Before the
Federal Communications Commission
Washington, D.C. 20554

GEN. Docket No. 84-467

In the Matter of

Preparation for an International
Telecommunication Union Region 2
Administrative Radio Conference
for the Planning of Broadcasting
in the 1605-1705 kHz Band

THIRD REPORT

Adopted: February 26, 1988; Released: April 22, 1988

By the Commission:

INTRODUCTION

1. This proceeding was begun in 1984 to develop a record to assist the Commission in its preparations for the First Session of the above-captioned international Conference on the use of the expanded AM band from 1605 kHz to 1705 kHz.[1] For this purpose, two *Notices of Inquiry* were issued inviting comments by interested parties.[2] Two *Reports* concluded this phase of the proceeding with the adoption of FCC recommendations regarding the technical criteria to be applied to broadcasting in the expanded band as well as the method for planning the band.[3] To prepare for the Second Session of the Conference,[4] which is to develop the final text for a Regional Agreement as well as the associated Broadcasting Plan,[5] a *Third Notice of Inquiry* was recently adopted.[6] It is to the record developed in response to this latter *Notice* and through other Conference preparatory activities that we now turn. However, before doing so, it is necessary to provide some background information to put the current subject in focus.

THE FIRST SESSION : PREPARATIONS AND RESULTS

2. The Commission's *First Notice* in this proceeding sought public comment on a wide variety of issues relating to the most effective use of the new broadcasting spectrum.[7] Many of these were technical issues concerning such matters as power limits, protection requirements and signal propagation. Also to be considered, was the type, extent and location of the United States' needs. Early identification of these needs would enable our representatives at the Conference to take appropriate steps to obtain international protection for them. Not only were new broadcast uses of the band to be considered, but also the disposition of current domestic users of this band, such as Travelers Information Stations (TIS) operating on 1610 kHz, was a matter for consideration.

3. After reviewing the record developed in response to the *First Notice* and taking into account information gained through Commission participation in such preparatory activities as meetings of working parties of Study Groups of the the International Radio Consultative Committee (CCIR), and meetings of the Inter-American Telecommunications Conference (CITEL), the Commission further refined its views.[8] These preliminary views, including treating the new band as an extension of the existing AM band rather than as a separate band, were detailed in the *Second Notice*. The Commission also proposed that the protection ratios, class of emission and bandwidth of emission should be the same as for the existing AM band. Additionally, comment was sought on the issues that had not yet been resolved, most significantly the planning method for use of the expanded band.

4. Two Commission *Reports* concluded the FCC's preparations for the First Session. The *First Report* dealt with most of the technical issues to be considered at the First Session, except for the planning method to be used. At this juncture, the FCC specifically recommended that the technical criteria contained in the Regional Agreement for the Medium Broadcasting Service in Region 2 for the existing AM band (535-1605 kHz) generally should be applied to the expanded band at 1605-1705 kHz to the maximum extent possible in recognition of the fact that the new frequency band is best considered as an extension of the existing band. Such an approach requires the fewest design and production changes and therefore promotes the earlier availability of receivers capable of receiving the extended band. This in turn fosters the early commencement of service on those frequencies in Region 2. Moreover, the FCC's Recommendations noted that this makes it possible to use many of the existing planning tools and computer techniques that already have been successfully applied to AM planning activities in the Region.

5. In the *Second Report*, the Commission recommended that the United States propose to the Conference that allotment planning, rather than assignment planning, be used for the new medium frequency broadcast (AM) band 1605 KHz to 1705 kHz.[9] Under an assignment plan, an assignment for each station is entered into the plan with a specific location, power and other pertinent characteristics; whereas, an allotment plan makes designated frequencies available for use anywhere within a specified area. Allotment planning offers more flexibility while helping to ensure an efficient and equitable distribution of channels. In addition, an allotment plan avoids the need to identify specific requirements and to resolve the many ensuing incompatibilities. Moreover, because it deals with allotments rather than specific assignments, an allotment plan provides a mechanism to protect future rights without the need to identify them in advance.

6. The U.S. proposals provided a foundation for much of the work of the First Session, and U.S. views were followed in all major regards. This included technical standards and adoption of an allotment planning method. Rather than require the specification of facilities, the allotment plan is framed in terms of the effect on other allotments. Not only does this simplicity permit changes in location or station facilities, it permits multiple uses within allotments provided that requisite international protection is provided. The U.S. urged that the method adopted should provide ample opportunity to re-use individual channels. Moreover, the method should recognize that administrations will construct and operate stations under

different schedules. Therefore, the method should preserve the rights of the administrations to develop broadcast operations in the future at times of their choosing.

7. The First Session adopted technical standards for the band 1605-1705 kHz consistent with those applied to the existing AM band. It also adopted additional technical criteria needed to facilitate development of an allotment planning procedure, *e. g.*, spacing requirements between allotment areas. The First Session, however, was unable to resolve two of the technical issues before it: the relationship between electrical and physical antenna heights and the technical basis for sharing the band between broadcast and non-broadcast services in Region 2. Both of these issues were referred to the CCIR for further study.

PREPARATIONS FOR THE SECOND SESSION

8. *Introduction.* In order to prepare for the Second Session, the Commission adopted the *Third Notice of Inquiry* inviting comments on the various international issues to come before it.[10] In addition, the Commission has been involved in several types of conference preparatory activities which were taking place during this intersessional period. For instance, the Industry Radio Advisory Committee and its technical and allocations Subgroups have resumed their consideration of expanded band issues. Also, both the CCIR and the International Frequency Registration Board (IFRB) are performing intersessional studies in preparation for the Second Session of the Conference.[11]

9. *Development of a Plan.* The *Report* of the First Session detailed five principal steps (in the allotment method) to be followed in establishing the plan at the Second Session of the Conference. These basic steps are as follows:

1) Using the appropriate co-channel standardized distance, areas in each country are identified to which a minimum number of channels is allotted;

2) The minimum number of channels to be allotted to each of the above areas is determined;

3) Taking into account the need to minimize adjacent channel interference, the minimum number of allotments are made;

4) The remaining channels are allotted pursuant to decisions of the Second Session;

5) Bilateral or multilateral negotiations take place between neighboring countries as desired.

10. While most issues related to the allotment planning method have been resolved, further refinement of the method by the IFRB is necessary. One of the Board's tasks is to develop a map for Region 2 which depicts the allotment areas in accordance with the first two planning steps described above. In those areas where channels initially will remain unallotted, Conference procedures dealing with such channels will need to be developed. Additionally, the IFRB is performing studies related to the standardized distances that are to be employed for mixed land/sea paths. A final issue that particularly warrants further study is development of procedures to be applied for coordinating adjacent channel assignments in border areas.

11. Although allotment planning allows considerable latitude in its implementation, the United States will need to coordinate extensively along its borders with Canada and Mexico to resolve adjacent channel incompatibilities arising from the allotment of five interleaved channels to each country. The *Third Notice* invited comments directed to the development of coordination guidelines. Likewise, parties were given the opportunity to address the issue of whether the Commission should adopt the allotment plan or a variant of it domestically or instead should use an assignment-based system. Regardless of the system chosen, we asked parties to consider whether the Commission should apply the same levels of protection domestically as are specified internationally.

12. *Other issues.* Other specific areas of inquiry of the *Third Notice* regard technical standards, the text of the draft agreement and provisions for the Travelers Information Stations (TIS). The technical issues remaining concern electrical vs physical height of antennas and sharing criteria between broadcast and non-broadcast services. Parties were invited to provide measurement data to help illuminate the relationship between electrical and physical height. Because actions taken at the Conference could affect the domestic technical assignment criteria that should be applied to the new band, comment was sought on any international action that would have domestic implications. In this connection, consideration was to be given to protection ratios, RF bandwidth limitations, calculation methodologies and contours to be protected, as well as related matters such as groundwave and skywave propagation criteria.[12]

13. Comment also was invited on the the draft agreement developed by the First Session of the Expanded Band Conference, recognizing that it needs to be refined before it is adopted at the Second Session. Only one area of the draft agreement, however, is likely to undergo major revision. The scope of the draft was limited by the agenda of The First Session to embrace only the use of this band by the broadcast service. Subsequently, the Second Session has been empowered to develop regulatory procedures governing the use of the band by other services in Region 2.[13] Accordingly, the draft agreement must be revised to deal with this by defining the relationship between the allotments in the broadcast service and the permitted services, fixed and mobile.[14]

14. In addition, the impact on TIS operations needed to be considered. Earlier, it had become clear that it was not feasible to maintain TIS operations on 1610 kHz. Without international interference protection from new broadcast stations in the expanded band, TIS operations would not be able to provide effective service on 1610 kHz. Based on the work done to date, the most feasible approach appears to involve the use of 1700 kHz for TIS, (presumably on an exclusive basis). Existing 1610 kHz users would move there and new operations would be established on that frequency. Clearly, international coordination with Canada and Mexico are important to the effective implementation of such an approach. Comments were sought only on the international aspects of TIS' spectrum allocation.

CONCLUSIONS REGARDING SECOND SESSION ISSUES

15. *Recommendations regarding a draft agreement.* As noted, one of the main tasks before the Second Session is the development of the text for the final agreement. The

Third Notice offered one possible model for this purpose. It involved the inclusion of appropriate provisions taken from Appendix 30 of the international Radio Regulations. Appendix 30 contains special procedures which are applied to proposed terrestrial uses in a band planned by the Broadcast Satellite Service (BSS). In effect, each such proposal is examined by the IFRB to determine if there is a probability of harmful interference to assignments in the BSS Plan. Here, a similar examination would be made by the IFRB of the impact of non-broadcast uses on the broadcast Plan.

16. Objection to the Appendix 30 approach has been made in comments filed by Offshore Navigation, Inc., (ONI) a company engaged in radiolocation operations. In its view, that approach is unacceptable because it forecloses radiolocation operations even if they can be conducted without causing or receiving interference. Instead, it seeks to rely on No. 342 of the Radio Regulations to permit it to conduct operations that do not result in interference. ONI has provided a description of the transmissions it uses and asserts that they could be conducted without impact on broadcast stations. While this may be true, it is important to bear in mind that at a date to be determined by the Second Session the radiolocation service is to become a secondary service in this band. As such, it is to provide full interference protection to both the primary and permitted services in the band while at the same time not receiving interference protection for itself. Thus, the assertion of non-interference is a necessity if radiolocation operations are to continue. It appears that the essence of the issue is not whether the language derives from Appendix 30 or some other source. Rather, it is a function of the status of radiolocation as a secondary service. That being the case, the agreement needs to be revised to include appropriate text to reflect the need of the non-broadcast operations to provide full protection to the broadcasting Plan. Consistent with its status and pursuant to the agreement, individual countries will determine if they wish to authorize such operations in this band, whether under No. 342 or otherwise. The choice of language for the agreement does not alter this situation.

17. Although it has not been the subject of extended comment in this proceeding, the issue of the text for the final agreement has been given careful consideration by the Commission. In addition, it was discussed internationally at the recent Lima meeting of CITEL PTC II, where a revised draft text was introduced for discussion by a member of the IFRB. The revisions in the earlier text were designed to deal with non-broadcast as well as broadcast uses of the band. Although no decision as such was made regarding this text, it met with general support by the countries attending the CITEL meeting. The Commision believes that this text with minor revisions is appropriate for adoption at the Second Session. Accordingly, the revised text will be forwarded as an FCC recommendation for a United States proposal to the Second Session. The recommended agreement text is attached as an appendix. As explained below, this is the only area for which a specific recommendation is warranted.

18. *Technical issues.* As noted previously, there were two technical issues not resolved by the First Session: the relationship between physical and electrical antenna heights and the sharing of the band between broadcast and non-broadcast uses. As to the former, considerable study has been given to this topic by the Radio Advisory Committee and by the CCIR to determine whether it would be possible to develop a more accurate assessment of an AM tower's electrical height than that currently in use in Region 2. The Technical Subgroup of the Radio Advisory Committee conducted a study of the information provided by U.S. stations operating on frequencies above 1500 kHz. This study revealed no correlation between physical and electrical antenna heights that would permit a more accurate assessment of a tower's electrical height than that currently utilized by Region 2. Likewise, the work of the CCIR proved to be inconclusive, and it, too, was unable to offer specific recommendations. Based on these studies, we believe that the asserted correlation between physical heights and electrical heights does not exist. Thus, when this issue was discussed at the recent CITEL PTC II meeting (held in Lima, Peru, August 3-7, 1987), there was agreement that this subject was not a practical one for resolution by the Conference and that electrical height in the band 1605-1705 kHz should be based upon "free space" calculations as is the case in the band 535-1605 kHz. In other words, the electrical height is to be determined using the velocity of transmission in a vacumn rather than adjusting for velocity of transmission in the tower itself.

19. Another technical matter left for resolution at the Second Session of the Conference is the subject of "sharing criteria." At the present time, in Region 2, the band 1605-1705 kHz is allocated to the fixed, mobile and aeronautical radionavigation services on a primary basis and to the radiolocation service on a secondary basis. However, on a date to be decided by the Expanded Band Conference, the band 1605-1625 kHz is allocated to the broadcasting service on an exclusive basis and the band 1625-1705 kHz is allocated to the broadcasting service on a primary basis, to the fixed and mobile services on a permitted basis and to the radiolocation service on a secondary basis.[15] Although most countries in the Region intend to use the band for broadcasting, some intend to continue (or even add) non-broadcast uses. As a consequence, it is necessary to develop sharing criteria so that these non-broadcast uses do not cause a derogation in the broadcasting Plan to be adopted. CCIR has investigated this matter and it will submit a report to the Second Session of the Conference. The Conference will need to make a decision on a related matter which pertains to the "service quality" to which non-broadcast uses should be protected.[16] It is the FCC's tentative conclusion that such uses should be protected to a quality of service equivalent to "marginal commercial quality". This would ensure the continued utility of such non-broadcast uses without imposing excessive contraints upon the broadcast service.

20. *Treatment of TIS operations.* A significant number of TIS stations now operate on 1610 kHz.[17] Some of these stations are licensed by the Commission. Others, operated by federal agencies, such as the Department of Interior, are the responsibility of the National Telecommunication and Information Administration. Under current regulation, all TIS stations operate outside the 535 - 1605 kHz band. At present, TIS operations are required to protect AM stations on adjacent channels but TIS facilities are not themselves afforded protection from such stations. Thus, while TIS operators must locate where adequate service can be provided, they must do so without causing interference. While this has presented little difficulty in the past, it could become a significant problem once broadcast use of the expanded band takes place.

21. This matter received considerable attention by the Allocation Subgroup of the Radio Advisory Committee as well as in various interagency meetings. As mentioned in the *Third Notice*, it became clear that it was not feasible to maintain TIS on 1610 kHz. Moreover, without international interference protection from new broadcast stations in the expanded band, TIS operations would not be able to provide effective service on 1610 kHz. As we observed in the *Third Notice*, the most feasible approach appears to involve the use of 1700 kHz for TIS, (presumably on an exclusive basis). Commenters support the move by existing 1610 kHz users to 1700 kHz which also would be available for new TIS operations. It is recommended that for purposes of international interference protection TIS be considered as a broadcast service. However, it is not feasible to expect that international interference protection would be specifically geared to TIS operations. Instead, interference protection for TIS or other broadcast operations would be derived from the allotment Plan adopted by the Conference. Nonetheless, effective coordination with Canada and Mexico is essential and can play an important part in maximizing the opportunity for these stations to offer effective service.

22. *Inter-regional sharing.* In addition to sharing criteria designed to deal with sharing the band between broadcast and non-broadcast uses within the Region, there is a concern regarding possible interference because of the sharing of the band with other uses in other ITU Regions. In particular, Maritime Mobile Service operations in Region 1 in the bands 1605.5-1625 kHz and 1635-1800 kHz could cause interference to broadcasting in Region 2. Although the Second Session will be a regional conference and, therefore is not competent to adopt standards applicable outside that Region, we believe a recommendation from the Second Session as to the technical standards for inter-regional interference to be adopted by IFRB would be appropriate. The Lima CITEL PTC II meeting adopted a resolution that, when the IFRB considers the compatibility between assignments made according to the Region 2 Broadcasting Plan and those of the Maritime Mobile Service in Region 1, the analysis should be carried out on the basis of groundwave propagation for the latter service. In other words, no protection to skywave service would be provided. The U.S. supported this position at the Lima CITEL PTC II meeting.

23. *Development Of A Regional Plan* The major portions of the technical criteria for use of the expanded band as a broadcast service have already been adopted at the First Session of the Conference. Therefore, the bulk of the work at the Second Session will be devoted to the development of a regional plan for broadcast use of the expanded band. As the First Session chose an allotment rather than an assignment plan to distribute channels, current planning will be framed in terms of the effect of one allotment on other allotments.[18] For planning purposes, standardized separations between co- channel allotment areas have been adopted. The need for an additional refinement to the allotment procedures was identified at the Lima CITEL PTC II meeting. It involves the use of the "pairing" concept, which allows for more efficient allotments than otherwise would be possible. As noted at the Lima CITEL PTC II meeting, additional work is needed so that the Second Session of the Conference will have complete studies using 450 km, 500 km and 600 km as standardized distances for mixed land and sea paths.[19] With such data, the Second Session will be able to properly balance the trade-offs of more available frequencies for some allotment areas against increases in interference resulting from shorter distances between allotment areas. Once these studies are completed, it will be possible to formulate recommendations concerning the most desirable mixed path distance(s) to be used for development of the allotment areas.

24. The planning techniques adopted at the First Session are based on co-channel considerations primarily. This is so because the allotment planning methodology is based on the re-use of the same frequency at a given standardized distance. Because these co-channel limitations are the most restrictive, they provided the general outline of the allotment areas. Within allotment areas, additional, albeit lesser, restrictions are imposed by the need to consider adjacent channel allotments and assignments. The Second Session will need to take these adjacent channel problems (especially first adjacent) into account as frequencies are alloted. Since a fully automated approach to evaluating adjacent channel situations (analogous to the co- channel situation) has not been found, it will not be possible to eliminate all first adjacent channel conflicts between all geographically adjacent countries.[20] However, we anticipate that the development of the Plan at the Second Session can avoid the potential for many first adjacent channel imcompatibilities between countries by judicious assignment of frequencies. Nevertheless, in many cases, such as when only two countries share the ten frequencies, it is simply impossible from a technical standpoint to provide that all allotments can be implemented without regard to first adjacent channels in other countries. Thus, in general throughout the Region, it will be necessary that the remaining adjacent channel situations be handled via bilateral and/or multilateral agreements between and/or among the affected countries.[21]

25. In the event that such agreements do not exist, or in the event of an unsuccessful application of such agreements, then the most appropriate and effective manner of resolving these situations would be a procedure similar to the one incorporated in International Radio Regulations Nos. 1506 and 1509, with appropriate modifications to apply to the band 1605-1705 kHz. These regulations provide that when coordination has not been successfully effected with respect to the probability of harmful interference, the IFRB will take into account the frequency assignments for transmission or reception already recorded in the Master International Frequency Register.

26. Participants at the Lima CITEL PTC II meeting, noting that the Second Session of the Conference will last less than three weeks, suggested that other intersessional tasks (in addition to completion of the studies discussed above) be undertaken so as to facilitate the work at the Second Session.[22] A suitable resolution requesting that the additional intersessional tasks be carried out has been adopted by CITEL and sent to the IFRB for consideration. It is understood that IFRB will not be able to perform these tasks with its own staff, and as a result, will need assistance from various countries in carrying this effort. The Commission is fully prepared to assist in this effort.

27. In view of the foregoing, and pursuant to Sections 4(i) and 303 of the Communications Act of 1934, as amended, IT IS ORDERED, That the attached Recommendation for United States Proposal to the Second Session IS ADOPTED for submission to the Depatment of State.

28. For further information, please contact Freda Lippert Thyden of the Mass Media Bureau at (202) 254-3394, or John Boursy of the Mass Media Bureau at (202) 634-6315.

FEDERAL COMMUNICATIONS COMMISSION

H. Walker Feaster, III
Acting Secretary

FOOTNOTES

[1] For simplicity, we shall refer to this Regional Administrative Radio Conference (RARC) as the Expanded Band Conference. Pursuant to Resolution No. 1 of the Plenipotentiary Conference of the International Telecommunication Union Conference (Nairobi, 1982), the Expanded Band Conference was scheduled to be held in two sessions. Its purpose is to implement the action of the 1979 World Administrative Radio Conference which revised portions of the frequency allocation tables of the International Radio Regulations to make this band available for broadcasting on a primary basis in Region 2 (the Western Hemisphere). The use of this band in other areas of the World is beyond the scope of this Conference.

[2] *First Notice of Inquiry*, 49 Fed. Reg. 21419, May 21, 1984; and *Second Notice of Inquiry*, 50 Fed. Reg. 2077, Jan. 15, 1985.

[3] *First Report*, 50 Fed. Reg. 33844, August 21, 1985; and *Second Report*, 51 Fed. Reg. 8706, March 13, 1986.

[4] The Second Session of the Conference is scheduled to take place in Rio de Janeiro, Brazil from May 23 through June 9, 1988.

[5] The final text of the Regional Agreement and the associated Broadcasting Plan are to be included in the Final Acts of the Conference.

[6] 52 Fed. Reg. 27570, July 22, 1987.

[7] Comments also were sought on inter-regional sharing issues that arise because in both Region 1 (Europe and Africa) and Region 3 (Asia and Oceania) this band is used by various non-broadcast services.

[8] Additionally, various meetings were held with other administrations on a bilateral or multilateral basis. Domestically, various federal agencies participated in an Ad Hoc group preparing for the Conference. Finally, the FCC Industry Radio Advisory Committee addressed issues concerning the Expanded Band Conference.

[9] In the *Second Report*, the Commission also adopted a recommendation that a maximum power of 10 kW be used in implementing the Plan.

[10] For a summary of comments filed in response to the *Third Notice*, see Appendix C.

[11] FCC representatives are participating in these studies. In addition, the Commission will continue to meet with other federal agencies on matters of mutual concern. Bilateral and multilateral meetings with other administrations in Region 2 also are anticipated. Likewise, there are meetings of Permanent Technical Committee II (broadcasting) of CITEL to consider issues expected to arise at the Second Session of the Conference.

[12] Although the First Session adopted technical criteria consistent with those applied in the existing band, domestic standards may vary provided other administrations are not adversely affected. It is important to note that there will be little opportunity at the Second Session to modify the technical criteria adopted at the First Session. This is important, as the Commission issued a *Notice of Inquiry* in MM Docket No. 87-267 to review the technical assignment criteria applied domestically to the existing band. Thus, in the *Third Notice*, comment was requested on the desirability of applying any new technical criteria that may be developed as an outgrowth of that proceeding.

[13] Originally, this conference was empowered to deal with broadcasting uses of the expanded band, but by action of the Administrative Council of the ITU, its scope has since been enlarged to cover all uses of the band within the Region. In addition, Resolution No. 953 adopted at the 41st session of the Administrative Council adopted the agenda for the 1988 Space Conference (ORB-88). The agenda includes as item 15 the following: "to consider and, if appropriate, revise No. 480 of the Radio Regulations only to the extent necessary to ensure that implementation of broadcasting stations in Region 2 in the band 1605 - 1705 kHz is without prejudice to the regional broadcasting plan adopted at the Second Session of RARC BC-R2". Appropriate text is to be developed at the Second Session. This situation arises because, unlike World Conferences, Regional Conferences are not empowered to revise the Radio Regulations. As a consequence, the Final Acts of a Regional Conference are not binding as to non-signatories. Thus, a revision of No. 480 by ORB-88 is necessary to ensure that the actions of non-signatories are not in derogation of the broadcasting Plan.

[14] The *Third Notice* observed that one possible model for such action was found in Article 6 of Appendix 30 of the International Radio Regulations. In that Article, terrestrial stations in a band planned by the Broadcasting Satellite (BSS) are made subject to additional procedures. These procedures require that any proposed fixed or mobile service registration be examined by the IFRB to determine if there is a probability of harmful interference to the assignments in the BSS Plan.

[15] International Radio Regulation No. 419 provides that permitted and primary services have equal rights, except that, in the preparation of frequency plans, the primary service, as compared with the permitted service, shall have prior choice of frequencies.

[16] CCIR recommendation 240-3 generally recognizes three service qualities, *i. e.*, good commercial quality, marginal commercial quality, and just usable.

[17] Others operate on 530 kHz, but these stations are outside the scope of the current proceeding.

[18] Allotment planning was chosen because of its much greater flexibility. It allots channels to areas rather than specific locations and thus does not require the specification of facilities in advance. Not only does this permit changes in location or station facilities, it permits multiple uses within allotment areas provided requisite international protection is provided. In addition, the allotment method avoids the need for the extensive coordination otherwise required to resolve the incompatiblities arising out of an assignment plan. Finally, for countries wishing to delay implementation of broadcasting in the new band, allotment planning protects their opportunity to implement stations in the future.

[19] A more detailed explanation of the "pairing" concept and the other aspects of the allotment planning methodology can be found in Appendix B.

[20] Because the planning method is based on a power of one kilowatt, the second-adjacent and third-adjacent considerations are sufficiently reduced so they can generally be ignored in developing the allotment plan. However, they will assume a greater importance in making actual assignments.

[21] In the case of the continental U.S., we anticipate that our excellent bilateral relationships with Canada and Mexico will lead to effective arrangements between us in regard to adjacent channel coordination.

[22] These tasks consist of the following items:

a. Preparation of lists showing how all of the allotment areas are linked to each other, using mixed path distances of 450, 500, and 600 km.

b. Preparations of maps showing stations on 1600, 1590, and 1580 kHz along with their pertinent contours, for assistance in allotting 1610, 1620, and 1630 KHz.

c. Development of draft allotment plans, based on mixed path distances of 450, 500, and 600 km. The draft plans would incorporate the pairing concept described in Appendix B.

APPENDIX A

PROPOSALS RECOMMENDED BY THE

FEDERAL COMMUNICATIONS COMMISSION

FOR THE SECOND SESSION OF THE REGION 2

ADMINISTRATIVE RADIO CONFERENCE

TO PLAN THE USE OF THE BAND 1605 - 1705 KHZ

IN REGION 2

Introduction

To assist the Conference in carrying out its responsibilities, the United States has developed proposals for an agreement which can accommodate future changes, technical innovation and effective domestic implementation. These proposals are fully consistent with the decisions made at the First Session. These proposals are designed to provide flexibility in the implementation of the allotment plan, thereby permitting the growth of the MF broadcasting service in the 1605-1705 kHz band in the Western Hemisphere.

The United States believes that in order to achieve these objectives, broadcasting standards developed for the expanded band should be consistent with the standards applied to the existing MF broadcasting band. Likewise, appropriate criteria should be adopted for the use of the band by non-broadcast services to ensure that such use is not in derogation of the allotment plan for the broadcast use of the expanded band.

There are several important tasks to be performed at the Second Session of the Conference, involving the development of Final Acts containing the text of the Regional Agreement on the use of the band 1605 - 1705 kHz. The Second Session, originally scheduled for three weeks has been shortened to two weeks and four days. The extremely short duration of the Second Session of the Conference and the enlargement of its scope to encompass all uses of the band, non-broadcast as well as broadcast, emphasizes the need to address the issues before it in the most efficient and expeditious manner. For this reason the United States believes that it would be helpful to the deliberations of the Second Session to have before it a text incorporating proposed revisions identified during the intersessional period. To this end, the United States has developed draft text for consideration by the Conference. It should be noted that the proposed text provides a complete document rather than simply a listing of suggested changes to the Report. It is believed that this approach can facilitate the work of the Conference. Overall, the goal has been to provide a means of facilitating the timely participation of administrations in a full and active manner in the decisions to be reached on the various issues to be resolved at the Conference.

The U.S. Proposal has been developed mainly from the Report to the Second Session of the Conference (First Session, Geneva, 1986) with minor editing and restructuring of the text. It also takes into account work done at meetings of Permanent Technical Committee II (PTC II) of the Interamerican Telecommunications Conference (CITEL), particularly the report of the IFRB on its intersessional work. Thus, the U.S. Proposal consists of a draft Agreement and three annexes. Annex 1 contains the technical data; Annex 2 contains the planning criteria and Annex 3 contains the Plan of allotments and allotments converted to assignments at the Second Session of the Conference. Also, an attempt was made to closely align the structure of the proposed text with the text of the Rio Agreement, 1981. This has been done since the First Session decided that the extended band would be, for all practical purposes, an extension of the existing band with respect to technical criteria. In this

connection, it should be noted that various references to figures or sections have had to be changed to correspond to the new structural arrangement. Also, slight additional restructuring of the text has been made to improve its readability.

Regional Agreement

For the sake of clarity and to facilitate its consideration, the various sections of the proposed text are discussed briefly to indicate in what respects (if any) they are changed from the draft text developed at the First Session and to explain the purpose behind any changes which are being proposed. In several cases, the changes are solely to clarify existing text or to provide appropriate cross-references. Such is the case with the changes proposed to Article 1, Article 3 and Article 4. In other instances, new ideas are introduced. Such is the case with the Preamble, Article 2 and Article 6, all of which reflect the fact that the scope of the conference has been enlarged to deal with the fixed and mobile as well as broadcast services. A new Article 5 has been added to deal with the procedures to be used to make modifications to the Plan, and an effective date, derived from Recommendation 504 (and referred to in No. 481 of the Radio Regulations), has been inserted in Article 13. Although various changes have been introduced into this draft text, in all respects it is reflective of the intent of the draft text adopted at the First Session.

Preamble - Revised to reflect applicability of the agreement to the fixed and mobile services as well as the broadcast service.

Article 1 - Revised to include cross-references to appropriate annexes.

Article 2 - Revised to reflect applicability of agreement to fixed and mobile services in the use of frequency band 1625-1705 kHz.

Article 3 - 3.2 revised to include cross-reference to Article 6.

Article 4 - 4.1.1.1 has been revised to refer to 2.1 of Annex 2.

4.1.1.2 has been revised to refer to section 4 of Annex 2 which concerns adjacent channel criteria.

4.1.1.3 has been revised to refer to 3.1 and 3.3 of Annex 2.

4.1.2 has been revised to clarify its applicability to cases not coming under the provisions of 4.1.1

4.1.2.2 has been revised to refer to 3.1 of Annex 2.

4.2.1 has been revised to refer to Annex 2.

4.2.1.1 has been revised to make it clear that the allotments appearing in the Plan are to be protected (in accordance with the provisions of Annex 2).

4.2.1.2 has been revised to include protection to fixed and mobile stations recorded in the Master Register with a favorable finding.

4.2.2 has been revised to refer to Annex 2.

4.4 has been revised to include additional language in the the parenthetical in 4.4 to clarify the need to comply with 4.2.2

Article 5 - New Article setting forth procedures to be used to make modifications to the Plan. Such procedures can facilitate arrangements between administrations to modify their allotments to make the most efficient use of the band while at the same time providing protection to the allotments of other administrations.

Article 6 - New Article, derived from intersessional work of IFRB, dealing with notifications of non-broadcast assignments. Such provisions are needed now that the scope of the conferences has been enlarged to include non-broadcast uses.

Article 7 - Former Article 5 (unchanged).

Article 8 - Former Article 6 (unchanged).

Article 9 - Former Article 7 (unchanged).

Article 10 - Former Article 8 (unchanged).

Article 11 - Former Article 9 (unchanged).

Article 12 - Former Article 10 (unchanged).

Article 13 - Former Article 11 revised to specify entry into force at 0001 hours UTC on 1 July, 1990.

Article 14 - Former Article 12 (unchanged).

Annexes to the Agreement

The United States has been fully satisfied with with the results embodied in the Report to the Second Session. Therefore, as was the case with the text for the agreement itself, the proposed text for the annexes to the agreement has been derived from the Report and is fully consistent with it. However, it

has been revised as needed to put it in the appropriate structure for inclusion in the final acts of the Conference. This structure has been derived from that used for the Region 2 MF Broadcasting Agreement (Rio de Janeiro, 1981). It should be noted that the United States anticipates the submission of additional proposals on the subject of standardized distances for mixed and sea paths and related planning criteria and on the subject of sharing criteria for broadcast and the fixed and mobile services.

The specific differences between the U.S. Proposal and the technical aspects of the Report are as follows:

- Annex 1 to the draft agreement includes the first five chapters of the Report. Chapters one through four are essentially identical to the Report with only minor changes having been made to these chapters. For instance, language (e.g., "shall be" vs "is") has been modified to reflect the change from a report to be considered by the Conference to text suitable for a final Regional Agreement. Also, the asterisk and note at the beginning of Chapter 3 have been deleted since they are not necessary for the Agreement; and, section 3.5 which reads, "NOT ALLOCATED", has been deleted with the subsequent sections renumbered.

- Appendix 1 to Annex 1, containing the Atlas of Ground Conductivity has been added. This follows the approach taken in the 1981 Rio Agreement. Appendices 2 and 3 contain calculation methods for antenna systems and are as given in the Report.

- Chapter 5 of Annex 1, which is intended to specify sharing criteria pertaining to the fixed and mobile services, is in square brackets in the U.S. proposal. The U.S. anticipates submission of subsequent proposals on this matter.

- Planning criteria which were the subject of chapter 6 in the Report have been incorporated where appropriate into a separate annex, Annex 2. The text has been edited to reflect the work of the recent Panel Of Experts, Geneva (January 1988). Moreover, some sections of the text has been expanded to provide greater specificity and to address several of the permutations that will occur as allotments and non-allotted channels are implemented.

- Included as a separate annex, Annex 3, is the Plan which is to be developed at the second session.

The following discussion identifies each of the proposed changes to the technical annexes and highlights the specific differences between the U.S. Proposal and the Report. It should be noted that the technical portion of the draft U.S. Proposal includes three annexes and three associated appendices.

-- Chapters one through five of the Report have been included in the draft Annex 1, "Technical Data", using the same chapter terminology as the Report. Specific changes from the Report are:

- Section 1.1.16: reference to Annex 2 has been added.

- Section 2.1.1, first paragraph: reference to Appendix 1, Atlas of ground conductivity is added.

- Section 2.2.4: Nocturnal variation of skywave field strength is suppressed since it has no application in the Agreement.

- Section 2.2.2, second paragraph: modified to clarify text and to prescribe use of Figure 2.3a to determine compliance with the Agreement.

- Section 2.2.5 is renumbered as Section 2.2.4.

- Table 2.II was modified to correct title.

- Figure 2.7 is suppressed since it has no application in the Agreement.

- Chapter 3, heading: suppress asterisk and the associated note at bottom of page.

- Section 3.1, paragraph 1, line 1: replace "shall be" with "is".

- Section 3.2, paragraph 1, line 1: replace "shall be" with "is".

- Section 3.2, paragraph 2, line 1: replace "could" with "may".

- Section 3.3, paragraph 1, line 1: replace "shall be" with "is".

- Section 3.4, paragraph 1, line 1: replace "As indicated in" with "In accordance with".

- Section 3.4, paragraph 1, lines 2 and 3: modified to prescribe a frequency tolerance consistent with the maximum power to be permitted.

- Section 3.5: suppress.

- Section 3.6: renumber as Section 3.5.

- Section 3.7: renumber as Section 3.6.

- Section 3.8: renumber as Section 3.7.

- Section 3.8.1: renumber as Section 3.7.1 and replace "shall be" with "is".

- Section 3.8.2: renumber as Section 3.7.2.

  paragraph 1, line 1: replace "shall be" with "is".

  paragraph 2, line 1: replace "shall be" with "is".

- Section 4.1, paragraph 1: modified to refer to Figure 2.3.

  paragraph 3: modified to refer to Figures 2.3a and 2.5 as well as Table 2.II.

- Section 4.2, paragraph 1, line 2: replace "Annex 1" with "Appendix 2".

- Section 4.3.1, paragraph 1, line 1: replace "Annex 2" with "Appendix 3".

- Section 4.3.3, paragraph 1, line 3: replace "Annex 2" with "Appendix 3".

- Chapter 5, heading: place the current text in brackets and add the following language, "[New text to be developed]".

- Add new appendix, Appendix 1, "Atlas of ground conductivity" (not contained in the Report) following Chapter 5.

- Rename Annex 1 of the Report (pp. 61-65) as Appendix 2 (to Annex 1), "Calculation of directional antenna patterns", and place it after Appendix 1.

- Rename Annex 2 of the Report (p. 67) as Appendix 3, "Equations for the calculation of the normalized vertical radiation from top-loaded and typical sectionalized antennas", and place it after Appendix 2.

- Rename Chapter 6 of the Report as "Annex 2 (to the Regional Agreement to establish a Plan for the Broadcasting Service in the Band 1 605 -1 705 kHz in Region 2".

- Add a new annex, Annex 3, "Plan of allotments and allotments converted to assignments", and place it after Annex 2.

DRAFT REGIONAL AGREEMENT FOR THE USE ~~BY THE BROADCASTING SERVICE~~ OF THE BAND 1605 - 1705 KHZ IN REGION 2

PREAMBLE

~~Noting No. 480 of the Radio Regulations, which provides that:~~

~~In~~ Recognizing that in Region 2 the use of the band 1605-1705 kHz by stations of the broadcasting service shall be subject to a Plan to be established by a regional administrative radio conference;

fully respecting the sovereign right of each country to regulate within its territory the use of the frequency band 1605-1705 kHz by the broadcasting service, and to reach special arrangements regarding this service with such countries as it may consider appropriate, without prejudice to other administrations;

seeking to facilitate mutual understanding and cooperation among the Members of Region 2 in achieving a satisfactory broadcasting service in MF band 1605-1705 kHz and, to the extent consistent with the Plan to be established for the broadcast use of this band, to make provision for the Fixed and Mobile use of the band 1625 -1705 kHz;

recognizing that all countries have equal rights, and that, in the application of the Plan and its provisions, the needs of each country, and in particular those of developing countries, shall be met as far as possible, and

acknowledging that mutual protection of the broadcasting service is a major objective of all countries and that mutual protection of the fixed and mobile services in a manner consistent with full protection to the Plan and its provisions is likewise a major objective of all countries, in order to ensure better coordination and the use of more efficient facilities;

the delegates of the Members of the International Telecommunication Union assembled in Rio de Janeiro at a regional administrative conference convened pursuant to the International Telecommunication Convention (Nairobi, 1982), have adopted, subject to approval by the competent authorities of their respective countries, the following provisions relating to the broadcasting service in Region 2 for the frequency band between 1605-1705 kHz.

ARTICLE 1

1. For the purpose of the Agreement, the following terms shall have the meanings defined below.

1.1 Union: The International Telecommunication Union.

1.2 Secretary-General: The Secretary-General of the Union.

1.3 IFRB: The International Frequency Registration Board.

1.4 CCIR: The International Radio Consultative Committee.

1.5 Convention: The International Telecommunication Convention.

1.6 Radio Regulations: The Radio Regulations supplementing the provisions of the Convention.

1.7 Region 2: The geographical area defined in No. 394 of the Radio Regulations, Geneva, 1979.

1.8 Master Register: The Master International Frequency Register.

1.9 Provisions: The provisions adopted herein that are associated with the Plan.

1.10 Agreement: This Instrument and its Annexes.

1.11 Plan: The Allotment Plan in Article ~~6~~ 8 and the associated provisions[1].

1.12 Administration: Any governmental department or service responsible for discharging the obligations undertaken in the Convention and the Radio Regulations.

1.13 Contracting Member: Any member of the Union which has approved the Agreement or acceded to it.

1.14 Affected Administration: An administration within whose territory the signal of a proposed assignment of another administration exceeds the value prescribed in ~~{section 3.5 of this Report}~~ 3.5 of Annex 1.

1.15 Allotment: Entry in the Plan of a designated broadcasting service in an allotment area under the conditions specified in the Plan. Each allotment included in the Plan may be used for one or more assignments using the technical criteria specified in ~~{section 6.3 of this Report}~~ Annex 2.

1.16 Allotment Area: Specifically defined geographical area within a country to which one or more channels are allotted.

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1 The allotments converted into assignments appear as Part B of the Plan.

ARTICLE 2

Frequency Band

2.1 The provision of the Agreement shall apply to the broadcasting service in the frequency band 1605-1705 kHz and to the fixed and mobile services in the frequency band 1625-1705 kHz as allocated to Region 2 under Article 8 of the Radio Regulations.

ARTICLE 3

Execution of the Agreement

3.1 The Contracting Members shall adopt for their stations in Region 2 in the frequency band which is the subject of the Agreement the technical characteristics and standards which are in conformity with the Agreement.

3.2 The Contracting Members shall not bring into use frequency assignments except under the conditions set out in Articles 4 and 6 of the Agreement.

3.3 The Contracting Members undertake, to the extent possible, to avoid or to reduce any harmful interference.

ARTICLE 4

Implementation of the Plan and Notification of Frequency Assignments in the Broadcasting Service

4.1 Assignments corresponding to an allotted channel

4.1.1 An administration may at any time, without the need for coordination, make assignments corresponding to any of its allotments, at one or more locations within the respective allotment area, provided that:

4.1.1.1 - the characteristics of the assignments are within the standardized parameters given in 2.1 of Annex 2;

4.1.1.2 - the adjacent channel criteria of section 4 of Annex 2 are satisfied;

4.1.1.3 - the criteria of 3.1 and 3.3 of Annex 2 are met in cases where the characteristics of the assignments exceed the values of the standardized parameters.

4.1.2 In cases not coming within the provisions of 4.1.1, an Administration may, after the successful completion of coordination, make assignments corresponding to its allotment, at one or more locations within the respective allotment area, provided that:

4.1.2.1 - where the adjacent channel criteria are not met, coordination has been effected with those administrations concerned;

4.1.2.2 - where in the case the characteristics of the assignment exceed the values of the standardized parameters and the criteria of 3.1 of Annex 2 are not met, coordination has been effected with those administrations concerned.

4.2 Assignments corresponding to channels not allotted to the area

4.2.1 An Administration may at any time, without the need for coordination, make an assignment on a channel not allotted to it provided that the characteristics of the assignment satisfy the criteria set out in Annex 2 with respect to:

4.2.1.1 - the allotments of another administration that are in the Plan, in accordance with provisions in Annex 2; and

4.2.1.2 - any broadcasting, fixed or mobile station of another Region 2 administration that is not assigned on a channel allotted to that administration in the Plan and which has been previously recorded in the Master Register with a favorable finding.

4.2.2 An Administration may make an assignment on a channel not allotted to it, the characteristics of which do not satisfy the criteria set out in Annex 2 with respect to 4.2.1.1 and 4.2.2.2, provided that such use has been successfully coordinated with the affected administration(s).

4.3 When an administration proposes to bring into use an assignment in conformity with the Agreement, it shall notify it to the IFRB in accordance with Article 12 of the Radio Regulations. Any such assignment recorded in the Master Register as a result of the application of Article 12 of the Radio Regulations shall bear a special symbol under the Remarks Column and a date in Column 2a or in Column 2b.

4.4 When the IFRB receives an assignment notice which is not in conformity with the Agreement, (including those in conflict with 4.2.2 above), it shall return the notice to the notifying administration.

4.5 If the notifying administration resubmits the notice with or without modification and insists that it be reconsidered, and if the Board's finding

remains unfavorable, the notice shall be returned to the notifying administration.

Article 5

Procedure for Modification of the Plan

5.1 The procedure set forth in this article applies when an administration seeks to modify the Plan to:

- Enter into the Plan a modification of an existing allotment; or

- Enter into the Plan a new allotment.

5.2 An administration seeking modification of the Plan shall obtain the agreement of any affected administration.

5.3 The administration seeking to modify the Plan shall send to the IFRB the information set forth in [ ] regarding such proposed modification. Affected administrations are encouraged to coordinate the development of proposed modifications to the Plan and may file such proposals jointly.

5.4 The IFRB shall determine, on the basis of the separation distances in Annex 3, those administrations whose allotments or assignments are considered as affected and shall publish the information in a special section of its weekly circular.

5.5 The IFRB shall send a telegram to the administrations listed in the special section of the weekly circular as being affected by the proposed modification, drawing their attention to the information it contains, and including the results of the IFRB's calculations.

5.6 The IFRB shall provide an opportunity for affected administrations to provide their comments on the proposed modification. Upon request, to the extent feasible, the IFRB shall provide such additional technical information as may be requested of it by the administration proposing the modification or by administrations which would be affected by it. In order to be considered, such request shall be received no later than 60 days following the date of the circular letter announcing the proposed modification.

5.7 In order to be considered, such comments shall be received by the IFRB no later than 60 days from the date of the circular letter announcing the proposed modification. Provided, however, that upon request by an affected administration, this date may be extended by a period of up to 90 days to permit the consideration of additional information requested from the IFRB under paragraph 5.6.

5.8 In the event no comments are received within the 60-day period set forth in 5.7 (or such additional period as is provided to an affected administration in accordance with 5.7), the affected administrations are deemed to have agreed to the proposed modification.

5.9. If, in seeking the agreement of affected administrations, the proposing adminstration modifies its original proposal, the procedures set forth above shall be followed with regard to any adminstration that has not already indicated to the IFRB their agreement to the modification.

5.10 The IFRB shall publish in a special section of its weekly circular the modifications to the Plan which shall have been effectuated, setting forth the administrations and allotments affected thereby. Such modifications shall be entered into the Plan and shall be considered as being in conformity with the Plan and shall be accorded the same status as allotments already appearing in the Plan.

ARTICLE 6

Notification of Assignments to Stations of the Fixed and Mobile Services

6.1 When an administration proposes to bring into use an assignment to a station in the Fixed and Mobile Services, it shall notify it to the Board in accordance with Article 12 of the Radio Regulations.

6.2 Upon receipt of such a notice the Board shall in accordance with RR1245 also examine it to determine if it meets the criteria contained in Annex 1 to this agreement.

6.3 If the Board's finding under 6.2 is unfavorable the notice shall be returned to the administration.

6.4 If the administration resubmits the notice with modifications and the finding under 6.2 is still unfavorable, the notice shall be returned to the administration.

6.5 Any such assignment recorded in the Master Register as a result of the application of Article 12 of the Radio Regulations and this article of the Agreement shall bear a special symbol in the Remarks Column and a date in Column 2a or 2b.

ARTICLE 5 7

Special Arrangements

7.1 In order to supplement the procedures laid down in these Provisions, or to facilitate the coordination provided for in Article 4, administrations may conclude or continue special arrangements in conformity with the applicable provisions of the Convention and the Radio Regulations.

ARTICLE 6 8

Plan

[Part A: consists of the allotments in the Region-wide Allotment Plan.

Part B: consists of the assignments developed at the Second Session by administrations converting their allotments to assignments.]

ARTICLE 7 9

Scope of Application of the Agreement

9.1 The Agreement is binding upon the Contracting Members in their mutual relations, but not in their relations with non-contracting countries.

9.2 Should a Contracting Member formulate reservations on the application of any provision of the Agreement, the other Contracting Members shall be free to disregard that provision in their relations with the Member that has made the reservations.

ARTICLE 8 10

Approval of the Agreement

10.1 The signatory Members shall notify the Secretary-General of their approval of this Agreement as soon as possible by depositing an instrument of approval; the Secretary-General shall immediately inform the other Members of the Union.

ARTICLE 9 11

Accession to the Agreement

11.1 Any Member of the Union in Region 2 which has not signed the Agreement may accede to it at any time by depositing an instrument of accession with the Secretary-General, who shall immediately inform the other Members of the Union. Accession shall apply to the Plan as it stands at the time of accession and shall be made without reservation.

11.2 Accession to the Agreement shall become effective on the date on which the instrument of accession is received by the Secretary-General.

ARTICLE ~~10~~ 12

Denunciation of the Agreement

12.1 Any Contracting Member may denounce the Agreement at any time by a notification sent to the Secretary-General, who shall inform the other Members of the Union.

12.2 Denunciation shall become effective one year after the date on which the Secretary-General receives the notification of denunciation.

ARTICLE ~~11~~ 13

Entry into Force of the Agreement

13.1 The Agreement shall enter into force on 1 July, 1990, at 0001 hours UTC.

ARTICLE ~~12~~ 14

Duration of the Agreement

14.1 The Agreement shall remain in force until revised by a competent administrative radio conference.

ANNEX 1

**to the Regional Agreement
to establish a Plan for the
Broadcasting Service in the Band 1 605 - 1 705 kHz
in Region 2**

TECHNICAL DATA

to be used in the application of the Agreement

CHAPTER 1 - DEFINITIONS, SYMBOLS AND UNITS

1.1 Definitions

In addition to the definitions given in the Radio Regulations, the following definitions and symbols apply.

1.1.1 Broadcasting channel (AM)

A part of the frequency spectrum, equal to the necessary bandwidth of AM sound broadcasting stations, and characterized by the nominal value of the carrier frequency located at its centre.

1.1.2 Nominal usable field strength (E_{nom})

Agreed minimum value of the field strength required to provide satisfactory reception, under specified conditions, in the presence of atmospheric noise, man-made noise and interference from other transmitters. The value of nominal usable field strength has been employed as the reference for planning.

1.1.3 Service area

The area delimited by the contour within which the calculated level of the groundwave field strength is protected from objectionable interference in accordance with the provisions of Chapter 3.

1.1.4 Audio-frequency (AF) signal-to-interference ratio

The ratio (expressed in decibels) between the values of the voltage of the wanted signal and the voltage of the interfering signal, measured under specified conditions, at the audio-frequency output of the receiver. These specified conditions include various parameters such as the frequency separation between the wanted carrier and the interfering carrier, the emission characteristics (type and percentage of modulation etc.), levels of input and output of the receiver and its characteristics (selectivity, sensitivity to intermodulation, etc.).

1.1.5 Audio-frequency (AF) protection ratio

Agreed minimum value of the audio-frequency signal-to-interference ratio corresponding to a subjectively defined reception quality.

1.1.6 Radio-frequency (RF) signal-to-interference ratio

The ratio (expressed in decibels) between the values of the radio-frequency voltage of the wanted signal and of the interfering signal, measured at the input of the receiver under specified conditions. These specified

conditions include various parameters such as the frequency separation between the wanted carrier and the interfering carrier, the emission characteristics (type and percentage of modulation etc.), levels of input and output of the receiver and its characteristics (selectivity, sensitivity to intermodulation, etc.).

1.1.7 Radio-frequency (RF) protection ratio

The radio-frequency signal-to-interference ratio which, in well-defined conditions, makes it possible to obtain the audio-frequency protection ratio at the output of a receiver. These specified conditions include various parameters such as the frequency separation between the wanted carrier and the interfering carrier, the emission characteristics (type and percentage of modulation, etc.), levels of input and output of the receiver and its characteristics (selectivity, sensitivity to intermodulation, etc.).

1.1.8 Relative radio-frequency protection ratio

This ratio is the difference (expressed in decibels) between the protection ratio when the carriers of the wanted and unwanted transmitters have a frequency difference of Δf (Hz or kHz) and the protection ratio when the carriers of these transmitters have the same frequency.

1.1.9 Daytime operation

Operation between the times of sunrise and sunset at the transmitter site.

1.1.10 Night-time operation

Operation between the times of sunset and sunrise at the transmitter site.

1.1.11 Station power

Unmodulated carrier power supplied to the antenna.

1.1.12 Groundwave

Electromagnetic wave which is propagated along or near the surface of the Earth and which has not been reflected by the ionosphere.

1.1.13 Skywave

Electromagnetic wave which has been reflected by the ionosphere.

1.1.14 Skywave field strength, 50% of the time

The skywave field strength during the reference hour which is exceeded for 50% of the nights of the year. The reference hour is the period of one hour beginning one and a half hours after sunset and ending two and a half hours after sunset at the midpoint of the short great-circle path.

1.1.15 Characteristic field strength (E_c)

The field strength, at a reference distance of 1 km in a horizontal direction, of the groundwave propagated along perfectly conducting ground for 1 kW station power, taking into account losses in a real antenna.

Note 1 - The gain (G) of the transmitting antenna relative to an ideal short vertical antenna is given in dB by the equation:

$$G = 20 \log \frac{E_c}{300} \qquad (1)$$

where:

E_c is expressed in mV/m.

Note 2 - The effective monopole radiated power (e.m.r.p.) is given in dB (kW) by the following equation:

$$e.m.r.p. = 10 \log P_t + G \qquad (2)$$

where:

P_t: station power (kW).

MOD 1.1.16 Allotment

Entry in the Plan of a designated broadcasting channel for use by an administration for the broadcasting service in an allotment area under the conditions specified in the Plan. Each allotment included in the Plan may be used for one or more assignments using the ~~technical~~ planning criteria specified in ~~section 6.3~~ Annex 2.

1.1.17 Allotment area

Specifically defined geographical area within a country to which one or more channels are allotted.

1.2 Symbols and units

Hz:	hertz
kHz:	kilohertz
W:	watt
kW:	kilowatt
mV/m:	millivolt/metre
µV/m:	microvolt/metre
dB:	decibel
dB(µV/m):	decibels with respect to 1 µV/m
dB(kW):	decibels with respect to 1 kW
mS/m:	millisiemens/metre
σ :	ground conductivity

CHAPTER 2 - PROPAGATION

2.1 Groundwave propagation

2.1.1 Ground conductivity

MOD For groundwave propagation calculations in the band 1 605 - 1 705 kHz, use shall be made of the Atlas of Ground Conductivity (see Appendix 1), which contains information communicated to the IFRB in connection with the first and second sessions of the Regional Administrative MF Broadcasting Conference (Region 2), (Buenos Aires, 1980 and Rio de Janeiro, 1981), and subsequent modifications.

The following provisions should also be included:

a) When an administration notifies to the IFRB data intended to modify the Atlas, the IFRB shall so inform all administrations of Region 2. After 90 days from the date on which this information is communicated by the IFRB, the IFRB shall modify the Atlas and communicate the modifications to all administrations.

b) No assignment or allotment in the Plan shall at any time require modification as a result of the incorporation of these new data.

c) Any proposal to modify the Plan shall be considered on the basis of the values appearing in the Atlas on the date the proposal was received by the IFRB.

2.1.2 Field strength curves for groundwave propagation

The curves shown in Figure 2.1 shall be used for determining groundwave propagation in the frequency range 1 605 - 1 705 kHz; these curves are computed for 1 655 kHz.

The curves are labelled with ground conductivities in millisiemens/metre. All curves, except the 5000 mS/m (sea water) curve, are derived for a relative dielectric constant of 15. The sea water curve is derived for a relative dielectric constant of 80.

Annex E to the Report by the first session of the Regional Administrative MF Broadcasting Conference (Region 2) (Buenos Aires, 1980) contains a mathematical discussion relating to the calculation of the groundwave curves. The corresponding computer program is available at the IFRB.

2.1.3 Calculation of groundwave field strength

Using the Atlas of Ground Conductivity, the relevant conductivity or conductivities for the chosen path are determined. If only one conductivity is

representative, the method for homogeneous paths is used. If several conductivities are involved, the method for non-homogeneous paths is used.

2.1.3.1 Homogeneous paths

The vertical component of the field strength for a homogeneous path is represented in Figure 2.1 as a function of distance, for various values of ground conductivity.

The distance in kilometres is shown on a logarithmic scale on the abscissa. The field strength is shown on a linear scale on the ordinate in decibels above 1 μV/m. The graph is standardized for a characteristic field strength of 100 mV/m corresponding to an effective monopole radiated power (e.m.r.p.) of -9.5 dB relative to 1 kW. The straight line marked "100 mV/m at 1 km" is the field strength on the assumption that the antenna is erected on a surface of perfect conductivity.

For omnidirectional antenna systems having a different characteristic field strength, correction must be made according to either of the following equations:

$$E = E_0 \times \frac{E_c}{100} \times \sqrt{P}$$

if field strengths are expressed in mV/m, or:

$$E = E_0 + E_c - 100 + 10 \log P$$

if field strengths are expressed in dB (μV/m)

For directional antenna systems, correction must be made according to either of the following equations:

$$E = E_0 \times \frac{E_R}{100}$$

if field strengths are expressed in mV/m, or:

$$E = E_0 + E_R - 100$$

if field strengths are expressed in dB (μV/m),

where:

E : resulting field strength

E_0 : field strength read from Figure 2.1

E_R : actual field strength at a particular azimuth at 1 km

E_c : characteristic field strength

P : station power in kW.

Figure 2.2 consists of three pairs of scales to be used with Figure 2.1. Each pair contains one scale labelled in decibels and another in millivolts per metre. Each pair can be cut out and trimmed as a unit to be used as sliding ordinate scales. The scales allow graphical conversion between decibels and millivolts per metre, and are used to make graphical determinations of field strengths. Other methods of making calculations on Figure 2.1 may be used, including the use of dividers to adjust for values of E_R that differ from 100 mV/m at 1 km. However, any method used will follow steps similar to those described below.

For both omnidirectional and directional antenna systems the value of E_R must be found. For omnidirectional systems E_R can be determined by using either of the following equations:

$$E_R = E_c \sqrt{P}$$

if field strengths are expressed in mV/m, or:

$$E_R = E_c + 10 \log P$$

if field strengths are expressed in dB (μV/m)

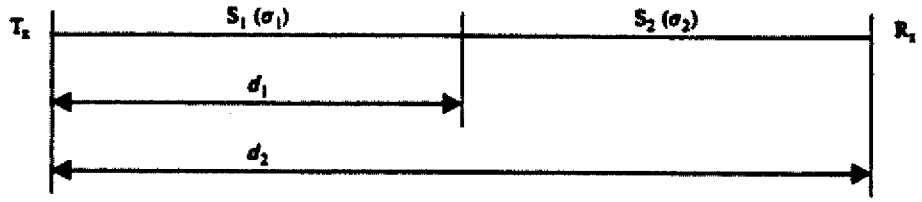
To determine the field strength at a given distance, the scale is placed at that distance with the 100 dB (μV/m) point of the scale resting on the appropriate conductivity curve. The value of E_R is then found on the scale; the point on the underlying graph (which lies underneath the E_R point of the scale) yields the field strength at the given distance.

To determine the distance at a given field strength, the E_R value is found on the sliding scale and that point is placed directly at the level of the given field strength on the graph. The scale is then moved horizontally until the 100 dB (μV/m) point of the scale coincides with the applicable conductivity curve. The distance may then be read from the abscissa of the graph.

2.1.3.2 Non-homogeneous paths

In this case, the equivalent distance or Kirke method shall be used. To apply this method, Figure 2.1 can also be used.

Consider a path whose sections S_1 and S_2 have lengths d_1 and $d_2 - d_1$, and conductivities σ_1 and σ_2 respectively, as shown on the following figure:



The method is applied as follows.

a) Taking section S_1 first, we read the field strength corresponding to conductivity σ_1 at distance d_1 on Figure 2.1.

b) As the field strength remains constant at the point of discontinuity, the value immediately after the discontinuity must be equal to that obtained in a) above. As the conductivity of the second section is σ_2, the curve corresponding to conductivity σ_2 gives the equivalent distance to that which would be obtained at the same field strength arrived at in a). This equivalent distance is d. Distance d is larger than d_1 when σ_2 is larger than σ_1. Otherwise d is less than d_1.

c) The field strength at the real distance d_2 is determined by taking the corresponding curve for conductivity σ_2 and reading off the field strength obtained at the equivalent distance $d + (d_2 - d_1)$.

d) For successive sections with different conductivities, procedures b) and c) are repeated.

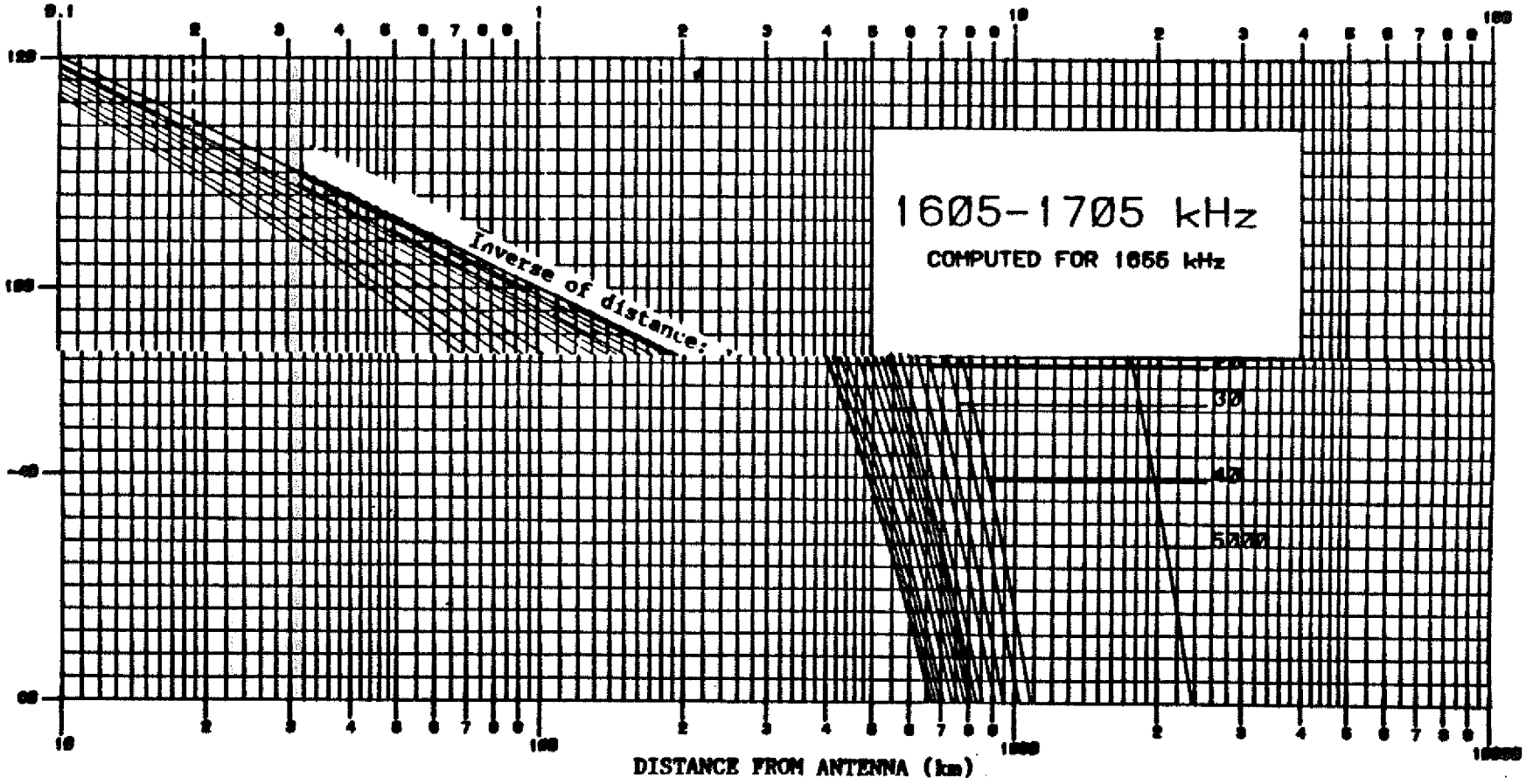


FIGURE 2.1

Groundwave field strength versus distance
(for a characteristic field strength of 100 mV/m)

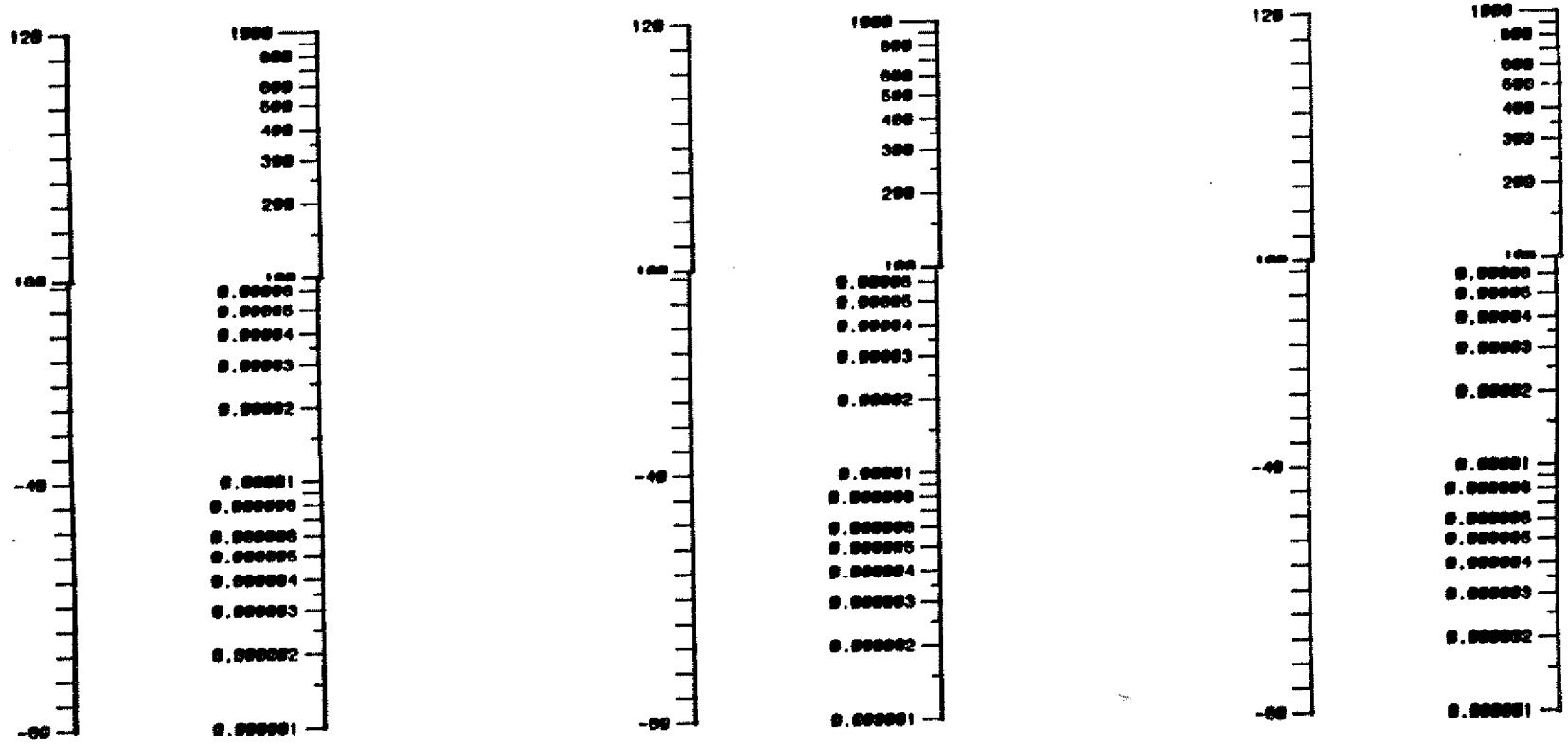


FIGURE 2.2

Scales for use with Figure 2.1

2.2 Skywave propagation

NOC The calculation of skywave field strength shall be conducted in accordance with the provisions which follow.

NOC 2.2.1 List of symbols

d: short great-circle path distance (km)

E_c: characteristic field strength, mV/m at 1 km for 1 kW

f(θ): radiation as a fraction of the value θ=0(when θ=0, f(θ)=1)

f: frequency (kHz)

F: unadjusted annual median skywave field strength, in dB (μV/m)

F_c: field strength read from Fig. 2.6 or Table 2.III for a characteristic field strength of 100 mV/m

F(50): skywave field strength, 50% of the time, in dB(μV/m)

P: station power (kW)

θ: elevation angle from the horizontal (degrees)

2.2.2 General procedure

NOC Radiation in the horizontal plane of an omnidirectional antenna fed with 1 kW (characteristic field strength, E_c) is known either from design data or, if the actual design data are not available, from Fig. 2.3, included for information.

MOD However, Figure 2.3a which shows the characteristic field strength of an antenna based on a 1 ohm resistance loss, ~~as currently used by the IFRB in the framework of the Rio de Janeiro Agreement, 1981. This figure~~ shall be used ~~for compatibility calculations.~~ for calculations to determine compliance with the Agreement.

NOC Elevation angle θ is given by

NOC $$\theta = \arctan\left(0.00752 \cot \frac{d}{444.54}\right) - \frac{d}{444.54} \quad \text{degrees} \qquad (1)$$

$$0° \leq \theta \leq 90°$$

NOC Alternatively, Fig. 2.4 or Table 2.I may be used.

It is assumed that the Earth is a smooth sphere with an effective radius of 6,367.6 km and that reflections occur from an ionospheric height of 96.5 km.

The radiation $f(\theta)$ expressed as a fraction of the value at $\theta = 0$ at a pertinent elevation angle θ can be deterimined from Fig. 2.5 or Table 2.II.

The product $E_c f(\theta) \sqrt{P}$ is thus determined for an omnidirectional antenna. For a directional antenna $E_c f(\theta) \sqrt{P}$ can be determined from the antenna radiation pattern. $E_c f(\theta) \sqrt{P}$ is the field strength at 1 km at the appropriate elevation angle and azimuth.

The unadjusted annual median skywave field strength F is given by:

$$F = F_c + 20 \log \frac{E_c f(\theta) \sqrt{P}}{100} \quad dB(\mu V/m) \qquad (2)$$

where F_c is the direct reading from the field strength curve in Fig. 2.6 or Table 2.III.

Note: Values of F_c in Fig. 2.6 and Table 2.III are normalized to 100 mV/m at 1 km corresponding to an effective monopole radiated power (e.m.r.p.) of -9.5 dB(kW).

For distances greater than 4250 km, it should be noted that F_c can be expressed by:

$$F_c = \frac{231}{3 + d/1000} - 35.5 \quad dB(\mu V/m) \qquad (3)$$

2.2.3 Skywave field strength, 50% of the time

This is given by:

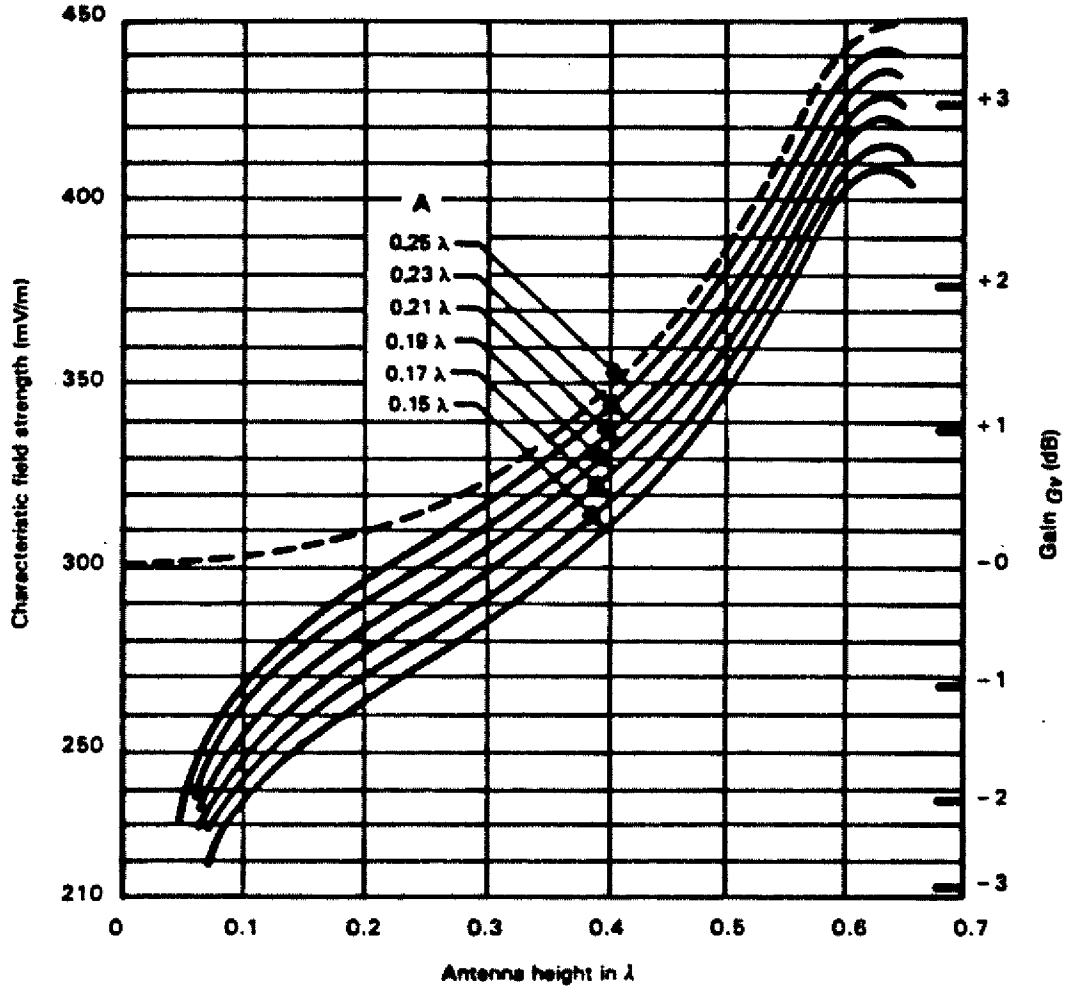
$$F(50) = F \quad dB(\mu V/m) \qquad (4)$$

SUP 2.2.4---~~Nocturnal variation of skywave field strength~~

~~Hourly median skywave field strengths vary during the night and at sunrise and sunset. Figure 2.7 shows the average variation referred to the value at 2 hours after sunset at the path midpoint. This variation applies to field strengths occuring for 50% of the nights.~~

MOD 2.2.5 2.2.4 Sunrise and sunset time

To facilitate the determination of the local time of sunrise and sunset, Fig. ~~2.8~~ 2.7 gives the times for various geographical latitudes and for each month of the year. The time is the local meridian time at the point concerned and should be converted to the appropriate standard time.



A: Radius of ground system
Full lines: Real antenna correctly designed
Dashed line: Ideal antenna on a perfectly conducting ground

FIGURE 2.3 - Characteristic field strengths for simple vertical antennas using 120-radial ground systems

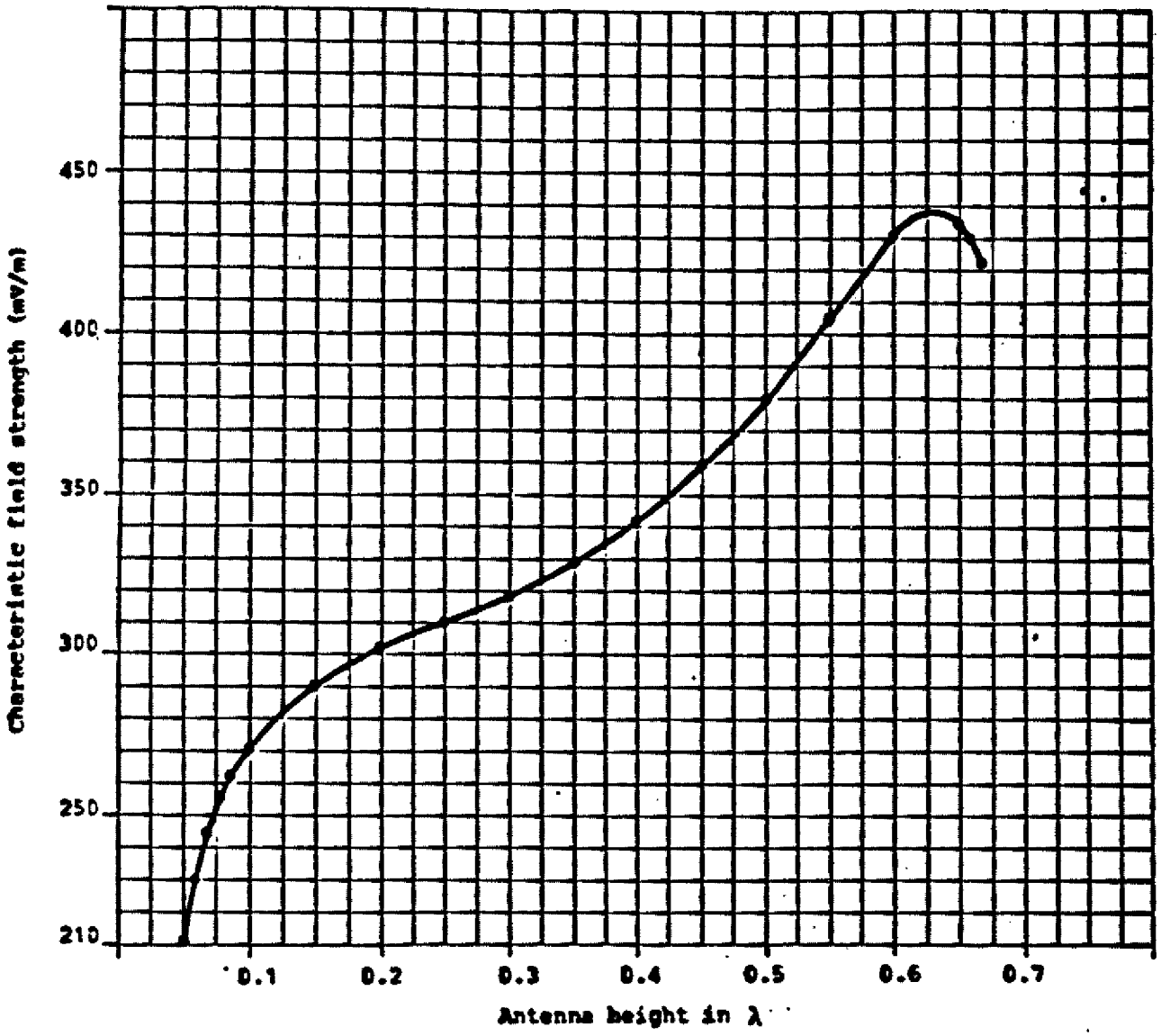


FIGURE 2.3a

Characterisic field strength of an antenna, based on a 1 ohm resistance loss

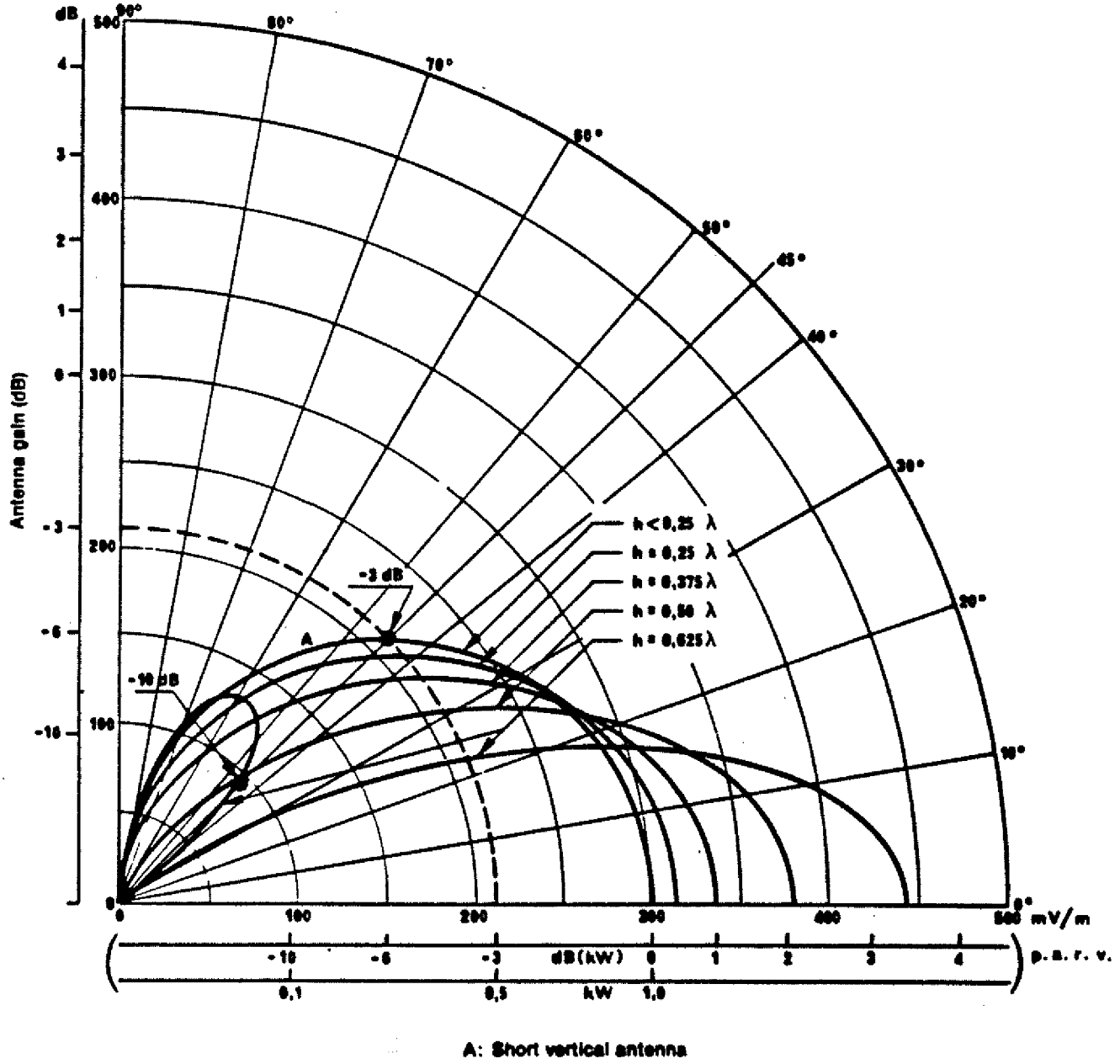


FIGURE 2.3b - Effective monopole radiated power (e.m.r.p.) and field strength at a distance of 1 km as a function of elevation angle, for different heights of vertical antennas assuming a transmitter power of 1 kW

TABLE 2.I - Elevation angle vs distance

Distance (km)	Elevation angle (degrees)	Distance (km)	Elevation angle (degrees)
50	75.3	1250	5.9
100	62.2	1300	5.4
150	51.6	1350	5.0
200	43.3	1400	4.6
250	36.9	1450	4.3
300	31.9	1500	3.9
350	27.9	1550	3.5
400	24.7	1600	3.2
450	22.0	1650	2.9
500	19.8	1700	2.6
550	18.0	1750	2.3
600	16.3	1800	2.0
650	14.9	1850	1.7
700	13.7	1900	1.5
750	12.6	1950	1.2
800	11.7	2000	1.0
850	10.8	2050	0.7
900	10.0	2100	0.5
950	9.3	2150	0.2
1000	8.6	2200	0.0
1050	8.0	2250	0.0
1100	7.4	2300	0.0
1150	6.9	2350	0.0
1200	6.4	2400	0.0

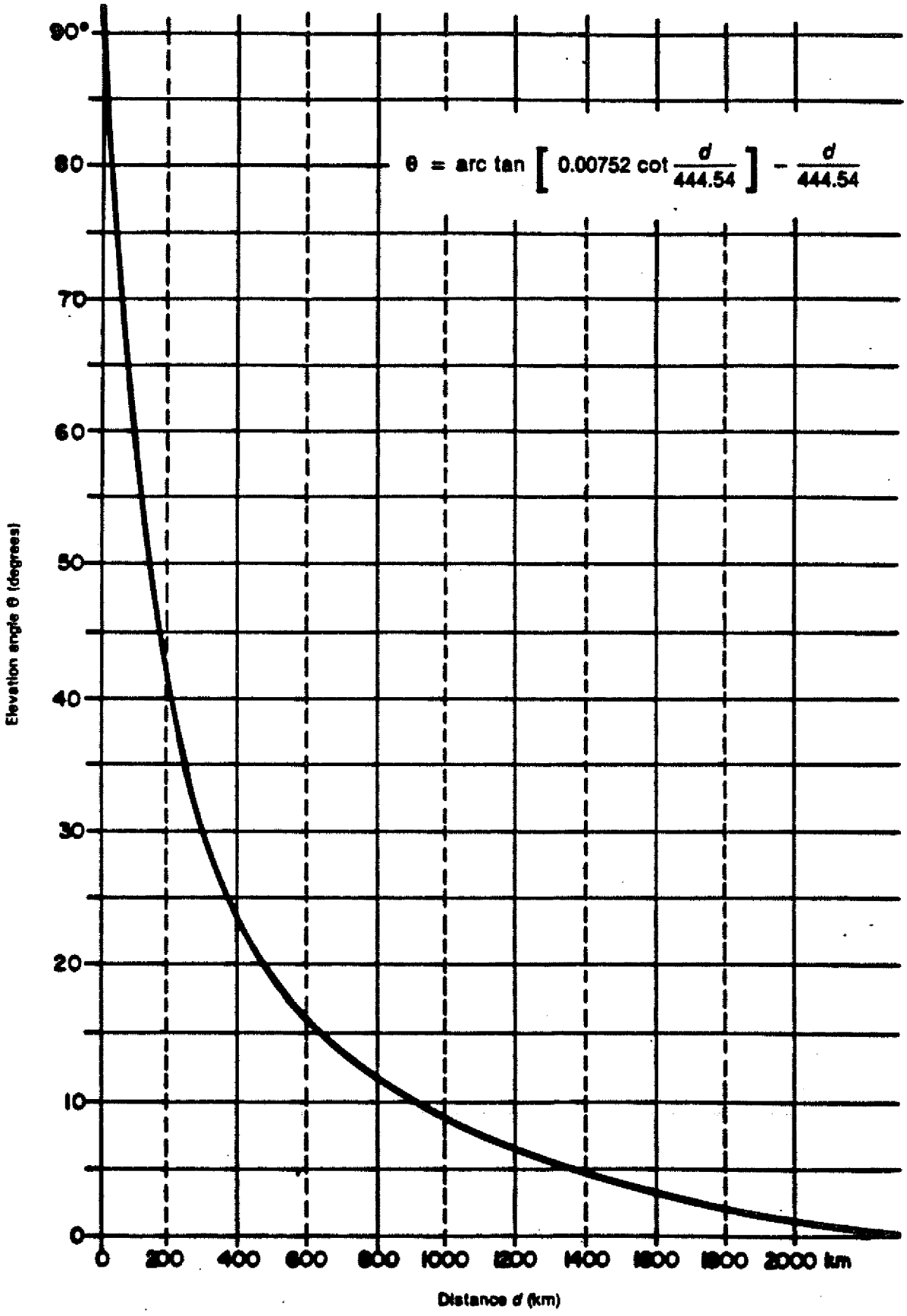


FIGURE 2.4 - Elevation angle vs distance

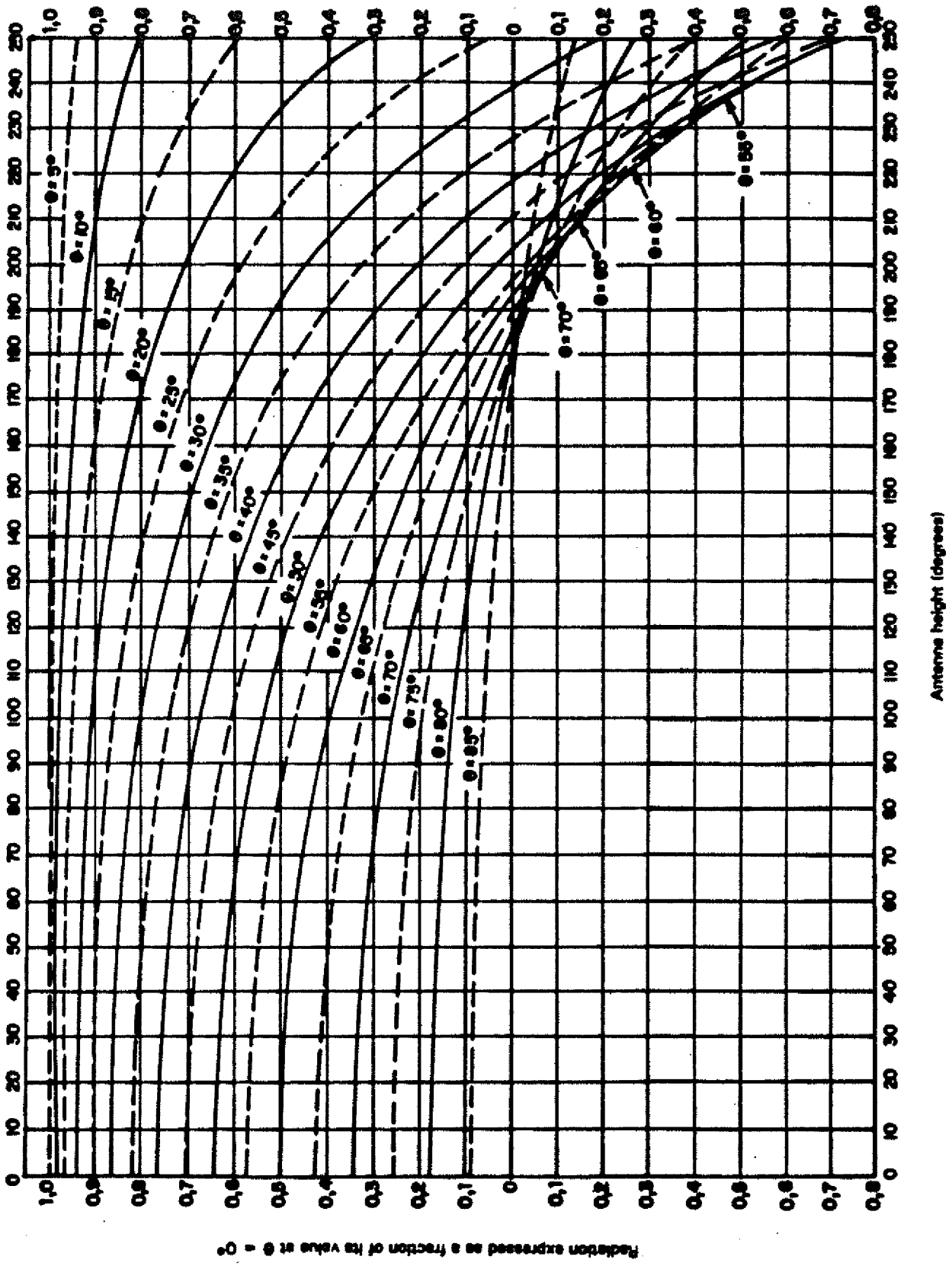


FIGURE 2.5 - Vertical plane radiation of simple vertical antennas as a function of electrical tower height for various values of elevation angle (θ)

MOD

TABLE 2.II - f(θ) values for simple vertical antennas

Elevation angle (degrees)	~~f(θ)~~ Electrical tower height					
	0.11λ	0.13λ	0.15λ	0.17λ	0.19λ	0.21λ
0	1.000	1.000	1.000	1.000	1.000	1.000
1	1.000	1.000	1.000	1.000	1.000	1.000
2	0.999	0.999	0.999	0.999	0.999	0.999
3	0.999	0.998	0.998	0.998	0.998	0.998
4	0.997	0.997	0.997	0.997	0.997	0.997
5	0.996	0.996	0.996	0.995	0.995	0.995
6	0.994	0.994	0.994	0.993	0.993	0.993
7	0.992	0.992	0.991	0.991	0.991	0.990
8	0.989	0.989	0.989	0.988	0.988	0.987
9	0.987	0.986	0.986	0.985	0.985	0.984
10	0.984	0.983	0.983	0.982	0.981	0.980
11	0.980	0.980	0.979	0.978	0.977	0.976
12	0.976	0.976	0.975	0.974	0.973	0.971
13	0.972	0.972	0.971	0.969	0.968	0.967
14	0.968	0.967	0.966	0.965	0.963	0.961
15	0.963	0.962	0.961	0.959	0.958	0.956
16	0.958	0.957	0.956	0.954	0.952	0.950
17	0.953	0.952	0.950	0.948	0.945	0.943
18	0.947	0.946	0.944	0.942	0.940	0.937
19	0.941	0.940	0.938	0.935	0.933	0.930
20	0.935	0.933	0.931	0.929	0.926	0.922
22	0.922	0.920	0.917	0.914	0.911	0.907
24	0.907	0.905	0.902	0.898	0.894	0.890
26	0.892	0.889	0.885	0.882	0.877	0.872
28	0.875	0.872	0.868	0.864	0.858	0.852
30	0.857	0.854	0.849	0.844	0.839	0.832
32	0.838	0.834	0.830	0.824	0.818	0.811
34	0.819	0.814	0.809	0.803	0.795	0.789
36	0.798	0.793	0.788	0.781	0.774	0.766
38	0.776	0.771	0.765	0.758	0.751	0.742
40	0.753	0.748	0.742	0.735	0.725	0.717
42	0.730	0.724	0.718	0.710	0.702	0.692
44	0.705	0.700	0.693	0.685	0.676	0.666
46	0.680	0.674	0.667	0.659	0.650	0.639
48	0.654	0.648	0.641	0.633	0.623	0.612
50	0.628	0.621	0.614	0.606	0.596	0.585
52	0.600	0.594	0.587	0.578	0.568	0.557
54	0.572	0.566	0.559	0.550	0.540	0.529
56	0.544	0.537	0.530	0.521	0.512	0.501
58	0.515	0.508	0.501	0.493	0.483	0.472
60	0.485	0.479	0.472	0.463	0.454	0.443

MOD

TABLE 2.II (continued)

Elevation angle (degrees)	~~f(θ)~~ Electrical tower height					
	0.23 λ	0.25 λ	0.27λ	0.29λ	0.311 λ	0.35 λ
0	1.000	1.000	1.000	1.000	1.000	1.000
1	1.000	1.000	1.000	1.000	1.000	1.000
2	0.999	0.999	0.999	0.999	0.999	0.999
3	0.998	0.998	0.998	0.998	0.998	0.997
4	0.997	0.996	0.996	0.996	0.996	0.995
5	0.995	0.994	0.994	0.994	0.993	0.992
6	0.992	0.992	0.991	0.991	0.990	0.989
7	0.990	0.989	0.988	0.988	0.987	0.985
8	0.987	0.986	0.985	0.984	0.983	0.980
9	0.983	0.982	0.981	0.980	0.978	0.975
10	0.979	0.978	0.977	0.975	0.973	0.969
11	0.975	0.973	0.972	0.970	0.968	0.963
12	0.970	0.968	0.966	0.964	0.962	0.955
13	0.965	0.963	0.961	0.958	0.955	0.949
14	0.959	0.957	0.955	0.952	0.948	0.941
15	0.953	0.951	0.948	0.945	0.941	0.932
16	0.947	0.944	0.941	0.937	0.933	0.924
17	0.941	0.937	0.934	0.930	0.925	0.914
18	0.934	0.930	0.926	0.921	0.916	0.904
19	0.926	0.922	0.918	0.913	0.907	0.894
20	0.919	0.914	0.909	0.904	0.898	0.883
22	0.902	0.897	0.891	0.885	0.877	0.861
24	0.885	0.879	0.872	0.865	0.856	0.837
26	0.866	0.859	0.852	0.843	0.833	0.811
28	0.846	0.838	0.830	0.820	0.809	0.795
30	0.825	0.816	0.807	0.797	0.784	0.758
32	0.803	0.794	0.784	0.772	0.759	0.729
34	0.780	0.770	0.759	0.747	0.732	0.701
36	0.756	0.746	0.734	0.721	0.705	0.671
38	0.732	0.720	0.708	0.694	0.677	0.642
40	0.706	0.695	0.681	0.667	0.649	0.612
42	0.681	0.668	0.654	0.639	0.621	0.582
44	0.654	0.641	0.627	0.611	0.593	0.552
46	0.628	0.614	0.600	0.583	0.564	0.523
48	0.600	0.587	0.572	0.555	0.536	0.494
50	0.573	0.559	0.544	0.527	0.507	0.465
52	0.545	0.531	0.515	0.498	0.479	0.436
54	0.517	0.503	0.487	0.470	0.451	0.408
56	0.488	0.474	0.459	0.442	0.423	0.381
58	0.460	0.446	0.431	0.414	0.395	0.354
60	0.431	0.418	0.403	0.387	0.368	0.328

MOD

TABLE 2.II (continued)

Elevation angle (degrees)	~~f(θ)~~ Electrical tower height					
	0.40 λ	0.45 λ	0.50 λ	0.528λ	0.55 λ	0.625λ
0	1.000	1.000	1.000	1.000	1.000	1.000
1	1.000	1.000	0.999	0.999	0.999	0.999
2	0.998	0.998	0.998	0.997	0.997	0.995
3	0.997	0.996	0.995	0.994	0.993	0.989
4	0.994	0.992	0.990	0.989	0.988	0.981
5	0.991	0.988	0.985	0.983	0.981	0.970
6	0.986	0.983	0.979	0.975	0.972	0.957
7	0.982	0.977	0.971	0.967	0.962	0.941
8	0.976	0.970	0.962	0.957	0.951	0.924
9	0.970	0.963	0.953	0.945	0.938	0.904
10	0.963	0.954	0.942	0.933	0.924	0.882
11	0.955	0.945	0.930	0.919	0.909	0.859
12	0.947	0.934	0.917	0.905	0.893	0.834
13	0.938	0.923	0.903	0.889	0.875	0.807
14	0.929	0.912	0.889	0.872	0.857	0.773
15	0.918	0.899	0.873	0.855	0.837	0.748
16	0.908	0.886	0.857	0.836	0.815	0.717
17	0.897	0.873	0.840	0.817	0.795	0.684
18	0.885	0.859	0.823	0.797	0.772	0.651
19	0.873	0.844	0.804	0.776	0.749	0.617
20	0.860	0.828	0.785	0.755	0.726	0.582
22	0.833	0.796	0.746	0.710	0.677	0.510
24	0.805	0.763	0.705	0.665	0.625	0.436
26	0.776	0.728	0.663	0.618	0.574	0.363
28	0.745	0.692	0.621	0.570	0.522	0.290
30	0.714	0.655	0.577	0.522	0.470	0.219
32	0.682	0.619	0.534	0.475	0.419	0.151
34	0.649	0.582	0.492	0.428	0.368	0.085
36	0.617	0.545	0.450	0.383	0.321	0.025
38	0.584	0.509	0.409	0.340	0.275	-0.031
40	0.552	0.473	0.370	0.298	0.231	-0.083
42	0.519	0.438	0.332	0.258	0.190	-0.129
44	0.488	0.405	0.296	0.211	0.152	-0.170
46	0.457	0.372	0.262	0.187	0.117	-0.205
48	0.427	0.341	0.230	0.155	0.085	-0.235
50	0.397	0.311	0.201	0.126	0.056	-0.259
52	0.369	0.283	0.174	0.099	0.031	-0.278
54	0.341	0.257	0.149	0.076	0.009	-0.291
56	0.315	0.232	0.126	0.055	-0.010	-0.300
58	0.289	0.208	0.105	0.037	-0.026	-0.304
60	0.265	0.186	0.087	0.021	-0.039	-0.304

MOD

TABLE 2.II (end)

Elevation angle (degrees)	~~f(θ)~~ Electrical tower height					
	0.40 λ	0.45 λ	0.50 λ	0.528 λ	0.55 λ	0.625 λ
62				0.003	-0.049	-0.300
64				-0.003	-0.056	-0.292
66				-0.011	-0.062	-0.281
68				-0.017	-0.064	-0.267
70				-0.022	-0.065	-0.250
72				-0.025	-0.064	-0.231
74				-0.026	-0.061	-0.210
76				-0.026	-0.056	-0.138
78				-0.024	-0.051	-0.163
80				-0.022	-0.044	-0.138

Note - When the negative sign (-) appears in the Table, it signifies only the existence of a secondary lobe having the opposite phase from the main lobe in the vertical radiation pattern. In order to perform the calculation, ignore the negative (-) and use only the absolute value f(θ) from the Table.

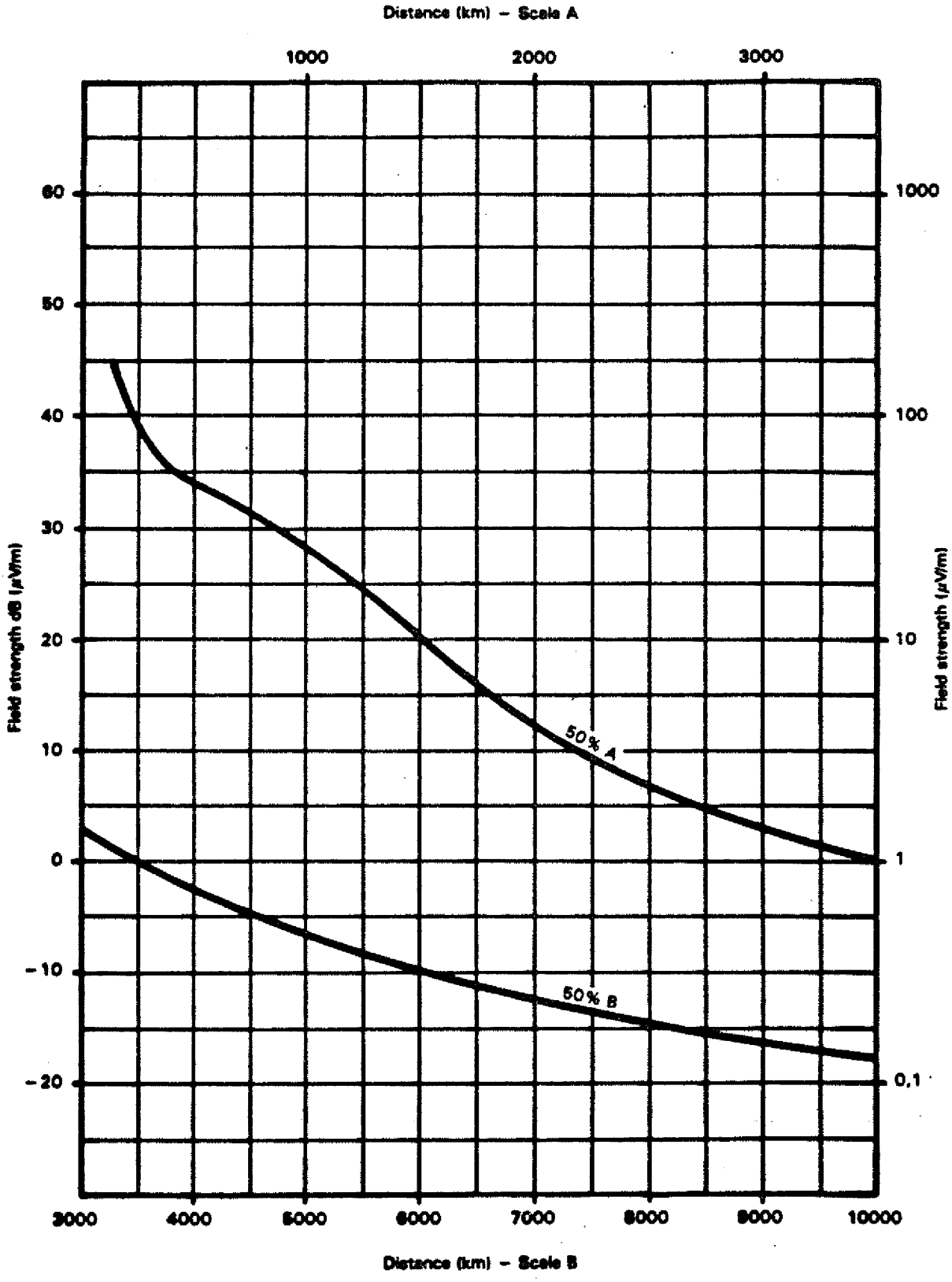


FIGURE 2.6 - Skywave field strength vs distance for a characteristic field strength of 100 mV/m

TABLE 2.III - Skywave field strength vs distance (0 to 10000 km) for a characteristic field strength of 100 mV/m

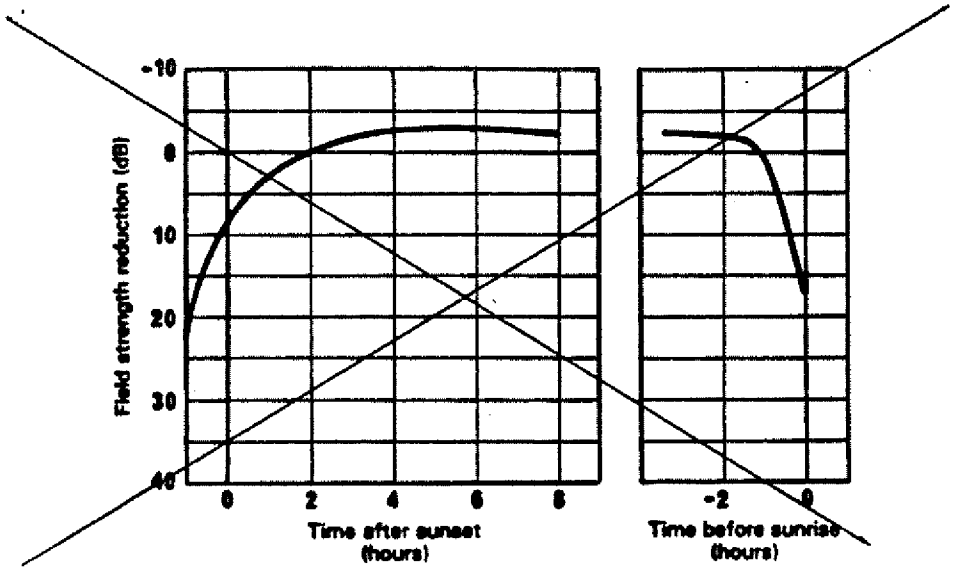
d (km)	F_c(dB(μV/m)) 50%	F_c(μV/m) 50%
0-200	39.28	92.06
250	37.79	77.54
300	36.75	68.82
350	35.86	62.06
400	35.13	57.08
450	34.46	52.86
500	33.92	49.65
550	33.40	46.78
600	32.94	44.36
650	32.45	41.95
700	31.94	39.54
750	31.32	36.81
800	30.73	34.40
850	30.18	32.30
900	29.51	29.89
950	28.83	27.63
1000	28.14	25.54
1050	27.44	23.56
1100	26.79	21.84
1150	25.98	19.91
1200	25.25	18.30
1250	24.50	16.78
1300	23.71	15.32
1350	22.90	13.97
1400	22.08	12.71
1450	21.25	11.55
1500	20.42	10.50
1550	19.59	9.53
1600	18.66	8.57
1650	17.75	7.72
1700	16.87	6.98
1750	16.04	6.34
1800	15.28	5.80

TABLE 2.III (continued)

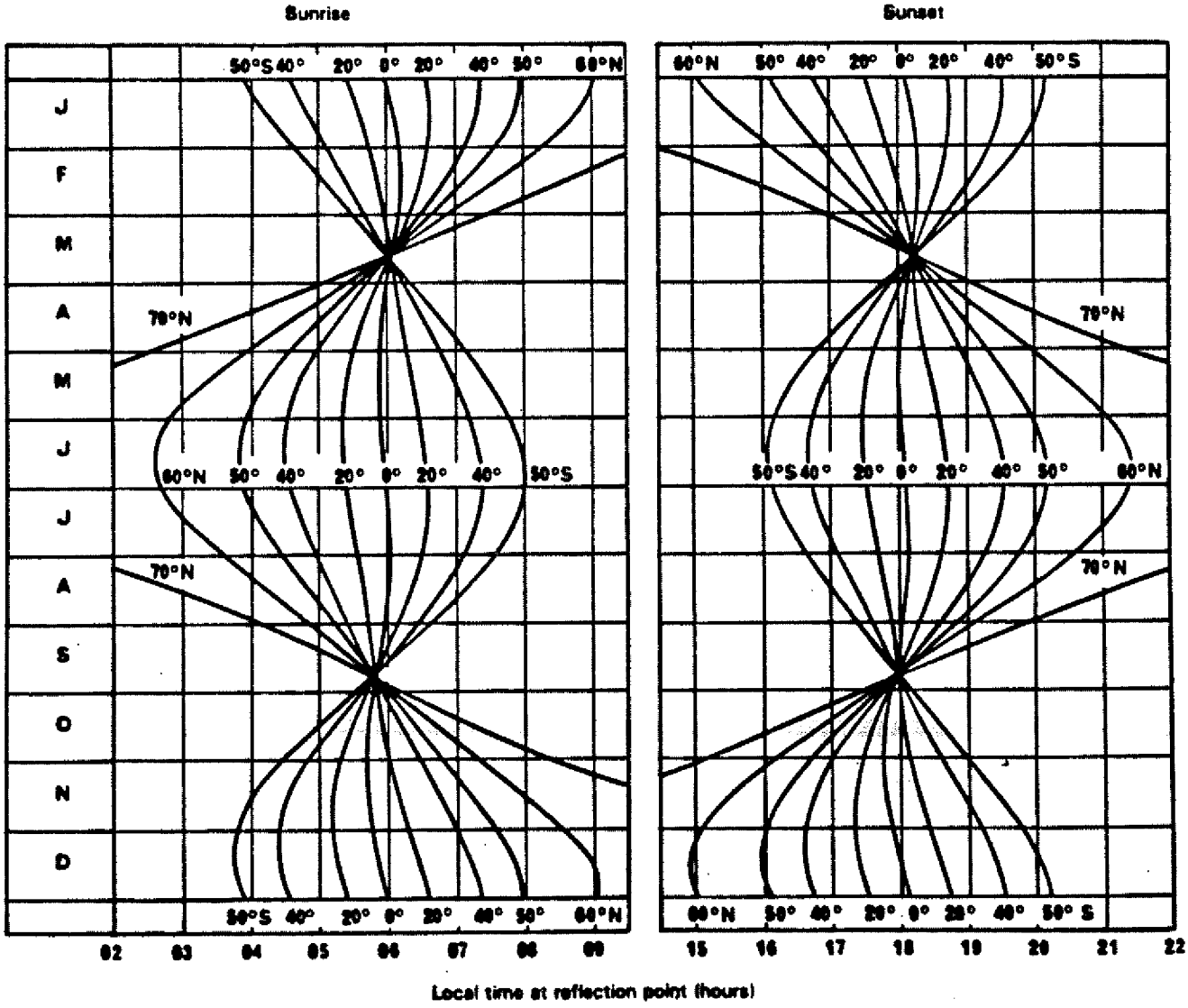
d (km)	F_c(dB(μV/m)) 50%	F_c(μV/m) 50%
1850	14.52	5.32
1900	13.78	4.89
1950	13.05	4.49
2000	12.34	4.14
2100	11.15	3.61
2200	10.05	3.18
2300	8.92	2.79
2400	8.13	2.55
2500	7.09	2.26
2600	6.16	2.03
2700	5.32	1.85
2800	4.58	1.69
2900	3.81	1.55
3000	3.11	1.43
3100	2.45	1.33
3200	1.78	1.23
3300	1.18	1.15
3400	0.57	1.07
3500	0.02	1.00
3600	-0.53	0.94
3700	-1.08	0.88
3800	-1.59	0.83
3900	-2.08	0.79
4000	-2.52	0.75
4100	-3.01	0.71
4200	-3.46	0.67
4300	-3.90	0.64
4400	-4.33	0.61
4500	-4.74	0.58
4600	-5.15	0.55
4700	-5.54	0.53
4800	-5.93	0.51
4900	-6.30	0.48

TABLE 2.III (end)

d (km)	F_c(dB(μV/m)) 50%	F_c(μV/m) 50%
5000	-6.67	0.46
5100	-7.02	0.45
5200	-7.37	0.43
5300	-7.71	0.41
5400	-8.04	0.40
5500	-8.37	0.38
5600	-8.68	0.37
5700	-8.99	0.36
5800	-9.29	0.34
5900	-9.59	0.33
6000	-9.88	0.32
6200	-10.43	0.30
6400	-10.97	0.28
6600	-11.48	0.27
6800	-11.97	0.25
7000	-12.44	0.24
7200	-12.90	0.23
7400	-13.33	0.22
7600	-13.75	0.21
7800	-14.15	0.20
8000	-14.54	0.19
8200	-14.92	0.18
8400	-15.28	0.17
8600	-15.63	0.17
8800	-15.97	0.16
9000	-16.29	0.15
9200	-16.61	0.15
9400	-16.91	0.14
9600	-17.21	0.14
9800	-17.50	0.13
10000	-17.77	0.13



SUP FIGURE 2.7---Field-strength-variation-during-the-night



MOD FIGURE 2.8 2.7 - Times of sunrise and sunset for various months and geographical latitudes

MOD CHAPTER 3 - BROADCASTING STANDARDS* AND TRANSMISSION CHARACTERISTICS

MOD 3.1 Channel spacing

The Plan ~~shall be~~ is based on a channel spacing of 10 kHz and carrier frequencies which are integral multiples of 10 kHz, beginning at 1 610 kHz.

MOD 3.2 Class of emission

The Plan ~~shall be~~ is based on double-sideband amplitude modulation with full carrier A3E.

Classes of emission other than A3E ~~could~~ may also be used on condition that the energy level outside the necessary bandwidth does not exceed that normally expected in A3E emission, for instance to accommodate stereophonic systems.

MOD 3.3 Bandwidth of emission

The Plan ~~shall be~~ is based on a necessary bandwidth of 10 kHz for which only 5 kHz audio bandwidth can be obtained. While this might be an appropriate value within some administrations, others may wish to employ wider bandwidth systems with necessary bandwidths of the order of 20 kHz. However, the protection ratios selected allow operation with 20 kHz occupied bandwidth without an appreciable increase in interference. Stations operating on the frequency 1 700 kHz shall take into account No. 343 of the Radio Regulations.

MOD 3.4 Frequency tolerance

~~As indicated in~~ In accordance with Appendix 7 to the Radio Regulations, the frequency tolerance shall be 20 parts in 10^6 (0.002%). ~~for powers of 10 kW or less, and 10 Hz for powers greater than 10 kW.~~

SUP ~~3.5 NOT ALLOCATED~~

SUP ~~*Note --- The effect of receiver characteristics upon AM broadcasting standards~~

~~It is expected that receiver characteristics for this band will be similar to those of existing receivers in the 535 --- 1 605 kHz band. Therefore, they should not affect broadcasting standards.~~

MOD 3.6 3.5 Nominal usable field strength (E_{nom})

Table of nominal usable field strength

	Noise zone 1	Noise zone 2
Daytime	0.5 mV/m	1.25 mV/m
Night-time	3.3 mV/m	6 mV/m

MOD 3.7 3.6 Definition of noise zones

Noise zone 1

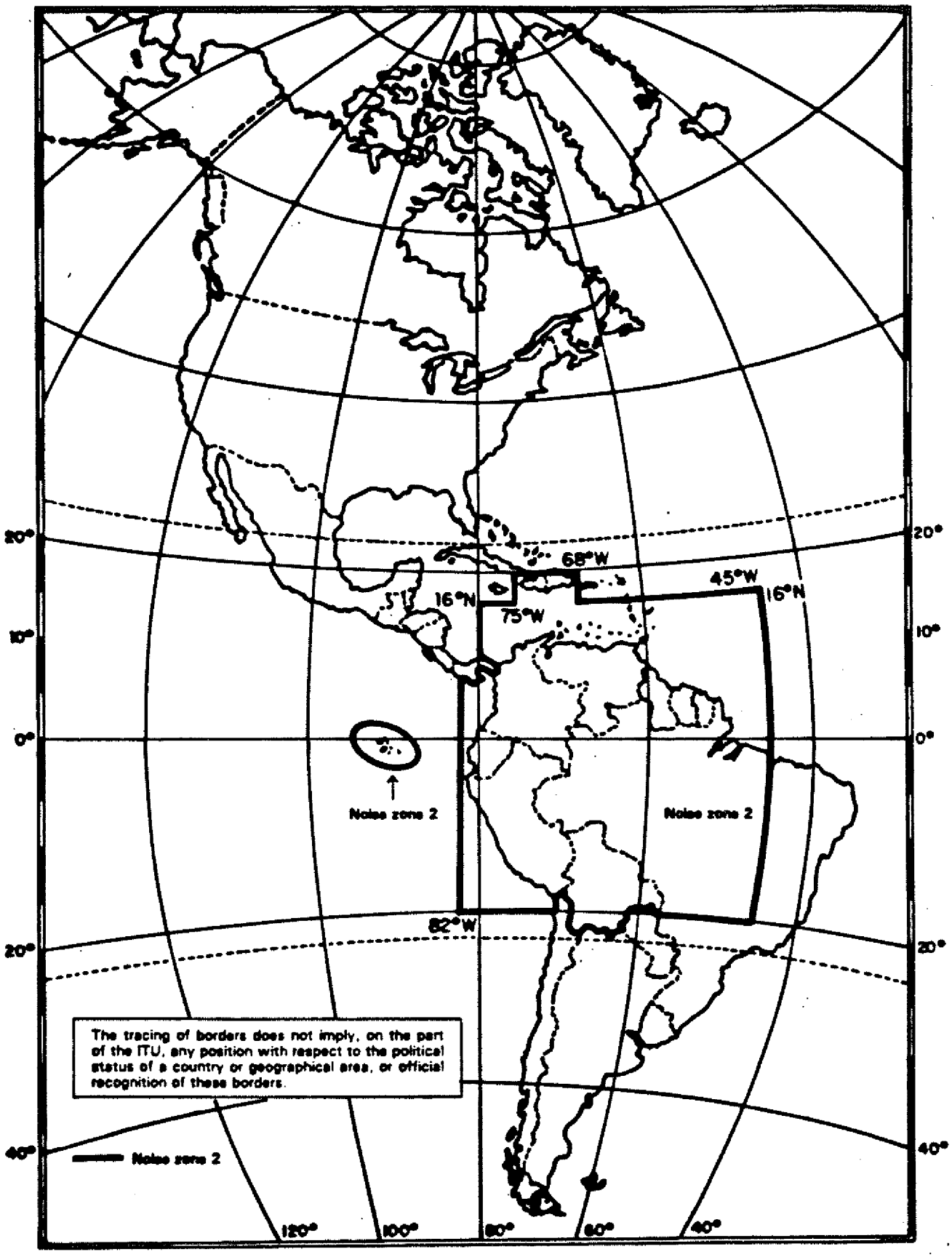
Comprises the whole of Region 2 with the exception of noise zone 2.

Noise zone 2

Comprises the area within the line defined by the coordinates 20° S-45° W, the meridian 45° W to the coordinates 16° N-45° W, the parallel 16° N to the coordinates 16° N-68° W, the meridian 68° W to the coordinates 20° N-68° W, the parallel 20° N to the coordinates 20° N-75° W, the meridian 75° W to the coordinates 16° N-75° W, the parallel 16° N to the coordinates 16° N-80° W, the meridian 80° W to the northeast coast of Panama, the frontier between Panama and Colombia, the southeast coast of Panama and the meridian 82° W to the parallel 20° S, and the parallel 20° S, with the exception of Chile and Paraguay, until the frontier between Paraguay and Brazil until 45° W. Bolivia is entirely included in noise zone 2 as are the archipelago of San Andres y Providencia and the islands belonging to Colombia and the Colon archpelago or the Galapagos Islands (Ecuador).

Note - See the maps of noise zones on the following page.

NOISE ZONES


20°
10°
0°
20°
40°
68°W
45°W
16°N
16°N
75°W
Noise zone 2
Noise zone 2
82°W
The tracing of borders does not imply, on the part of the ITU, any position with respect to the political status of a country or geographical area, or official recognition of these borders.
Noise zone 2
120°
100°
80°
60°
40°

MOD 3.8 3.7 Protection ratios

MOD 3.8.1 3.7.1 Co-channel protection ratio

The co-channel protection ratio ~~shall be~~ is 26 dB.

MOD 3.8.2 3.7.2 Adjacent channel protection ratio

- the protection ratio for the first adjacent channel ~~shall be~~ is 0 dB
- the protection ratio for the second adjacent channel ~~shall be~~ is -29.5 dB.

CHAPTER 4 - RADIATION CHARACTERISTICS OF TRANSMITTING ANTENNAS

In carrying out the calculations indicated in Chapter 2 the following shall be taken into account.

MOD 4.1 Omnidirectional antennas

Figure-4 2.3 of section 2.2 shows the characteristic field of a simple vertical antenna as a function of its height in wavelengths and of the radius of the ground system.

It is clear that the characteristic field strength increases as the loss in the ground system is reduced to zero and as the antenna height is increased up to 0.625 wavelengths.

The increased characteristic field strength for antenna heights up to 0.625 wavelengths is obtained at the expense of radiation at high angles as shown in Figures 4a 2.3b and 2.5 and Table ~~II~~ 2.II of section 2.2.

MOD 4.2 Considerations of the radiation patterns of directional antennas

The procedures for calculating theoretical, expanded and augmented (modified expanded) directional antenna patterns are given in ~~Annex-4~~ Appendix 2.

MOD 4.3 Top-loaded or sectionalized antennas

4.3.1 Calculation procedures are given in ~~Annex-2~~ Appendix 3.

4.3.2 Many stations employ top-loaded or sectionalized towers, either because of space limitations or to vary the radiation characteristics from those of a simple vertical antenna. This is done to achieve desired coverage or to reduce interference.

4.3.3 An administration using top-loaded or sectionalized antennas shall supply information concerning the tower structure of the antennas. Normally, one of the equations in ~~Annex-2~~ Appendix 3 shall be employed to determine the vertical radiation characteristics of the antennas. Other equations may also be proposed by an administration for determining the vertical radiation characteristics of the antennas of that administration, subject to the agreement of the other administration(s) concerned.

[CHAPTER 5 - TECHNICAL CRITERIA FOR INTERSERVICE SHARING]

[New text to be developed and submitted separately]

APPENDIX 1

(To Annex 1)

Atlas of ground conductivity *

The tracing of borders does not imply on the part of the ITU any position with respect to the status of a country or geographical area, or official recognition of these borders.

* Published separately.

ANNEX-1

APPENDIX 2

(To Annex 1)

Calculation of directional antenna patterns

ANNEX-4

APPENDIX 2

(to Annex 1)

Calculation of directional antenna patterns

Introduction

This annex describes methods to be employed in calculating the field strength produced by a directional antenna at a given point.

1. General equations

The theoretical directional antenna radiation pattern is calculated by means of the following equation, which sums the field strength from each element (tower) in the array.

$$E_T(\phi,\theta) = \left| K_L \sum_{i=1}^{n} F_i f_i(\theta) \angle \psi_i + S_i \cos\theta \cos(\phi_i - \phi) \right| \qquad (1)$$

where:

$$f_i(\theta) = \frac{\cos(G_i \sin\theta) - \cos G_i}{(1 - \cos G_i)\cos\theta} \qquad (2)$$

where:

$E_T(\phi,\theta)$: theoretical inverse distance field strength at one kilometer in mV/m for the given azimuth and elevation;

K_L: multiplying constant in mV/m which determines the pattern size (see paragraph 2.5 below for derivation of K_L);

n: number of elements in the directional array;

i: denotes the ith element in the array;

F_i: ratio of the theoretical field strength due to the ith element in the array relative to the theoretical field strength due to the reference element;

θ: vertical elevation angle, in degrees, measured from the horizontal plane;

$f_i(\theta)$: ratio of vertical to horizontal plane field strength radiated by the ith element at elevation angle θ;

G_i: electrical height of the ith element, in degrees;

S_i: electrical spacing of the ith element from the reference point in degrees;

ϕ_i: orientation of the ith element from the reference element (with respect to True North), in degrees;

ϕ: azimuth with respect to True North, in degrees;

ψ_i: electrical phase angle of field strength due to the ith element (with respect to the reference element), in degrees.

Equations (1) and (2) assume that;

- the current distribution in the elements is sinusoidal,
- there are no losses in the elements or in the ground,
- the antenna elements are base-fed, and
- the distance to the computation point is large in relation to the size of the array.

2. Determination of values and constants

2.1 Determination of the multiplying constant K for an array

The multiplying constant K for the loss-free case may be computed by integrating the power flow over the hemisphere, deriving an r.m.s. field strength and comparing the result with the case where the power is radiated uniformly in all directions over the hemisphere.

Thus:

$$K = \frac{E_s \sqrt{P}}{e_h} \qquad \text{mV/m}$$

where:

K: no-loss multiplying constant (mV/m at 1 km);

E_s: reference level for uniform radiation over a hemisphere, equal to 244.95 mV/m at 1 km for 1 kW;

P: antenna input power (kW);

e_h: root mean square radiation pattern over the hemisphere which may be obtained by integrating $e(\theta)$ at each elevation angle over the hemisphere. The integration can be made using the trapeziodal method of approximation, as follows:

$$e_h = \left[\frac{\pi\Delta}{180}\left\{\tfrac{1}{2}[e(\theta)]^2 + \sum_{m=1}^{N}[e(m\Delta)]^2\cos m\Delta\right\}\right]^{\frac{1}{2}} \qquad (3)$$

where:

Δ: interval, in degrees, between equally-spaced sampling points at different elevation angles θ;

m: an integer from 1 to N, which gives the elevation angle θ in degrees when multiplied by Δ, i.e. $\theta = m\Delta$;

N: one less than the number of intervals $N = \frac{90}{\Delta} - 1$;

$e(\theta)$: root mean square radiation pattern given by equation (1) with K equal to 1 at the specified elevation angle θ (the value of θ is 0 in the first term of equation (3) and $m\Delta$ in the second term); $e(\theta)$ is computed using equation (4).

$$e(\theta) = \left[\sum_{i=1}^{n}\sum_{j=1}^{n} F_i f_i(\theta) F_j f_j(\theta)\cos\psi_{ij} J_0(S_{ij}\cos\theta)\right]^{\frac{1}{2}} \qquad (4)$$

where:

i: denotes the ith element;

j: denotes the jth element;

n: number of elements in the arry;

ψ_{ij}: difference in phase angles of the field strengths from the ith and jth elements in the array;

S_{ij}: angular spacing between the ith and jth elements in the array;

$J_0(S_{ij}\cos\theta)$: the Bessel function of the first kind and zero order of the apparent spacing between the ith and jth elements. In equation (4), S_{ij} is in radians. However when special tables of Bessel functions giving the argument in degrees are used, the values of S_{ij} should then be in degrees.

2.2 Relationship between field strength and antenna current

The field strength resulting from a current flowing in a vertical antenna element is:

$$E = \frac{R_c I[\cos(G\sin\theta) - \cos G]}{2\pi r\cos\theta} \times 10^3 \quad \text{mV/m} \qquad (5)$$

where:

E: field strength in mV/m;

R_c: resistivity of free space ($R_c = 120\pi$ ohms);

I: current at the current maximum, in amperes[1];

G: electrical height of the element, in degrees;

r: distance from the antenna, in metres;

θ: vertical elevation angle, in degrees.

At one kilometre and in the horizontal plane ($\theta = 0°$);

$$E = \frac{120\pi\ I(1 - \cos G) \times 10^3}{2\ (1000)} \quad \text{mV/m} \qquad (6)$$

hence:

$$E = 60I(1-\cos G) \quad \text{mV/m} \qquad (7)$$

1 I is the current at the maximum of the sinusoidal distribution. If the electrical height of the element is less than 90°, the base current will be less than I.

2.3 Determination of no-loss current at current maximum

For a tower of uniform cross-section or for a similar type of directional array element, the no-loss current at the current maximum is:

$$I_i = \frac{KF_i}{60(1-\cos G_i)} \tag{8}$$

where:

I_i: current at current maximum in amperes in the ith element;

K: no-loss multiplying constant computed as shown in paragraph 2.1 above.

The base current is given by $I_i \sin G_i$.

2.4 Array power loss

Power losses in a directional antenna system are of various types, including ground losses, antenna coupling losses, etc. The loss resistance for the array may be assumed to be inserted at the current maximum to allow for all losses. The power loss is:

$$P_L = \frac{1}{1000} \sum_{i=1}^{n} R_i I_i^2 \tag{9}$$

where:

P_L: total power loss, in kW;

R_i: assumed loss resistance, in ohms (one ohm, unless otherwise indicated) for the ith tower[1];

I_i: current at current maximum (or base current if the element is less than 90 degrees in electrical height) for the ith tower.

---

1 The loss resistance shall in no way exceed a value such that the value of K_L (see paragraph 2.5) differs by more than ten percent from that calculated for a resistance of one ohm.

2.5 Determination of a corrected multiplying constant

To allow for power loss in the antenna system, the multiplying constant K can be modified, as follows:

$$K_L = K \left(\frac{P}{P + P_L} \right)^{\frac{1}{2}} \qquad (10)$$

where:

K_L: multiplying constant after corrrection for the assumed loss resistance;

K: no-loss multiplying constant computed in paragraph 2.1 above;

P: array input power (kW);

P_L: total power loss (kW).

2.6 r.m.s. value of radiation to be notified for directional antennas

The radiation E_r for directional antennas is determined as follows:

$$E_r = K_L e(\theta) \qquad \text{mV/m at 1 km}$$

2.7 Determination of expanded pattern values

The expanded pattern is determined as follows:

$$E_{EXP}(\phi,\theta) = 1.05 \left\{ [E_T(\phi,\theta)]^2 + Q^2 \right\}^{\frac{1}{2}} \qquad (11)$$

where:

$E_{EXP}(\phi,\theta)$: expanded pattern radiation at a particular azimuth, ϕ, and a particular elevation angle θ;

$E_T(\phi,\theta)$: theoretical pattern radiation at a particular azimuth, ϕ, and a particular elevation angle θ;

Q: quadrature factor, computed as:

$$Q = Q_{OB}(\theta)$$

where:

Q_0 is the Q on the horizontal plane, and is normally the greatest of the following three quantities:

$$10.0 \quad ; \quad 10\sqrt{P} \quad \text{or} \quad 0.025K_L\left[\sum_{i=1}^{n} F_i^2\right]^{\frac{1}{2}}$$

$g(\theta)$ is computed as follows:

If the electrical height of the shortest tower is less than or equal to 180 degrees, then:

$$g(\theta) = f(\theta) \text{ for the shortest tower.}$$

If the electrical height of the shortest tower is greater than 180 degrees, then:

$$g(\theta) = \frac{[[f(\theta)]^2 + 0.0625]^{\frac{1}{2}}}{1.030776}$$

where $f(\theta)$ for the shortest tower is used.

Note: In comparing the electrical heights of the antenna towers to determine the shortest tower, the total apparent height (as determined by current distribution) is used for top-loaded and sectionalized towers.

2.8 Determination of augmented (modified expanded) pattern values

The purpose of the augmented (modified expanded) pattern is to put one or more "patches" on an expanded pattern. Each "patch" is referred to as an "augmentation". The augmentation may be positive (resulting in more radiation than that of the expanded pattern) or negative (resulting in less radiation than that of the expanded pattern). In no case shall the augmentation be so negative that the augmented (modified expanded) pattern radiation is below the theoretical radiation pattern.

Spans of augmentation may overlap. That is, an augmentation may itself be augmented by a subsequent augmentation. To ensure that the calculations are properly made, the augmentations are handled in increasing order of central azimuth of augmentation, starting at True North. If several augmentations have the same central azimuth, then they are considered in order of decreasing span (i.e. the one with the largest span is handled first). If more that one augmentation has the same central azimuth and the same span, then they are considered in ascending order of their effect.

$$E_{MOD}(\phi,\theta) = \left\{[E_{EXP}(\phi,\theta)]^2 + g^2(\theta)\sum_{i=1}^{a} A_i\cos^2(180\Delta_i/\alpha_i)\right\}^{\frac{1}{2}} \qquad (12)$$

where:

$E_{MOD}(\phi,\theta)$: augmented (modified expanded) pattern radiation at a particular azimuth, ϕ, and a particular elevation angle, θ;

$E_{EXP}(\phi,\theta)$: expanded pattern radiation at a particular azimuth, ϕ. and a particular elevation angle, θ;

$g(\theta)$: same parameter as described for the expanded pattern (see paragraph 2.7);

a: number of augmentations;

Δ_i: difference between the azimuth at which the radiation is desired ϕ, and the central azimuth of augmentation of the ith augmentation. It will be noted that Δ_i must be less than or equal to one-half of α_i;

α_i: total span of the ith augmentation;

A_i: is the value of the augmentation given by the expression[1]:

$$A_i = [E_{MOD}(\phi_i,\theta)]^2 - [E_{INT}(\phi_i,\theta)]^2 \qquad (13)$$

where:

ϕ_i: central azimuth of the ith augmentation;

$E_{MOD}(\phi_i,\theta)$: augmented (modified expanded) horizontal plane radiation at the central azimuth of the ith augmentation, after applying the ith augmentation, but before applying subsequent augmentations;

$E_{INT}(\phi_i,\theta)$: an interim value of radiation in the horizontal plane at the central azimuth of the ith augmentation. The interim value is the radiation obtained from applying previous augmentations (if any) to the expanded pattern, but before applying the ith augmentation.

---

1 When A_i is negative, there is negative augmentation; when A_i is positive, there is positive augmentation. A_i must not be so negative that $E_{MOD}(\phi,\theta)$ falls below $E_T(\phi,\theta)$ of any azimuth, ϕ, or elevation angle, θ.

ANNEX-2

APPENDIX 3

(to Annex 1)

Equations for the calculation of the normalized vertical radiation from top-loaded and typical sectionalized antennas

ANNEX-2

APPENDIX 3

(to Annex 1)

Equations for the calculation of the normalized vertical radiation from top-loaded and typical sectionalized antennas

Basically, the equation is:

$$f(\theta) = \frac{E_\theta}{E_0}$$

where:

E_θ: radiation at a desired elevation angle, θ;

E_0: radiation in the horizontal plane.

Specific equations for top-loaded and typical sectionalized antennas are given below.

These equations use one of more of four variables A, B, C and D, which are defined after each equation.

1. Top-loaded antenna (Type 1 antennas)

$$f(\theta) = \frac{\cos B\cos(A\sin\theta) - \sin\theta\sin B\sin(A\sin\theta) - \cos(A+B)}{\cos\theta[\cos B - \cos(A+B)]}$$

where:

A: electrical height of the antenna tower;

B: difference between the apparent electrical height (based on current distribution) and the actual height (A);

θ: the elevation angle with respect to the horizontal plane.

Note: When B is zero (i.e., when there is no top-loading), the equation reduces to that of a simple vertical antenna.

2. Sectionalized tower (Type 2 antennas)

$$f(\theta) = \frac{[\cos B\cos(A\sin\theta) - \cos(A+B)]\sin(C+D-A) + \sin B[\cos D\cos(C\sin\theta) - \sin\theta\sin D\sin(C\sin\theta) - \cos(C+D-A)\cos(A\sin\theta)]}{\cos\theta([\cos B - \cos(A+B)]\sin(C+D-A) + \sin B[\cos D - \cos(C+D-A)])}$$

where:

A: actual height of the lower section;

B: difference between the apparent electrical height (based on current distribution) of the lower section and the actual height of the lower section (A);

C: actual total height of the antenna;

D: difference between the apparent electrical height (based on current distribution) of the total tower and the actual height of the total tower (C);

θ: vertical angle with respect to the horizontal plane.

3. Administrations proposing to use other types of antenna should furnish details of their characteristics together with a radiation pattern.

[ANNEX 2]

[to the Regional Agreement]
[to establish a Plan for the]
[Broadcasting Service in the Band 1 605 - 1 705 kHz]
[in Region 2]

[PLANNING CRITERIA]

1. Assignment principles

1.1 An administration may make assignments on its allotted channels without regard to other co-channel assignments and allotments, provided that the standard parameters in 2.1 are used.

1.2 Where neighboring countries have allotments on adjacent channels, the procedures to be followed before bringing into use assignments from allotments in border areas are specified in section 4. of this Annex.

1.3 An administration may make assignments on channels not allotted to it in a given area provided that it protects the allotments and assignments of other countries in accordance with 5.2. Such assignments shall not restrict the use of allotments which comply with 2.1 and 3.1 of this Annex.

1.4 Administrations may bring into use assignments with parameters different from the standardized parameters provided the conditions given in 3. of this Annex are met.

2. Planning criteria

2.1 Standardized parameters

The Allotment Plan is based on the following standard parameters for day and night and for noise zones 1 and 2.

- Station power: 1 kW

- Antenna: omnidirectional with 90° degrees electrical height

2.2 Co-channel standardized distance

The standardized distances between allotments in the Plan are:

- for noise zone 1 land path: 330 km, based on skywave protection for the nighttime E_{nom} of 3.3. mV/m;

- for noise zone 2 land path: 120 km, based on groundwave protection for the daytime E_{nom} of 1.25 mV/m, using a uniform conductivity of 6 millisiemens;

- for sea paths and mixed paths in noise zones 1 and 2, [ ]

3. Use of different parameters

3.1 Assignments on allotted channels may use parameters other than the standardized parameters prescribed in 2.1 provided that:

- the groundwave or skywave field strength, whichever is greater, produced during nighttime hours at the boundary of any co-channel allotment area of another administration does not exceed the nominal usable field strength in 3.5 of Annex 1 divided by 20. Moreover, the skywave field strength produced at any point within the allotment area must not exceed the maximum permissible field strength prescribed in Figure 1 of this Annex; and

- the groundwave field strength produced over land paths at the boundary of the any co-channel allotment during daytime hours does not exceed the nominal usable field strength in 3.5 of Annex 1 divided by 20. In the case of mixed or sea paths, the groundwave field strength produced at the boundary of any co-channel allotment area shall not exceed the field strength that would be produced by a reference station with standardized parameters located at any point on the boundary of the allotment area within which proposed station will be located; and

- the groundwave field strength produced at any point within the allotment area of another administration to which a first or second adjacent channel is allotted does not exceed the field strength that would be produced by a reference station with standarized parameters situated at any point on the boundary of the allotment area within which the proposed station will be located.

3.2 Assignments on non-allotted channels may use parameters other than the standardized parameters in 2.1, provided that protection is accorded pursuant to 5.2 and 5.4 of this Annex. Additionally, the field strength produced by the proposed assignment within the area of a neighboring country without a co-channel or adjacent channel allotment shall not exceed the field strength that would be produced by a reference station with standardized parameters located on at any point on the border of the country within which the proposed station will be located.

3.3 In no case may station power exceed 10 kW.

4. Required coordination of assignments on first and second adjacent channels

An administration proposing to bring into use an assignment on an allotted channel in a border area shall coordinate this assignment with another administration if the field strength produced by the proposed assignment within the neighboring adjacent channel allotment area of that other administration exceeds the daytime nominal usable field strength divided by the applicable protection ratio as prescribed in 3.5 and 3.7 of Annex 1, respectively. In no case, however, will such coordination be required if the

proposed assignment is located at a distance from the neighboring adjacent channel allotment area greater than the following:

for first adjacent channels:

- ground path in noise zone 1: 53 km
- mixed or sea path in noise zone 1: [310] km
- ground path in noise zone 2: 35 km
- mixed or sea path in noise zone 2: [160] km

for second adjacent channels:

[to be developed]

5. Protection considerations

5.1 Protection of allotments from assignments on allotted channels

Assignments implementing co-channel allotments are considered to be compatible with each other when they are brought into use in accordance with section 2.

5.2 Protection of allotments from assignments on non-allotted channels

5.2.1 The area of another administration to which a channel is allotted shall be protected by assignments on non-allotted channels. The area to be protected is delimited by:

- the boundary of the allotment area; and
- the contour corresponding to the nominal usable field strength of any assignment on the allotted channel which extends beyond the boundary of the allotment area and is within the country.

5.2.2 In the case of nighttime co-channel interference, the skywave or groundwave field strength, whichever is greater, produced at the boundary of the area defined in 5.2.1 by an assignment on a non-allotted channel shall not exceed the nominal usable field strength prescribed in 3.5 of Annex 1 divided by the co-channel protection ratio prescribed in 3.7 of Annex 1. In all other cases only groundwave interference is considered.

5.2.3 In the case of mixed or sea paths for daytime hours, the groundwave field strength produced at the boundary of the area defined in 5.2.1 shall not exceed the field strength that would be produced by a station with standardized parameters located at the standardized distance. The reference

situation is established by hypothetically locating the reference station at the standardized distance on a line that passes through the proposed transmitter site and each point on the boundary of the protected allotment area being assessed.

5.2.4 In addition to the proscriptions in 5.2.2, the interfering skywave field strength produced at any point within the protected area defined in 5.2.1 shall not exceed the maximum permissible field strength prescribed in Figure 1.

5.2.5 Where the contour corresponding to the nominal usable field strength extends beyond the border of the country in which the station is located, the maximum permissible interfering field strength at the border shall be the field strength of the protected station calculated along the border divided by the protection ratio. For protection purposes, the border of a country should be deemed to encompass only its land area, including islands.

5.2.6 The effect of each interfering transmitter shall be evaluated separately, and interference from other transmitters shall not be taken into account in determining the maximum signal strength permitted from each transmitter.

5.3 Protection of assignments on non-allotted channels from assignments on allotted channels

Assignments on non-allotted channels do not receive protection from assignments on allotted channels.

5.4 Protection of assignments on non-allotted channels from other assignments on non-allotted channels

5.4.1 Assignments on non-allotted channels are protected from subsequent assignments on non-allotted channels. The protected contour encompasses the area in which the groundwave field strength is equal to or greater than the appropriate value of E_{nom} given in 3.5 of Annex 1.

5.4.2 The field strength of skywave interfering signals shall be calculated at the site of an assignment using a non-allotted channel.

5.4.3 The maximum permitted interfering field strength is the value of the nominal usable field strength divided by the appropriate protection ratio.

5.4.4 In the case of nighttime co-channel interference, the interfering signal considered is the greater of the skywave or groundwave signal. In all other cases, only groundwave interference is considered.

5.4.5 The effect of each interfering transmitter shall be evaluated separately, and interference from other transmitters shall not be taken into

account in determining the maximum signal strength permitted from each transmitter.

5.4.6 Where the protected countour extends beyond the border of the country in which the station is located, the maximum permissible interfering groundwave field strength at the border is the field strength of the protected station calculated along the border divided by the protection ratio. For protection purposes, the border of a country should be deemed to encompass only its land area, including islands.

6. Protection of stations of the fixed and mobile services on non-allotted channels

(To be addressed in additional proposals submitted by the United States.)

FIGURE 1

Maximum permitted skywave field strength
at any point within an allotment area

[To be developed]

ANNEX 3

to the Regional Agreement
to establish a Plan for the
Broadcasting Service in the Band 1 605 - 1 705 kHz
in Region 2

PLAN

OF ALLOTMENTS

AND

ALLOTMENTS CONVERTED TO ASSIGNMENTS

APPENDIX B

DESCRIPTION OF THE ALLOTMENT PLANNING METHOD

1. *Introduction*

Because the major portions of the technical criteria were already adopted at the First Session, the bulk of the work at the Second Session will be devoted to the development of a regional plan. During the intersessional period, a considerable amount of work was to be done in preparation for the Second Session. Although some of this has been done; additional work remains to be done with the assistance of experts from various countries in the Region.

Since the First Session of the Conference adopted a plan based on the allotment of channels to areas rather than the assignment of channels to specific locations, planning will be framed in terms of the effect between allotments. Each country will be divided into one or more allotment areas, and one or more frequencies will be assigned for use in each allotment area. Following is a more detailed description of this process, with an indication of how much has already been accomplished, and what remains to be done.

2. *Standardized Separations Between Co - channels* For planning purposes minimum standardized separations have been adopted between co-channel allotment areas. For land paths, these separations are 330 km for Noise Zone 1 (which includes all U.S. territory) and 120 km for Noise Zone 2. For mixed land and sea paths, various separations have been used in studies conducted by the IFRB as part of the intersessional activities. However, for mixed paths, the distances were limited to the sea portion of the path plus no more than 330 km or 120 km of the land path in Noise Zones 1 and 2, respectively.

Using the fixed land path separations and the various mixed path separations, maps have been prepared showing the allotment areas and the minimum number of frequencies available for use in each allotment area. A complete study of Region 2 has been completed using a mixed path separation of 600 km, and a study of the Region (excluding the Eastern Carribean) has been completed using a mixed path separation of 450 km.[1]

When using a mixed path separation of 600 km, at least one frequency is available for use throughout the Region, except in the Eastern Carribean. Following the procedures adopted at the First Session, the IFRB found that it would be necessary to reduce the mixed path separation to 350 km in the Eastern Carribean to provide for at least one frequency per allotment area. However, the IFRB went beyond the techniques described in the Report to the Second Session. The planning method adopted at the First Session was enhanced through the use of a "pairing" concept that allows a frequency to be reused at a closer geographic distance. Consider the following example:

A<----400 km---->B<----350 km---->C

This figure shows three allotment areas (A, B, and C) within a 600 km radius of B, thus permitting the allotment of a minimum of three channels for area B pursuant to the planning method adopted at the First Session. However, it is obvious that areas A and C are separated by more than the co-channel standardized distance (in this example, 600 km), thus allowing the use of the same frequencies in areas A and C. By pairing A and C and requiring them to use the same frequencies, five frequencies become available for use in area B instead of three. This approach can be generalized for any number of linked allotment areas and pairs, and can be extended threefold and beyond if appropriate.

Using the pairing concept in the Eastern Carribean, the IFRB found that a mixed path distance as high as 500 km could provide for at least one frequency per allotment area.[2]

As the Lima CITEL meeting analyzed the IFRB's work, it became apparent that certain additional studies are required in preparation for the Second Session. Specifically, it was deemed necessary to develop maps of allotment areas and related tables for a mixed path of 500 km for all of Region 2; the 500-km study was done only for the Eastern Carribean. Also, it was thought important to develop the maps and tables for a mixed path of 450 km in the Eastern Carribean; the earlier 450-km study did not include the Eastern Carribean. These additional studies are necessary so that the Second Session will have complete studies using 450 km, 500 km, and 600 km to be able to properly balance the tradeoffs of more available frequencies for some allotment areas against increases in interference resulting from shorter distances between allotment areas. Until we receive the results of these studies, and have an opportunity to analyze them, we will be unable to take a position concerning the most desirable mixed path distance(s) to be used for development of the allotment areas.

3. *Adjacent Channel Situations*

The planning techniques adopted at the First Session are based primarily on co-channel considerations. However, at the Second Session it will be necessary to take adjacent channels into account as we allot the frequencies. A rigorous approach to taking adjacent channels into account (analagous to the co-channel situation) has not been found. Indeed, work at the Ecole Polytechnique Federale de Lausanne in Switzerland, in conjunction with the IFRB, has shown that it is not possible to eliminate all first adjacent channel relationships between all geographically adjacent countries. (Because the power has been limited to one kilowatt, the second-adjacent and third-adjacent considerations are so minimal that they can generally be ignored in developing the allotment plan, although they will assume a greater importance in making actual assignments.)

We anticipate that the development of the Plan at the Second Session can avoid the potential for many first adjacent channel incompatibilities between countries by judicious assignment of frequencies. However, in many cases, such as when only two countries share the 10 frequencies, it is simply impossible from an engineering standpoint to provide that all allotments can be implemented while ignoring first adjacent channels in other countries. Thus, in general throughout the Region, it will be necessary that the remaining adjacent channel situations be handled via bilateral and/or multilateral agreements between and/or among the affected countries. In the case of the continental U.S., we anticipate that our excellent bilateral relationships with Canada and Mexico will be extended to cover the adjacent channel situation.

In the event that such agreements do not exist, or in the event of an unsuccessful application of such agreements, then the most appropriate and effective manner of resolving these situations would be a procedure similar to the one incorporated in International Radio Regulations 1506 and 1509, with appropriate modifications to apply to the band 1605-1705 kHz. These regulations provide that when coordination has not been successfully effected, with respect to the probability of harmful interference, on examination of notices of frequency assignments, the IFRB will take into account the frequency assignments for transmission or reception already recorded in the Master Register.

The First Session adopted distances to be used to determine when there would be a first adjacent channel impact between allotment areas. Since these distances correspond to a co-channel mixed path separation of 600 km, it would be necessary to change the adjacent channel distances if a co-channel mixed path distance other than 600 km is adopted at the Second Session.

4. *Additional Preparatory Work*

Participants at the Lima CITEL meeting, noting that the Second Session will last less than three weeks, suggested that other intersessional tasks (in addition to completion of the 450-km and 500-km studies discussed above) be undertaken so as to facilitate the work at the Second Session:

a. Preparation of maps showing stations on 1600, 1590, and 1580 KHz, along with their pertinent contours, for assistance in allotting 1610, 1620 and 1630 KHz.

b. Preparation of lists showing how all of the allotment areas are linked to each other using distances of 450, 500, and 600 km.

c. Development of draft allotment plans, based on mixed path distances of 450, 500, and 600 km. The draft plans would incorporate the pairing concept described above.

A suitable resolution requesting that the additional intersessional tasks be carried out has been adopted by CITEL and sent to the IFRB for consideration. It is understood that the IFRB would not be able to handle these tasks with its own staff, and would need assistance from various countries in carrying them out. The Commission is more than prepared to assist in this effort.

FOOTNOTES FOR APPENDIX B

[1] The results of these studies by the IFRB were previously placed in the docket of this proceeding.

[2] The results of this study will be placed in the docket of this proceeding.

APPENDIX C

SUMMARY OF COMMENTS

1. Comments were filed by three parties: Association for Broadcast Engineering Standards Inc., Offshore Navigation, Inc., and the American Association of State Highway and Transportation Officials.[1]

2. In its comments, the Association for Broadcast Engineering Standards, Inc. (ABES), notes that the allotment method, adopted at the First Session of the Conference, provides the proper foundation for the ultimate station assignments which will be made in the expanded band. It further submits that this approach will give the Commission the greatest degree of flexibility in making station assignments on the basis of actual demands for service, rather than on the basis of a more rigid system of predictive station assignments. ABES believes that the two principal technical issues left unresolved by the 1986 First Session of the Expanded Band Conference were properly referred to the Radio Advisory Committee for further study and elaboration. Commenter commits itself to full participation in the Committee's work to deal with any aspects of these or other technical matters on which its assistance would be helpful.

3. In regard to Travelers Information Stations (TIS), ABES does not take issue with the Commission's tentative conclusion that the present assignment of TIS facilities to 1610 kHz will have to be modified. Although the ultimate placement of TIS is a domestic issue, ABES points out that the Commission's flexibility in this regard will be affected by the provisions in the Final Agreement reached at the Second Session of the Conference. Therefore, commenter asserts that it is important for the United States to support station assignment standards that will be compatible with the establishment and continuation of TIS service on 1700 kHz or elsewhere in the expanded band. Also, it submits, TIS should continue to be considered a broadcast service and agreements on any secondary uses of the additional 100 kHz of spectrum to be allotted to the AM band should recognize the importance of full and adequate protection to broadcast services.

4. Also commenting on the TIS service is the American Association of State Highway and Transportation Officials, Special Committee on Communications (AASHTO Committee). This is a non-profit, non-partisan association representing the highway and transportation departments of the fify states and the District of Columbia and the Commonwealth of Puerto Rico. This broad based, nationally constituted organization is involved in all aspects of highway and transportation system planning, construction, and operation. The ASSHTO Special Committee on Communications is one of many committees of this organization. It focuses its interest and expertise on the various radio frequency communications needs associated with America's highway systems. This committee is charged with the responsibility for promoting communications system planning to meet future needs as well as promoting the efficient operation of the country's highway system for public safety and convenience.

5. Commenter agrees with the Commission that the most feasible approach to providing effective and improved TIS service as well as to increase the number of locations where TIS stations can provide adequate service, is to permit the use of 1700 kHz for TIS operations on an exclusive basis. AASHTO Committee also believes that this channel would be the most desirable to use because interference would be negligible on the upper band- edge side and, with appropriate power adjustments, interference would be minimal to other broadcast services on the lower adjacent channels. In addition, the problem of many AM radios not being able to tune outside the band-edge, as in the present situation with 1610 kHz, would be eliminated.

6. Based on information provided by state and local governments and by federal agencies, AASHTO Committee notes that requirements to provide emergency or informative highway data, highway services availability and localized weather information are increasing significantly. Current TIS operations on band-edge channels with fixed power and antenna characteristics do not always provide reliable service. In order to ensure that the public can receive this important information, commenter states that not only is it necessary to provide an in-band channel for TIS, but also it is important to establish technical criteria that will ensure an adequate signal level for the required service area. In its view this means establishing a field strength contour system similar to that used by the AM Broadcast Service.

7. Offshore Navigation, Inc. (ONI), was established in 1946 to provide "high accuracy radiopositioning services" in support of petroleum exploration and development. Other users of ONI's services include entities engaged in photomapping and hydrographic operations. Also, the United States Navy has engaged ONI to render "positioning" service in the speed and manuvering trials of the Navy's fleet ballistic missile submarines for more than twenty years.

8. ONI's comments are directed to the sharing criteria between broadcast and non-broadcast services. ONI is interested in this issue because currently the Radiolocation service is a secondary service at 1625-1705 kHz. Commenter's "SPOT" spread spectrum system operates in this frequency range with an emission bandwidth of 156 kHz. The system is operated from coastal locations to provide coverage over the offshore waters. The SPOT system enables the radiolocation operator to maintain precise position control at distances of 350-400 miles from shore. According to ONI, the operation of its spread spectrum system poses no threat of harmful interference to AM broadcast service. The SPOT system is operated along the coastlines and provides service to the offshore waters, away from populated areas where AM broadcast stations operate. Furthermore, commenter submits that locating stations along shore easily can be coordinated with AM broadcast stations.

9. In particular, ONI objects to use of the procedure suggested in the *Third Notice* for establishing sharing criteria between broadcast and non- broadcast services. The *Notice* mentioned that one possible model for defining the relationship between the allotments in the broadcast service and the permitted services, fixed and mobile, may be found in Article 6 of Appendix 30 of the International Radio Regulations. In that Article, terrestrial stations in a band planned by the Broadcasting Satellite (BSS) are made subject to additional procedures. These procedures require that any proposed fixed or mobile service registration be examined by the IFRB to determine if there is a probability of harmful interference to the assignments in the BSS Plan. ONI believes that such a procedure might result in a virtual ban upon the licensing of its services. It argues that the IFRB reviews terrestrial assignments due to the international service aspects of the broadcasting - satellite assignments and the relatively high power of terrestrial stations. However, ONI states that spread spectrum systems do not produce a field strength in excess of 120 microvolts per meter per square root Hertz at one mile from the transmitter site. Thus, ONI believes the above-described procedure would be inappropriate for Radiolocation services such as its own. Instead, it seeks to rely on No. 342 of the International Radio Regulations to permit operations that do not result in interference.

FOOTNOTE FOR APPENDIX C

[1] Comments and reply comments were due in response to the *Third Notice of Inquiry* on September 8, and September 23, 1987, respectively. Although the comments of the American Association of State Highway and Transportation Officials were late-filed, they will be accepted as their consideration is not prejudicial to any party and they were late by only one day. No reply comments were filed in response to the *Notice*.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1988— 201-708/80016