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

In the Matter of	)	
	)	
Second Periodic Review of the	)	MB Docket No. 03-15
Commission's Rules and Policies	)	
Affecting the Conversion to	)	
Digital Television	)	
	)	

To: The Commission

Petition for Reconsideration

The firm of Hammett & Edison, Inc., Consulting Engineers, respectfully submits these comments in the above-captioned proceeding relating to DTV broadcasting. Hammett & Edison, Inc. is a professional service organization that provides consultation to commercial and governmental clients on communications, radio, television, and related engineering matters.

I. Qualifications of Hammett & Edison, Inc.

1. Hammett & Edison, Inc. (H&E) is well qualified to make comments on this matter, its professional staff having been involved for over 50 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.

2. As the result of performing scores of consolidated database system (CDBS) checks for its clients, in response to Paragraph 34 of the September 7, 2004, Report & Order (R&O) to MB Docket 03-15, and as a result of information obtained from FCC staff regarding how database errors will be treated when recalculating the interference-free populations TV stations, we have become concerned that this recalculation will contain systemic and significant errors. We feel compelled to submit this Petition for Reconsideration of the MB 03-15 R&O, even though the R&O has not yet been published in the Federal Register.

II. 0.1% "*de minimis*" Allowance

3. The R&O decided that the interference allowance, should, in general, be changed from the present 2% *de minimis* allowance for DTV stations, and 0.5% rounding allowance for NTSC

stations, to 0.1%. We question the logic for this change. The purpose of the 0.5% allowance for interference that modifying NTSC stations could cause to DTV stations was not that the Commission felt that 0.5% interference "bites" were acceptable, but was set to allow for uncertainty and imprecision in the calculations. That is, Commission policy was that modifying NTSC stations could cause no new interference at all to DTV allotments, DTV construction permits (CPs), or licensed DTV facilities, but that an integer percent calculation resolution would be reasonably applied, to allow for small differences between computer calculation resolution/accuracy, small differences in terrain database accuracy, and other factors. The use of different computer platforms and different sources of digitized terrain has not changed. Therefore we submit that there is no reason to ratchet down the "*de minimis*" allowance from 2% to 0.1%; at most, the new "*de minimis*" allowance should be the same 0.5% that is presently derived from an integer percent rounding of the calculated interference.

III. For DTV Stations Returning To Their Analog Channel, the Commission-Derived DTV ERP Should Be Based on the Exact NTSC Transmitting Antenna Pattern

4. The Commission needs to ensure that, for DTV stations electing to return to their NTSC channel, the allowable effective radiated power ("ERP") that is calculated by the Commission is based on the station's actual NTSC pattern for the antenna that is presently in use, and not a generally un-buildable, derived replication pattern. Further, for in-core UHF NTSC stations that use antennas with both electrical beam tilt (ebt) and mechanical beat tilt (mbt), it is important that the pattern used by the Commission for deriving the allowable DTV power be based on the station's main beam pattern and actual elevation pattern, with due regard to the analog antenna's actual ebt and mbt. Failure to do so will mean that some lower buildable ERP will generally have to be used, because it will not be possible to exactly match the pattern used by the Commission in deriving the allowable final DTV channel ERP.

IV. Clarification of Post-Transition DTV Interference Calculations

5. When calculating the allowable power for a station's final DTV channel, we request clarification whether any interference to other DTV stations or final allotments will take into account the existing levels of interference that may now exist, including NTSC interference. For example, assume Station A received a UHF DTV allotment for its VHF high-band analog channel, and wishes to return to the VHF channel at the end of the transition period. Also assume that there is an adjacent-channel DTV Station B that is receiving some interference from Station A's present VHF analog operation. When calculating the new "*de minimis*" limit, will the existing interference be considered or not? That is, will the "de minimis" ERP for the after-transition

DTV Station A, now on a VHF channel, include the interference that was already being causing by NTSC Station A to the adjacent-channel DTV Station B?

V. Clarification Regarding In-Core, Already Built and Operating Maximized DTV Facilities

6. Clarification is also requested for the case of an in-core, already built and operating DTV station with maximized facilities: Is that station at risk of having its final after-transition DTV power reduced, in order to accommodate another DTV station?

VI. The Continuing Error Code 3 Problem

7. In our June 13, 1997, Petition for Reconsideration of the Fifth and Sixth R&Os to M M Docket 87-268, we pointed out a serious problem with the Longley-Rice terrain-sensitive propagation model that the Commission requires be used when conducting OET-69 coverage and interference studies. This is the "Error Code 3" or "EC3" problem. Specifically, in cases where the actual horizon from a given cell or transmitter location is less than 0.1 times or greater than 4 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 that 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, has been to treat that cell as having interference-free service. That is, the "desired" signal is assumed to be above its signal threshold, even though it may not be, and the desired signal is not checked for interference from "undesired" signals. While this engineering sleight-of-hand made possible the original DTV Table of Allotments, it ill-serves broadcasters and ultimately will ill serve the viewing public, because radio waves propagate according to the laws of physics, and not according to convenient assumptions designed to facilitate the FCC's DTV allocation challenge of several years ago.

8. The Commission chose not to correct the EC3 problem, so in our April 26, 1999, comments to MM Docket 87-268, we again addressed the EC3 problem.* We provided an

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* At Paragraph 116 of the April 21, 1997, Fifth R&O to MM Docket 87-268, the Commission stated is would hold a "periodic review every two years until the cessation of analog service" in order to ensure the smooth introduction of DTV and the timely recovery of spectrum upon the demise of analog television service. That paragraph further went on to state "During these reviews, we will address any new issues raised by technological developments, necessary alterations to our rules, or other changes necessitated by unforeseen circumstances." That two-year period tolled in April of 1999, with no Commission action. Four months later, on August 26, 1999, H&E took the initiative and filed its biennial review comments, pointing out several technical problems with the Commission's adopted methodologies and policies that had become

analysis of the severity of EC3 for all 1,601 DTV allotments in the contiguous United States (*i.e.*, excluding Alaska, Hawaii, Puerto Rico, Guam, and the Virgin Islands), with the following results:

Percentage of DTV Allotments	Percent of Population in Cells with EC3
2.8%	<0.1%
7.1	0.1 – 1
16.0	1 – 5
16.0	5 – 10
23.4	10 – 20
28.1	20 – 50
6.5	50 – 90
0.1	> 90

9. We reported that, on the average, 18.2% of a DTV allotment's population fell in EC3 cells, which was troubling then, and is all the more troubling now. It made little sense to have a 2% *de minimis* criteria for DTV stations, and a 0.5% *de minimis* criteria for NTSC stations, when the underlying prediction model had an average error of 18%. And it borders on silly to use a 0.1% *de minimis* criteria, as now proposed, while retaining a prediction model with an average uncertainty that is 182 times greater.

10. Accordingly, we implore the Commission to adopt the simple solution proposed in the December 11, 1998, H&E comments to CS Docket 98-201: namely, simply ignore EC3. As was explained in those comments, comparing the Longley-Rice EC3 results to the results given by the Terrain Integrated Rough Earth Model (TIREM) for the same path indicates that, ironically, most of the time EC3 is a false alarm. Assuming perfect service at these locations and no interference, as the FCC now does, introduces large, unnecessary errors.

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apparent in over two years of preparing DTV applications, many of them involving "maximized" DTV facilities.

Then, on March 8, 2000, the Commission released the MM Docket 00-39 Notice of Proposed Rulemaking (NPRM), the first DTV review rulemaking. While H&E applauded that the Commission was finally undertaking the DTV review it had promised (albeit not a biennial one), we were disappointed that the 00-39 NPRM was silent on all of the technical issues raised in our August 1999 filing. This strange failure to include the significant and serious technical problems documented in our 1999 filing meant that parities reading the 00-39 NPRM were not put on notice regarding issues such as the EC3 problem, the depression angle calculation problem, and the bizarre assumption that DTV receiving antennas for VHF low band, VHF high band, and UHF will have significantly better performance than their NTSC counterparts. As was noted at Paragraph 3 of the May 17, 2000, H&E MM 00-39 comments, which repeated the apparently ignored H&E April 1999 MM 87-268 comments, this was a regrettable FCC omission.

VII. Miscalculation of Depression Angles

11. Another ongoing problem involves miscalculation of the depression angle from a transmitting antenna to a cell. Due to a source code error, the FCC OET-69 computer program calculates the depression angle to a cell based on the transmitting antenna's height above ground level (AGL) rather than height above mean sea level (AMSL). For stations that obtain their height from tall buildings or tall towers, this does not introduce much of an error. However, for stations that obtain their height from tall mountains, a significant error can be introduced. For example, the TV stations at Mt. Wilson, near Los Angeles, have typical center-of-radiation heights of only 91 meters AGL but 1,828 meters AMSL. This results in depression angle errors of 2.5° to 3.0° to cells in the Los Angeles basin. When combined with the fact that most DTV allotments are UHF, and that UHF antennas typically have elevation pattern half-power beam widths ("HPBW") of 1.5° to 2.0°, then a 2.5° to 3° error in the calculation of depression angle can be significant.

12. Unlike the EC3 problem, which was the result of an intentional decision that experience has now shown urgently needs to be revisited, the depression angle problem was clearly the result of a source coding error and so was unintentional. Surprisingly, when the Commission was alerted to this problem, in December 1998, rather than fixing the problem (a simple correction of one line of the source code), giving a Public Notice to that effect, and processing all subsequent applications based on correctly calculated depression angles, the FCC instead continues to use the flawed source code. As shown by Figure 1, depicting a portion of actual source code being used by the Commission's Office of Engineering and Technology ("OET"), there is now a "mod4" version of the source code that allows depression angles to be correctly calculated, if so requested by the Commission engineer running the study; however, it is believed that normally the Commission will use the uncorrected source code and so intentionally miscalculate the depression angles to cells under study. In this regard, the FCC's OET-69 software does not duplicate Longley-Rice Version 1.2.2, and so produces different and incorrect results.

13. At Paragraph 66 of the January 19, 2001, R&O to MM Docket 00-39, the Commission decided that where ignoring EC3 and/or correctly calculating the depression angle to cells would "make a critical difference," applicants could base their OET-69 studies on correctly calculated depression angles, and ignore EC3. We respectfully submit that for stations in mountainous or even merely "hilly" terrain, ignoring EC3 and not giving "free parking" in EC3 cells will "make a critical difference" more often than not. We also respectfully submit that for UHF DTV stations on mountain tops, it will always "make a critical difference" to correctly calculate the depression angles to cells. Accordingly, we ask the Commission to simply fix the EC3 "free parking "

loophole and fix the depression angle calculation error for all cases. To do anything less at this opportunity is unjustifiable.

VIII. Actual Rather Than Generic Elevation Patterns

14. OET-69 provides generic UHF NTSC and DTV elevation patterns; these are shown in Figure 2. Since these patterns were used to develop the DTV Table of Allotments and the "baseline" noise-limited, interference-free service for NTSC stations and DTV allotments, their use is necessary if current OET-69 interference studies are to replicate the FCC baseline populations. Of course, accurately replicating the FCC baseline populations is critical for determining whether a proposed facility will cause no more than *de minimus* new interference. There are two items to note regarding the OET-69 generic UHF elevation patterns: 1) Table 8 of OET-69 provides values only from 0.75° below the horizontal to 10° below the horizontal; and 2) an electrical beam tilt ("ebt") of 0.75° for both the NTSC and for the DTV elevation patterns is presumed. Unfortunately, many NTSC stations on tall mountains have more than 0.75° ebt, and many employ a combination of electrical and mechanical beam tilts ("mbt").

15. The inclusion of mbt means that the main beam and horizontal plane azimuth patterns are no longer the same, as shown in the attached Figure 3A; the solid line is the main-beam azimuth pattern (corresponding to the Dielectric TLP-M pattern at 270°T) while the dashed line is the horizontal plane azimuth pattern. Even greater departures are possible; for example, Figure 3B shows the main-beam versus horizontal plane patterns for a Mt. Wilson UHF station with 1.6° of EBT and 0.6° of MBT toward 225°T, and Figure 9C shows the horizontal plane azimuth pattern for a Mt. Wilson UHF station with 1.5° of ebt and 1.5° of mbt towards 195°T. For Figure 3B the main-beam pattern is a Dielectric S180 at 172°T, whereas the horizontal plane pattern has its maximum at 92°T. For Figure 3C the main beam is an Andrew cardioid at 195°T, whereas the horizontal plane pattern has its maximum at 310°T.

16. The horizontal plane pattern is used because it is the pattern that Section 73.685(f)(2) of the NTSC Rules, and Section 73.625(c)(3)(ii) of the DTV Rules, states must be provided in applications that propose a directional transmitting antenna. Further, the Rule states, "Where mechanical beam tilt is intended, the amount of tilt in degrees of the antenna vertical axis and the orientation of the downward tilt with respect to true North must be specified, and the horizontal plane pattern must reflect the use of mechanical beam tilt." Thus, both the NTSC and DTV Rules are clear that 1) it is the horizontal plane azimuth pattern and not the main-beam azimuth pattern that is to be used and 2) the horizontal plane azimuth pattern must reflect the effect of mbt when used. In other words, this is not an ambiguously worded rule, requiring interpretation by FCC staff.

Finally, it should be noted that the magnitude of the effect of mbt on the main-beam pattern depends on 1) the elevation pattern shape; 2) the amount of ebt; 3) the amount of mbt; and 4) the direction of the mbt. The greatest "distortion" of the horizontal plane azimuth pattern from the main beam azimuth pattern generally occurs when the mbt is equal to, or a high percentage of, the ebt.

17. The Commission's regrettable failure to use actual elevation patterns, actual ebt, and, for stations employing both ebt and mbt, basing cell calculations on the main beam azimuth pattern rather than the "distorted" horizontal plane azimuth pattern, means that a significant percentage of the Commission's OET-69 studies were inaccurate, with little linkage to reality. Put another way, it made no sense to use a horizontal plane azimuth pattern when OET-69 studies calculated the field strengths to cells that were not at a zero-degree depression angle; indeed, for OET-69 studies, the range of depression angles extends all the way down to 90 degrees below the horizontal.

18. While H&E realizes that use of actual elevation patterns, beam tilts, and main beam azimuth patterns would require changes to the Commission's CDBS and OET-69 software, and providing stations with an opportunity to submit the additional pattern data, the benefits of such significantly more accurate calculations for stations with mechanically tilted antennas would be so substantial as to warrant the consideration of such a step. Put another way, can the Commission afford to have significant calculation errors in these final rounds of DTV calculations? H&E submits that, in light of the Commission's decision to recalculate NTSC interference-free "baseline" service, and then to use those baselines for determining the allowable power of a DTV station's final channel, the answer is "no." Accordingly, we urge the Commission to issue a public notice giving stations an opportunity to submit their actual elevation pattern, and, for mechanically tilted antennas, to submit their main beam azimuth pattern. Then, the Commission should enter this critical information into an expanded CDBS, and finally use that information for far more reliable OET-69 studies.

IX. Identical Concerns Raised in Comments to MB Docket 03-185

19. We note that the just released September 30, 2004, R&O to MB Docket 03-185, concerning digital TV translator/LPTV/Class A stations, at Paragraphs 98 through 104, describes comments by parties other than H&E addressing these same concerns about the accuracy of the Commission's OET-69 software and the use of actual rather than generic patterns, and the use of actual ebt and mbt values. At Paragraph 104, the Commission states that it is hesitant to make the digital LPTV/TV translator procedures more complicated than those for full-service stations. Paragraph 104 goes on to state,

> If in the future we develop an ability to account for actual elevation patterns and related beam tilt in the full service context, we will consider applying that ability in the digital LPTV and TV translator context.

We submit that the time to add this capability is now, along with the single fixes to the EC3 and miscalculated depression angle problems.

X. CDBS Should Not Be the Sole Source of Official Station Information

20. An association trade group, the Association of Federal Communications Consulting Engineers (AFCCE), has urged the Commission to make the CDBS the primary source of station information. After this latest round of CDBS information checks, we believe that such a course of action would be unwise. However, H&E would have no objection to making the CDBS *an* official information source, just not *the* only official information source. Original filings and electronic applications still have their place when uncertainty or conflicts exist in the Commission's records regarding exactly what facilities are authorized.

XI. Summary

21. The Commission needs to delay re-calculating the new NTSC baseline populations, and calculating the allowable effective radiated power (ERP) for a station's requested final DTV channel, until:

A. The Commission's OET-69 software has been modified to ignore EC3.

B. The Commission's OET-69 software has been modified to correctly calculate depression angles.

C. If possible, until TV station licensees have been given the opportunity to submit their actual elevation patterns, and, for mbt cases, their main beam azimuth patterns, and the Commission's OET-69 software, and the CDBS, have been modified to accept and use this important information (that is, a station's main beam azimuth pattern, actual elevation pattern, actual ebt, actual mbt, and actual mbt direction).

22. Failure to make these technical corrections will result in some final DTV assignments that will likely be fundamentally flawed, especially for DTV stations transmitting from mountaintop sites. The laws of physics, and radio wave propagation, do not respect engineering or software "simplifications." H&E implores the Commission to take these corrective steps now that it is at a new juncture, requiring re-calculation of all NTSC baseline populations using 2000 Census data, and then the calculation of allowable final-DTV-channel ERPs.

List of Figures

23. The following figures or exhibits have been prepared as a part of this MB Docket 03-15 Petition for Reconsideration filing:

1. Depression angle source code problem
2. OET-69 UHF generic elevation patterns
3. Main beam vs. horizontal plane azimuth pattern comparisons.

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FCC Source Code Addressing Depression Angle Calculation Error Problem

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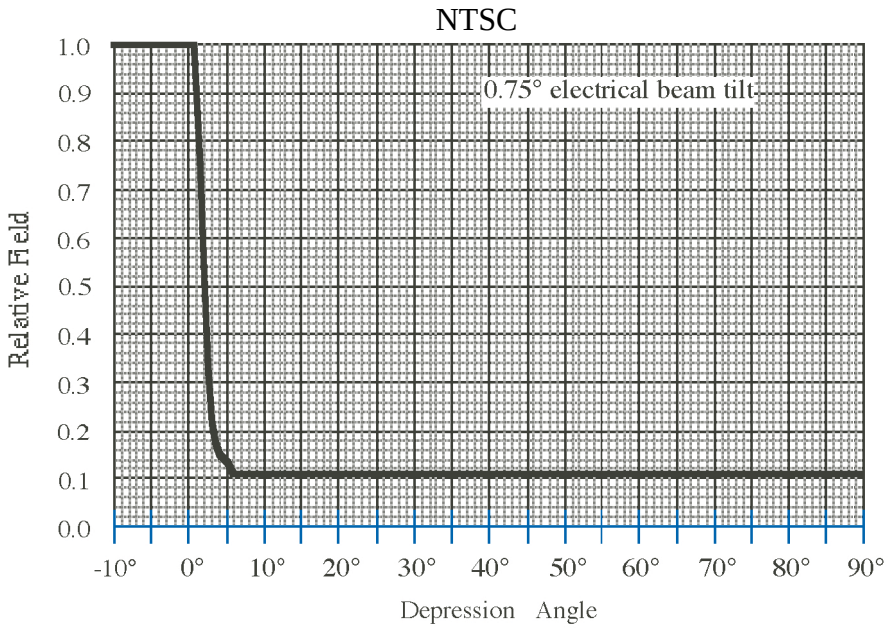
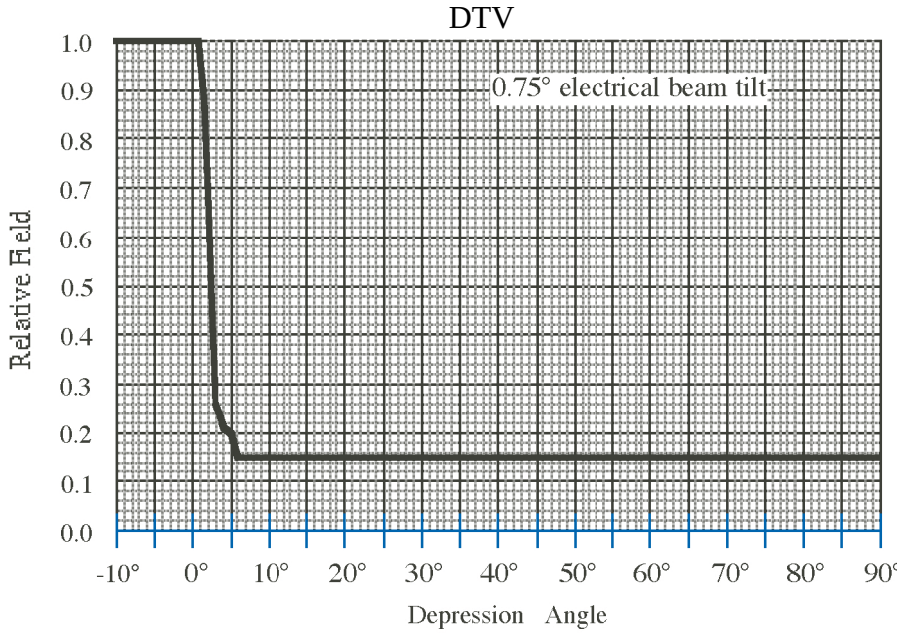
c
c  Vertical radiation factor.  The tables prepared for the 6th R&O and
c  reconsideration orders used antenna heights AGL and forced the
c  transmitter height to be at least 30.0 meters.  Under mod4, these
c  heights are reckoned AMSL and there is no minimum.
c
            n_ant = NTSC
            if (sta_type(k) .eq. 'a') n_ant = ATV
            call antenna_tilt(k, az, vpat_bias)
            if (mod4 .and. .not. per_6th_order) then
               height = rcamsl_tmp
               rec_height = path_elev_pt(n_ter_pts) + rec_ant_hgt
            else
               height = max(30.0, rcamsl_tmp - path_elev_pt(1))
               rec_height = rec_ant_hgt
            end if
            instance = LONGLEY_RICE
            call gt_vert_rad_fac(height, rec_height, dtc, vpat_bias,
     &         instance, iband, n_ant, v_fac)
            if (v_fac .lt. 1.0) then
               v_log = flog10(v_fac)
               field = field + 20.0*v_log
            end if
```

OET-69 UHF Elevation Patterns





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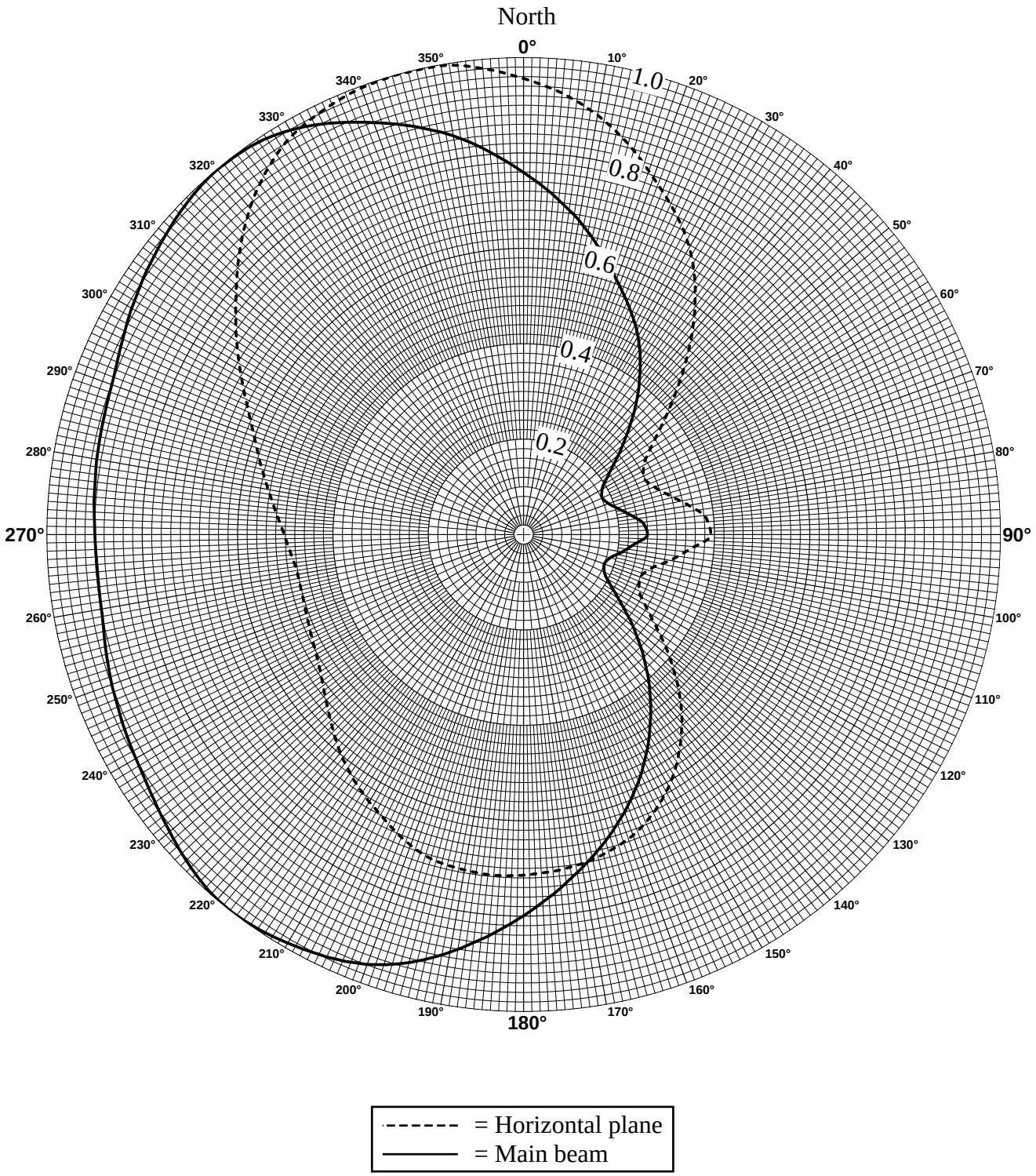
Comparison of Main Beam and Horizontal Plane Azimuth Patterns for UHF Station with 2° EBT Plus 1° MBT at 250°T - Relative Field -



HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
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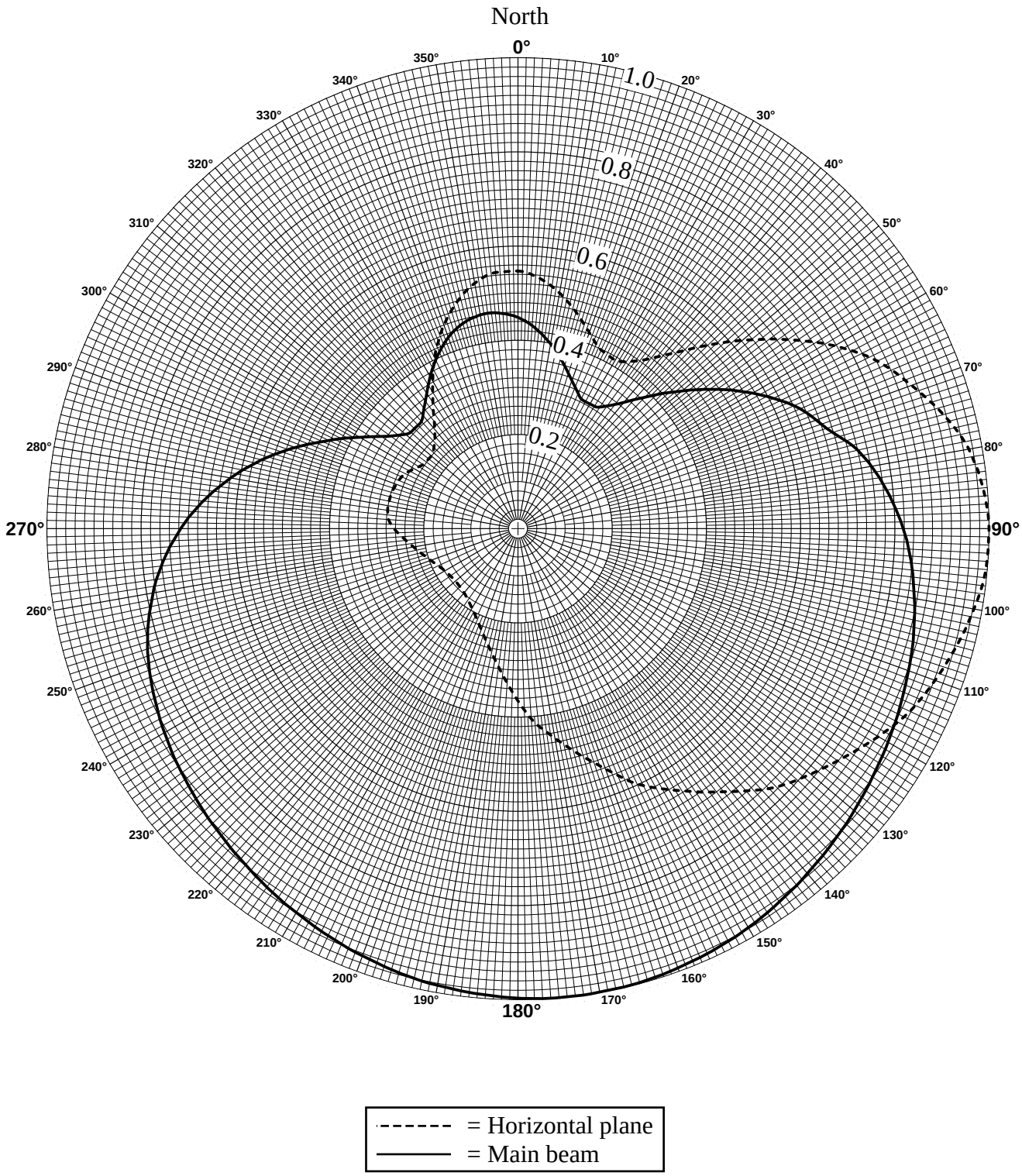
041002.1
Figure 3A

Comparison of Main Beam and Horizontal Plane Azimuth Patterns for UHF Station with 1.6° EBT Plus 0.6° MBT at 255°T - Relative Field -



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Comparison of Main Beam and Horizontal Plane Azimuth Patterns for UHF Station with 1.5° EBT Plus 1.5° MBT at 195°T - Relative Field -

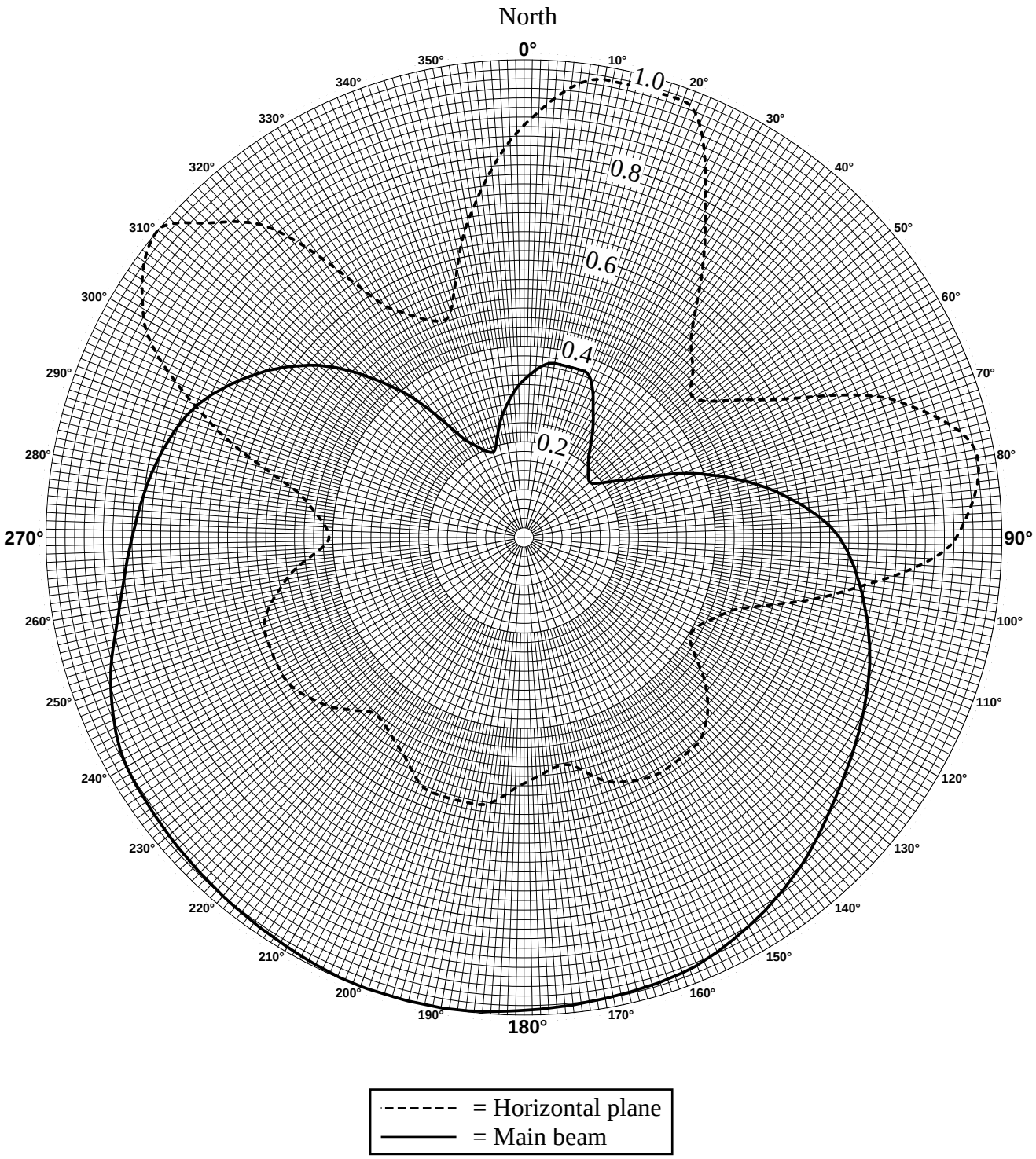

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Figure 3C