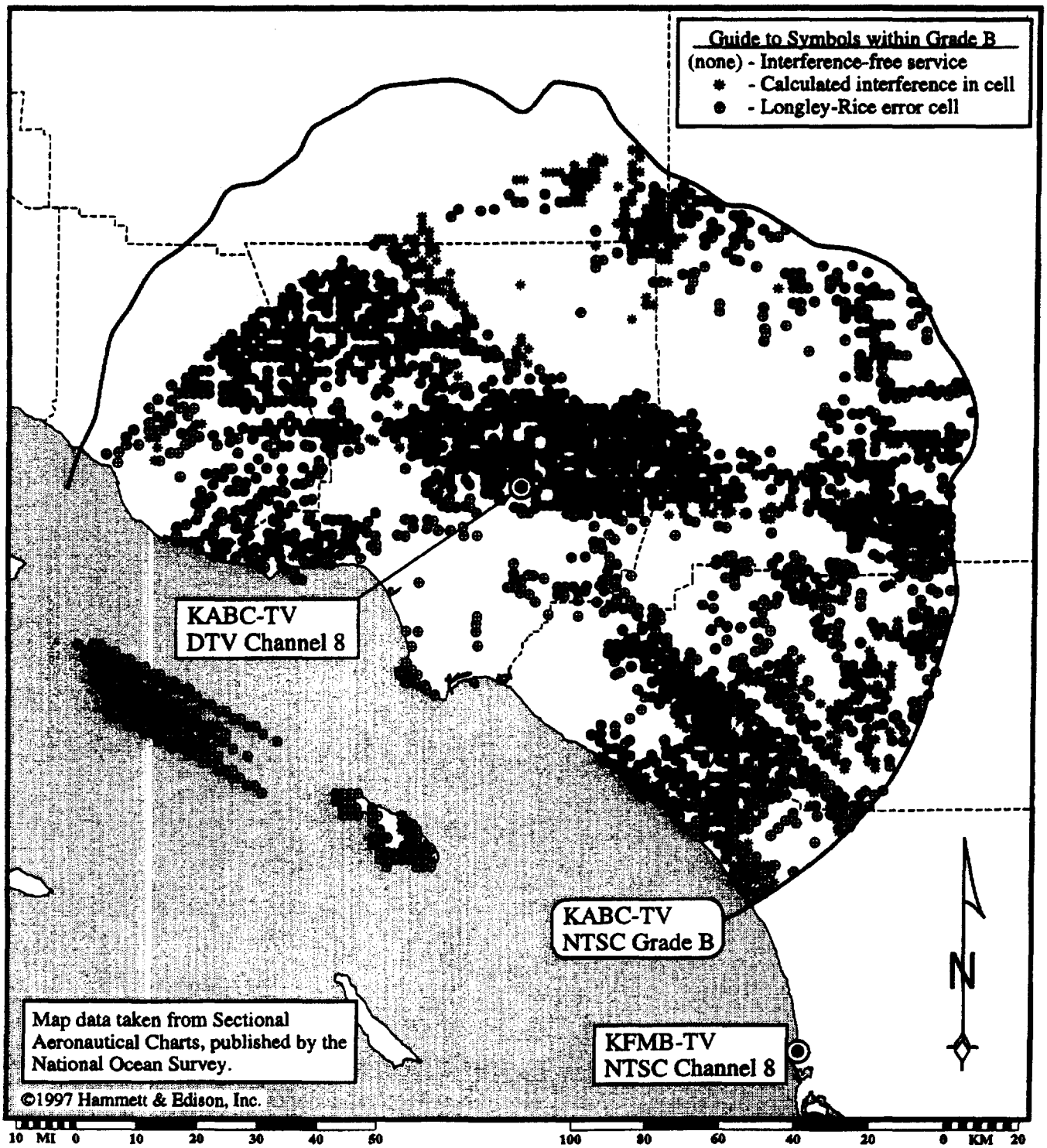
In addition to the use of the Grade B envelope and an assumed directional transmitting antenna for all DTV facilities, the model assumes the use of directional receiving antennas at each studied location, or "cell." The characteristics of the receiving antennas are different not only for the low VHF, high VHF, and UHF frequency bands, but also for NTSC and DTV receiving situations, where, based on the FCC model, more directive antennas are employed for analysis of DTV reception.

The FCC analysis technique employs terrain-sensitive calculation methods based on Version 1.2.2 of the ITS Irregular Terrain Model, also known as the Longley-Rice model. For each NTSC or DTV station to be studied, a grid of cells, two kilometers on a side, fills the associated Grade B contour. The program first determines which of the cells is predicted to receive service from the associated station, using Longley-Rice with F(50,50) statistical weighting for NTSC stations and F(50,90) statistical weighting for DTV stations. Cells determined to have no service are not studied for interference from other stations.* Once cells having service are determined, the software analyzes potential interference from other NTSC or DTV stations, again using the Longley-Rice propagation algorithm and F(50,10) statistical weighting for all potential interfering signals. Each cell is evaluated using the desired-to-undesired ratios presented in FCC Rules Section 73.623 for each channel relationship, and cells determined to have interference are flagged and summed with the study results of other cells, resulting in the generation of total interference area figures and tabulations of total population contained within the summed cells.

The Hammett & Edison analysis software program employs all of the analysis features described above, as well as several other more subtle elements employed in the FCC allotment program. Additionally, the Hammett & Edison program provides a graphical element that allows the identification of all interference cells on a map with an associated tabulation, and the program generates a DTV antenna pattern envelope that shows areas that can be maximized without creating interference in any cells that were not already receiving interference. The program can be used to test implementation scenarios that involve changes to antenna height, antenna pattern, channel number, and transmitter location. Additionally, the program has the capability to determine coverage areas of DTV and NTSC stations, with interference cells omitted. The Hammett & Edison program can also identify cells that fall in major bodies of water, based on digitized map data, summarizing those cells separately in an interference study or excluding them from a coverage study. Arguably, cells in water do not require protection from interference.

* It is noted that the Longley-Rice model is not always capable of determining, within certain confidence limits, whether a particular block has service. In such cases, the Longley-Rice algorithm returns an error code; the FCC method for handling such error codes is to assume the associated cells have interference-free service, and as such, are not considered further. This assumption is presently being scrutinized by Hammett & Edison to determine its validity and to identify possible situations where significant actual interference areas may be overlooked from station studies.

Calculated KFMB-TV NTSC Interference to KABC-TV DTV Plus Longley-Rice Error Cell Locations Determined Using FCC Algorithms



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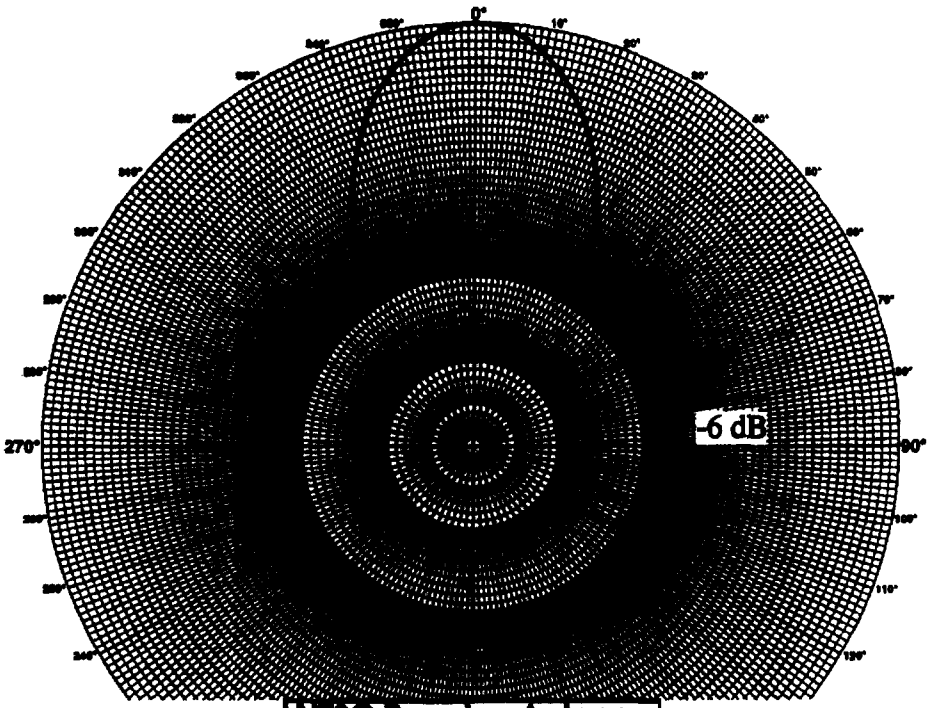
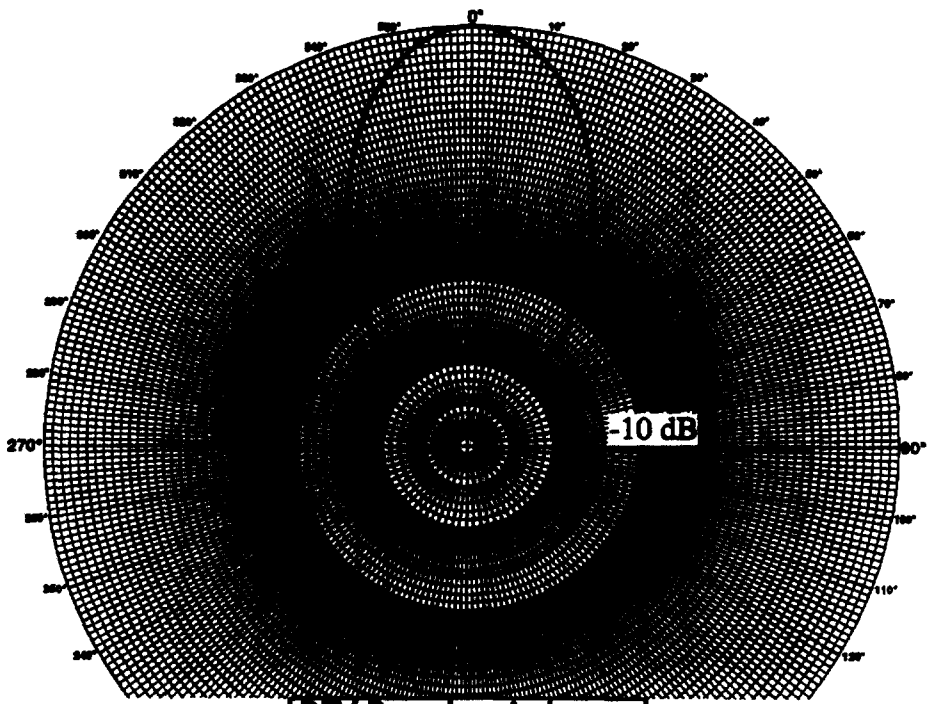
CONSULTING ENGINEERS
SAN FRANCISCO

970612
Figure 2

Different Consumer Receive Antenna Patterns, as Assumed by FCC "Replication" Program to Develop DTV Allotments
- Low-Band VHF -

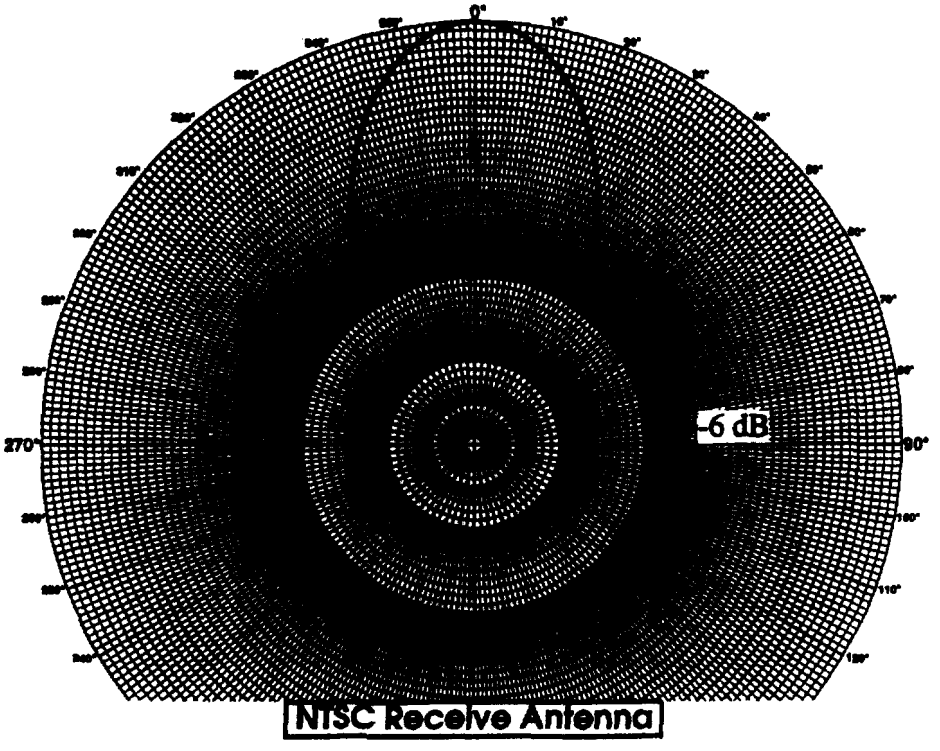


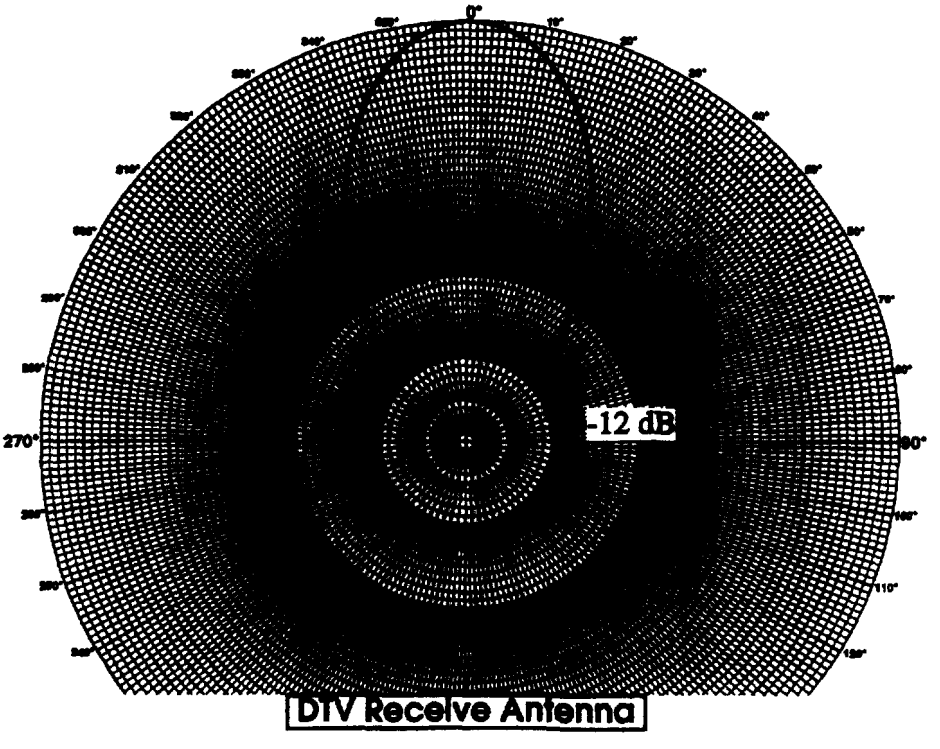
NTSC Receive Antenna



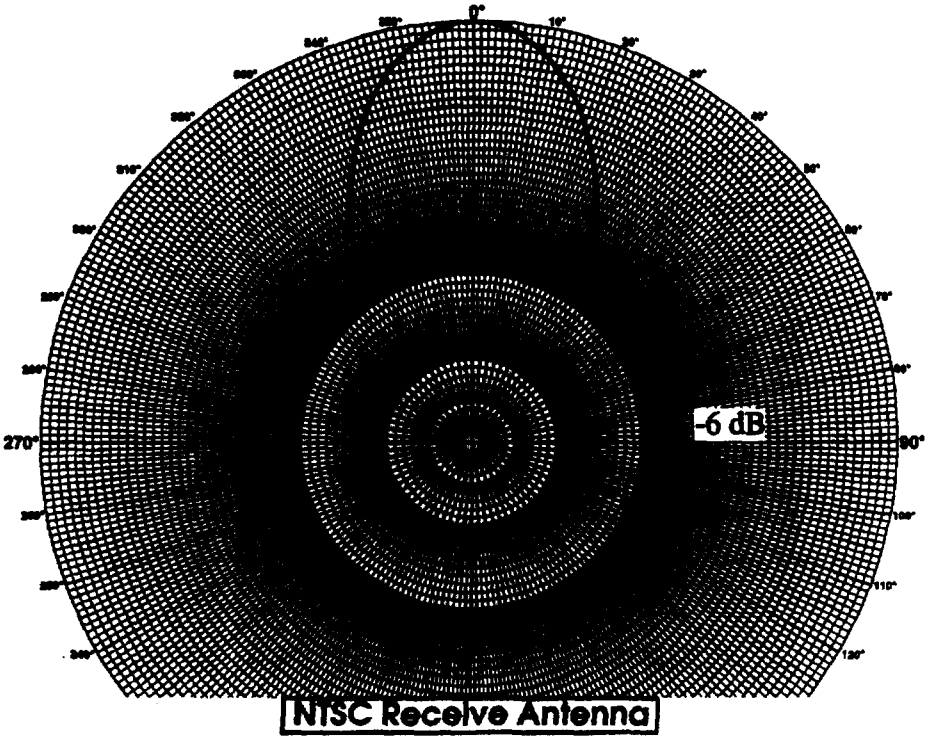
DTV Receive Antenna

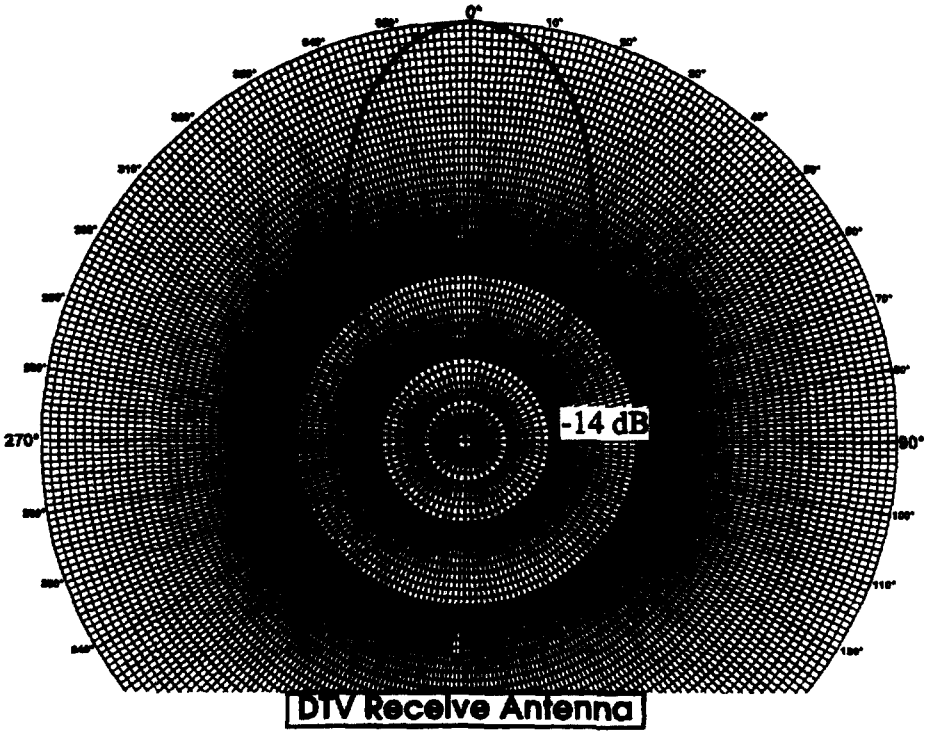
Different Consumer Receive Antenna Patterns, as Assumed by FCC "Replication" Program to Develop DTV Allotments - High-Band VHF -





Different Consumer Receive Antenna Patterns, as Assumed by FCC "Replication" Program to Develop DTV Allotments
- UHF -





Petition for Reconsideration • MM Docket 87-268

Example of Errors in "Grade B" Contour Location for FCC DTV Replication Method vs. FCC Rules Section 73.684

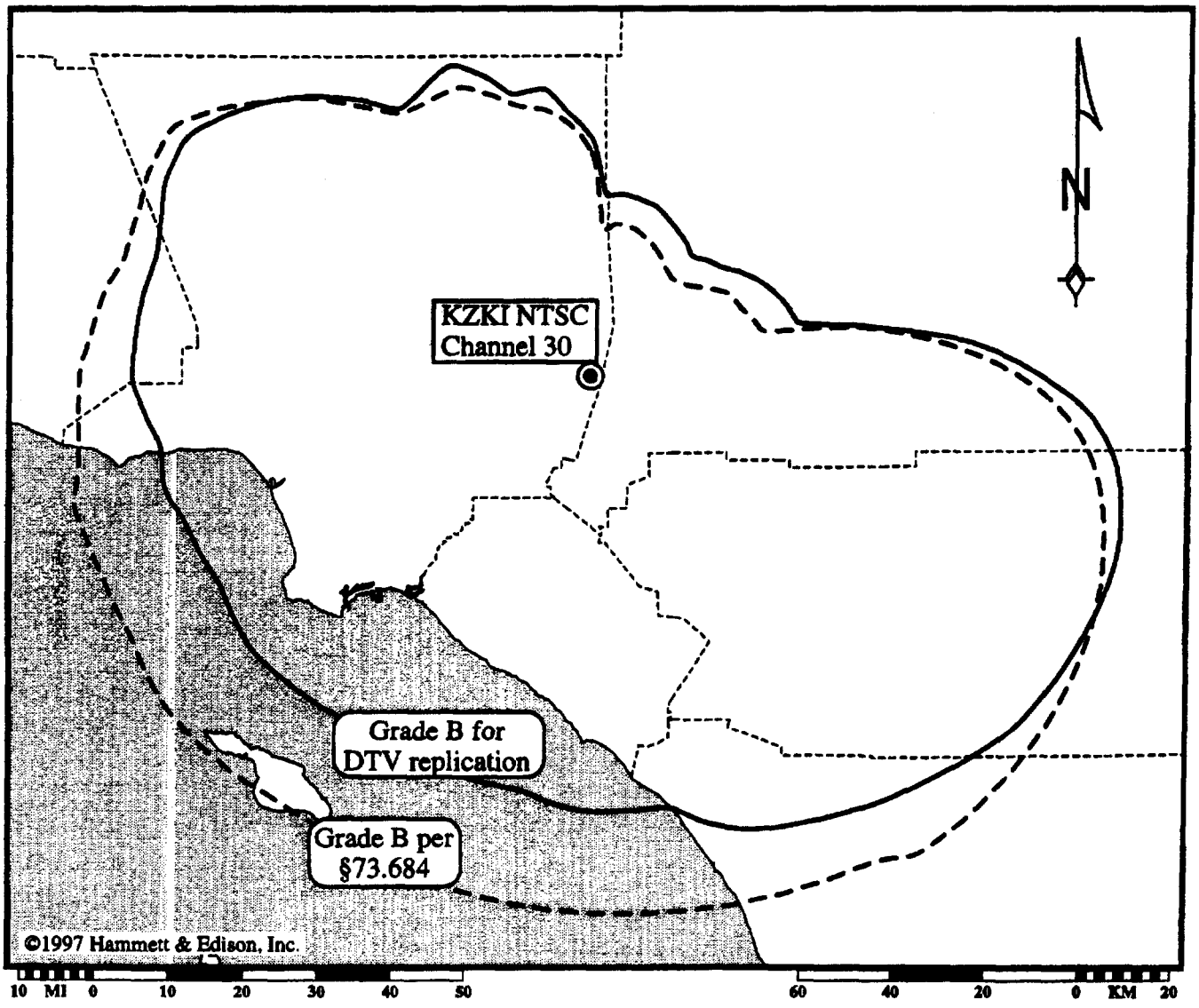


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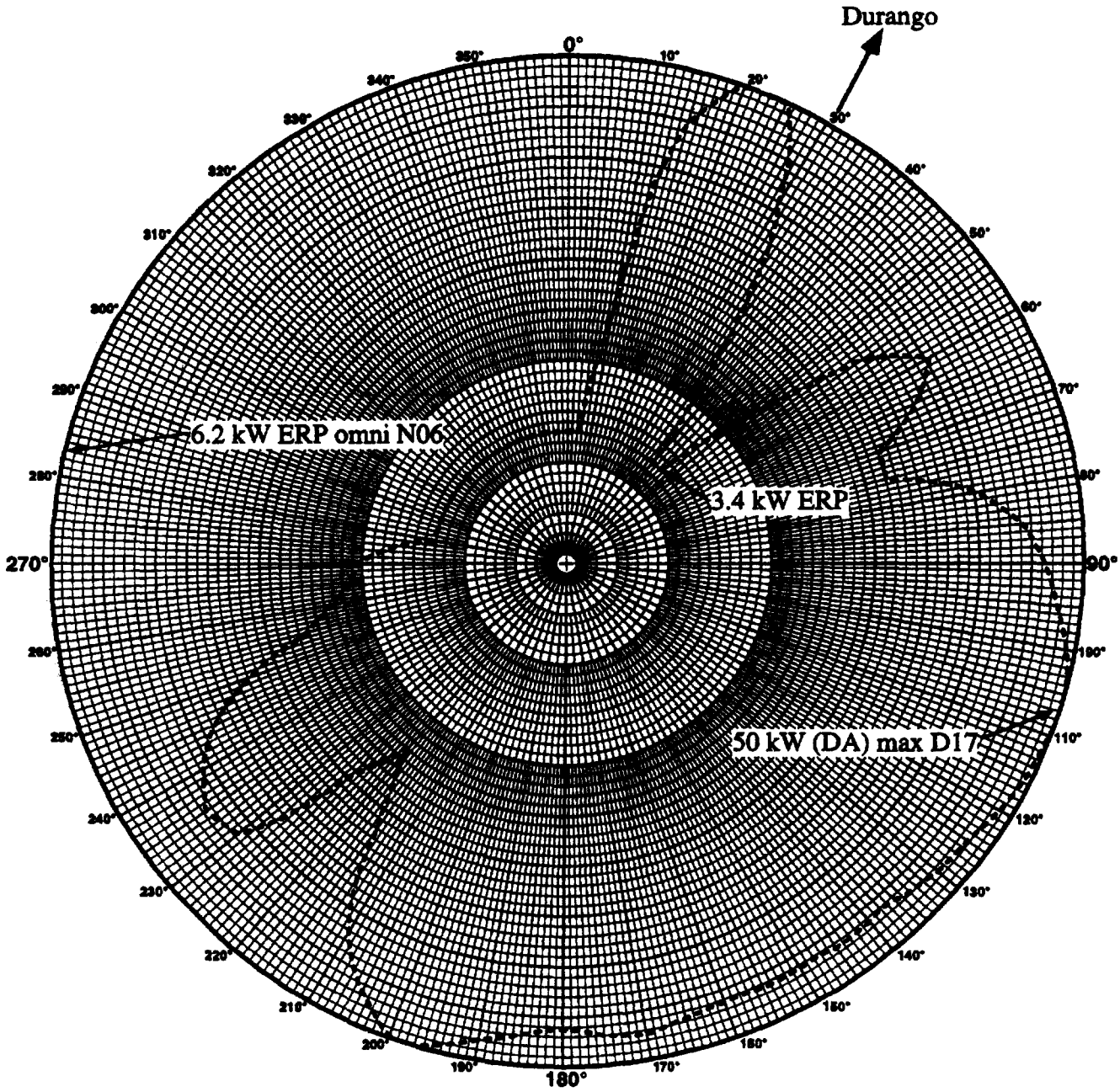
Figure 4

Calculated Replication Pattern for Station KREZ-TV, Channels N06/D17, Durango, Colorado



Affidavit

State of California
County of Sonoma | ss:

William F. Hammett, being first duly sworn upon oath, deposes and says:

1. That he is a qualified Registered Professional Engineer, holds California Registrations Nos. E-13026 and M-20676, which expire on June 30, 2001, and is a principal in the firm of Hammett & Edison, Inc., Consulting Engineers, with offices located near the city of San Francisco, California,

2. That he graduated from Dartmouth College with a degree in Engineering Sciences in 1977 and from the University of Illinois with a degree of Master of Science in 1978, has completed two years of employment by the Standard Oil Company and five years by Dean Witter Reynolds in various engineering, computer, and management capacities, and has been associated with the firm of Hammett & Edison, Inc., since 1985,

3. That the firm of Hammett & Edison, Inc., Consulting Engineers, has of its own volition prepared the accompanying Petition for Reconsideration in MM Docket 87-268,

4. That such engineering work has been carried out by him or under his direction and that the results thereof are attached hereto and form a part of this affidavit, and

5. That the foregoing statement and the report regarding the aforementioned engineering work are true and correct of his own knowledge except such statements made therein on information and belief and, as to such statements, he believes them to be true.

William F. Hammett, P.E.

Subscribed and sworn to before me this 13th day of June, 1997

LINDA SIEMER
Comm. # 1099501
NOTARY PUBLIC - CALIFORNIA
Sonoma County
My Comm. Expires June 2, 2000

Linda Siemer