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COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND APPLICATIONS

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March 31, 1995

Mr. William F. Caton
Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

DOCKET FILE COPY ORIGINAL

Re: MM Docket No. 95-17

In the Matter of

Amendment of Parts 73 and 74
of the Commission's Rules
To More Effectively Protect
Radio Astronomy Activity
On Channel 37

Dear Mr. Caton:

Transmitted herewith by the National Academy of Sciences, through the Committee on Radio Frequencies of the National Research Council, are an original and nine (9) copies of its comments in the above-referenced proceedings.

If additional information is required concerning this matter, please communicate with this office.

Sincerely yours,

Robert L. Riemer

Robert L. Riemer
Senior Program Officer

Enc.

cc: Members of CORF
Mr. Paul J. Feldman, Esq.
Dr. Donald C. Shapero

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Before the
FEDERAL COMMUNICATIONS COMMISSION
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COMMENTS OF THE
NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

The National Academy of Sciences, through the National Research Council's Committee on Radio Frequencies (hereinafter, "CORF"), hereby submits its comments in response to the Commission's Notice of Proposed Rulemaking, FCC 95-35, released February 21, 1995, in the above-captioned proceeding (the "Notice"). In these Comments, CORF strongly supports the Commission's goal of protecting radio astronomy facilities from interference from television operations on Channels 36 and 38. However, CORF suggests that its original proposal of protection based on minimum distance separation is required under footnote US74. In any case, the original CORF proposal will provide better

protection than the protection based on field strength limits proposed in the Notice.

I. Introduction.

CORF is pleased that the Commission has issued a proposal to increase protection to radio astronomy facilities doing research at 608-614 MHz, the allocation to the Radio Astronomy Service at Channel 37. Radio astronomy is a vitally important tool used by scientists to study our universe. Using radio astronomy, scientists have recently discovered the first planets outside the solar system circling a distant pulsar. Measurements of radio spectral-line emission have identified and characterized the birth sites of stars in our own Galaxy and the complex distribution and evolution of galaxies in the universe. Observations of supernovas provide evidence of the creation and distribution of heavy elements essential to the formation of planets like the Earth and of life itself. Furthermore, in addition to increasing knowledge of the universe, the technique of very-long-baseline interferometry ("VLBI"), developed for cosmic observations, is increasingly producing substantial benefits through use in terrestrial observations, including measurements of global distances

(e.g., identification of potential earthquake zones through measurement of fault motion), and through major contributions to navigation, including the tracking of spacecraft. These benefits of radio astronomy, obtained through years of work and substantial federal investment, as well as future benefits, must be protected.

As passive users of the spectrum, radio astronomers have no control over the character of the "transmitted" signal. Furthermore, the emissions that radio astronomers detect are extremely weak—a typical radio telescope receives only about one-trillionth of a watt from even the strongest cosmic source. Radio astronomy is therefore particularly vulnerable to interference from unwanted emissions from users of neighboring bands. These concerns motivated CORF to file its petition for rulemaking, which led to the Notice in this proceeding.

In its Petition, CORF noted that, although the Commission's rules reserve Channel 37 for the Radio Astronomy Service,[1] radio astronomy sites were receiving destructive interference from adjacent channel facilities on

[1]See Sections 73.603(c) and 74.702(a).

Channels 36 and 38, in amounts greater than that allowed under the Commission's rules. Footnote US74 provides:

> In the bands...608-614 [MHz]..., the radio astronomy service shall be protected from extraband radiation only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service which it operates. (47 C.F.R. Sec. 2.106)

In other words, radio astronomy ("RA") operations on Channel 37 are entitled to protection from interference resulting from television stations operating in compliance with the "technical standards" and other "applicable criteria" of Parts 73 and 74. The Petition noted that one such standard or criterion is the minimum separation provisions of Section 73.610(c)(1). The Petition noted, however, that full-power stations have been authorized on Channels 36 and 38 at less than the minimum distance separation, apparently without concern for, or even knowledge of, radio astronomy operations. The Petition noted that low-power TV stations have caused even greater concern, because of their ubiquity and the fact that Part 74 specifies adjacent channel protection for one TV station from another TV station's Grade B contour, while RA operations have no such contour.

CORF proposed a three-part solution:

1. Incorporating into Part 73 the locations of thirteen radio astronomy sites that use the 608-614 MHz band, so that applicants will know the specific locations entitled to protection;

2. Deleting Channel 38 at Hilo, Hawaii, from the Table of Allotments; and

3. Amending Part 74 of the Rules so as to provide for protection of Channel 37 in terms of a minimum distance separation.

In the Notice, the Commission recognizes the need for further protection to RA research in the 608-614 MHz band and proposes the deletion of the Channel 38 allocation at Hilo, Hawaii. CORF fully supports this proposal and notes that the documentation provided in the Petition demonstrates the public interest in this deletion.

The Notice also proposes to list (in Part 73 of the Rules) the RA sites that conduct observations in the 608-614 MHz band and that are entitled to protection. Again, CORF fully supports this proposal[2] and believes that such a

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[2]Except that the National Radio Astronomy Observatory at Green Bank, West Virginia, receives greater protection under the Commission's "quiet zone" rules (Sections 73.1030(a) and 74.12), and because such additional protection is necessary, CORF recommends that the Green Bank site be removed from the list proposed in Section 73.613(b), to prevent confusion as to the level of protection given that site. Proposed Section 73.613(b) should be modified to add the following language: "Channel 37 is also used for radio astronomy

listing will better alert new applicants and prevent inadvertent filing and grant of applications that fail to properly protect RA sites.

However, rather than protecting the RA sites through use of minimum distance separations, proposed Sections 73.613(a) and 74.711 establish maximum field strength from Channel 36 or Channel 38 facilities of 64 dBu at the RA site. Apparently the Commission believes that the language in footnote US74 is not sufficiently clear to mandate protection through use of minimum distance separations. As shown below, CORF believes that this belief is incorrect: the footnote explicitly states that television facilities are to protect RA facilities by complying with the "technical standards or criteria applicable to" the television service. The minimum distance separations are clearly stated in the TV service rules although CORF asserts that they are "technical standards," at the very least they are "criteria" applicable to TV stations. Accordingly, the Commission is obliged to protect RA sites through use of minimum distance separation, as long as that is the manner

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facilities at Green Bank, West Virginia, at 38/25/59 N.L., 79/25/59 W.L. These facilities are subject to protection from adjacent-channel interference pursuant to Sections 73.1030(a) and 74.12."

of protection under which TV stations are protected from other stations. And regardless of the applicability of US74, use of minimum distance separations is a simpler, more efficient method for all parties involved. It should not be burdensome for broadcasters, and flexibility can be retained by allowing for consideration of petitions for waiver, where necessary.

II. Minimum Distance Separations Are Technical Standards or Criteria Applicable to the TV Service, and Thus Must Be Used in Protecting Radio Astronomy Facilities.

In its Petition, CORF proposed that the provision of the rule that lists the RA sites to be protected explicitly re-state the adjacent channel minimum distance separation requirement set forth in Section 73.610(c)(1) of 87.7 kilometers (54.5 miles). CORF's proposal was based on the premise that RA sites are entitled to the same sort of protection from adjacent channel interference as that afforded to UHF stations. That premise was based on the following logic:

1. The Report and Order originally giving protection to RA operations on Channel 37 stated that although the Commission would not place extraordinary burdens on stations at Channel 36 and 38 it would

require protection based on the rules applicable to other UHF-TV channels;[3]

2. Footnote US74 is consistent with this interpretation in stating that television facilities are to protect RA facilities by complying with the "technical standards or criteria applicable to" the television service;

3. The "technical standards or criteria" under which full-power UHF stations at Channels 36 and 38 must protect adjacent channels is the 87.7 kilometer minimum distance separation provided for in Section 73.610(c)(1); and

4. Although Part 74 does not have the same explicit minimum distance standard, RA facilities do not have a "protected contour" to protect, and it would be incongruous to require low-power stations to provide less protection to RA facilities than that required of full-power stations.

The Notice did not specifically address any of these points, but rather stated that it "disagrees" with CORF's construction of the rules. The Notice states (at para. 4) that instead, the Commission believes that RA facilities are not entitled to any protections "other than what results from regulatory limitations on TV station facilities and out-of-band emissions." However, in the "Regulatory Notice's Flexibility Analysis" of the document, the Commission stated that the language of US74 "is not

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[3]Report and Order in Docket 15022, 39 FCC 884, 898 (1963).

sufficiently clear to precisely establish the protection that radio astronomy facilities should be afforded." CORF believes that the Commission's statement is incorrect and that US74 obliges the Commission to give RA facilities the same protection given to TV facilities.

First, the minimum separation requirement established in Section 73.610 of the Commission's rules is clearly a "technical standard." It is a requirement imposed on television facilities, as opposed to a rule regarding the content of programming, structural regulation regarding ownership, or procedural rules for applications or hearings. The minimum distance rule is one means of limiting interference, just as field strength measurement is another means of limiting interference. Clearly field strength limits are "technical standards," and there is no logical basis for denying that another means of limiting interference is also a "technical standard."[4]

Even if, arguendo, minimum separation distances are not "technical standards," US74 provides that RA facilities are

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[4]See, e.g., Narrowband PCS Report and Order, 8 FCC Rcd 7162, 7168-69 (1993)(minimum distance separation discussed under category "Technical Standards") and Section 99.417 of the Commission's rules (Co-channel separation distances listed under Sub-Part C "Technical and Operational Requirements").

to be protected by requiring TV facilities to follow "criteria applicable to the [TV] service...." How can minimum distance separation rules applicable to TV facilities not at least be "criteria applicable" to the TV service? CORF asserts that the answer is obvious.

Accordingly, the Commission is obliged under US74 to give RA facilities the same protection accorded TV facilities. CORF urges the Commission to revise Section 73.613(a) to require adjacent-channel TV stations to give RA facilities listed in Section 73.613(b) the minimum distance separation required under Section 73.610(c)(1).

III. Use of Minimum Distance Separations Is in the Public Interest.

CORF asserts that US74 obliges the Commission to enact rules using minimum distance separation to protect RA facilities, as long as such rules are used to protect TV facilities. However, regardless of the role and interpretation of US74, use of minimum distance separation for the protection of RA facilities is in the public interest. As the Commission stated in proposing rules for Advanced Television Service,

> [t]his traditional approach [use of minimum spacings to protect against interference] has proved to be an

> efficient, effective means for managing interference between stations...the geographical spacing approach allows considerable flexibility in the specification of station operating parameters such as power and antenna height.... [ATV Second Further NPRM, 7 FCC Rcd 5376, 5381 (1992)]

CORF concurs with this judgment. The use of minimum distance separation is the most efficient and effective method of protection, since compliance, as well as evaluation of compliance, is simple: it is a purely go/no-go evaluation. This reduces the burden on the broadcaster, the RA facilities, and the Commission. Nevertheless, where specific conditions require less than the minimum distance separation, flexibility is available for the broadcaster to file a petition for waiver. The Commission has accepted and granted numerous such petitions, while acknowledging that the general application of the minimum spacing rule is in the public interest. See, Caloosa Television Corp., 3 FCC Rcd 3656, 3657 (1988).

In addition to being efficient to use, minimum separation distance is a more effective protection than field-strength measurements, because such measurements can vary regularly, based on atmospheric conditions and other factors. In addition, while the locations of transmitting facilities are hard to change, it is very easy for a

broadcaster to increase power, even if such an increase is inadvertent and made with no intention of harming adjacent channel users.

IV. Comments on Other Matters.

For the reasons stated above, CORF firmly believes that the Commission should use minimum distance separation to protect RA facilities from adjacent channel interference. However, the Notice sought comments on the choice of 64 dBu as the field strength protection to be given to RA facilities, and in light of the possibility of the Commission retaining the field strength method of protection, CORF offers the following observation.

CORF appreciates the Commission's attempt to calculate a field strength level that approximates the protection that would result from the minimum distance separation of 87.7 kilometers. CORF remains concerned, however, that the proposed level of protection not only is less than that recommended by the International Telecommunication Union (ITU), but also limits the productivity of RA operations at the facility receiving that level of interference. Commission rules [Sections 73.687(e)(1) and 74.736(c) and (d)] limit spurious emissions (mainly intermodulation

products) to -60 dB (relative to carrier power) for frequencies above 611 MHz for Channel 36 and below 611 MHz for Channel 38. Thus, a 64 dBu (-82 dBW/m^2) carrier level at an RA site means that intermodulation products within Channel 37 could be as high as -142 dBW/m^2. This is 43 dB above the Recommendation ITU-R RA.769 Table 1 harmful interference level of -185 dBW/m^2 for single antennas and for the RA Very Large Array. Furthermore, the 64 dBu proposal creates a level of interference greater than the Recommendation ITU-R RA.769 Table 3 level of -143 dBW/m^2 for the RA Very Long Baseline Array. The greater the level of interference to such RA facilities, the greater the limitation on the types of research that can be conducted at such facilities. Accordingly, CORF recommends that the field strength protection of 64 dBu be applied to the sum of field strengths from all Channel 36 and Channel 38 stations within the 87.7 km distance.

On another matter, the Notice sought comments as to whether the Commission should require notification to radio astronomers by applicants for new or modified Channel 36 or Channel 38 facilities proposed within 87.7 kilometers of an RA site listed in Section 73.613. The answer is yes-such

notification would be of tremendous assistance to radio astronomers. The RA community does not have the resources to monitor all TV applications, and the notification requirement would alert the RA site at issue of a matter of great importance. Such early notification is likely to result in discussions leading to a mutually acceptable resolution, limiting the burden on the Commission. The notification requirement would not place a substantial burden on broadcast applicants, and as the Commission noted, is already required of applicants within the RA "quiet zone." The proposed notification for the remaining RA sites should be coordinated through the Electromagnetic Spectrum Manager, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Room 1045, Arlington, Virginia 22230.

V. Conclusion

CORF strongly supports the Commission's goal of protecting radio astronomy facilities from interference from television operations on Channels 36 and 38. CORF fully supports the proposed deletion of the Channel 38 allocation at Hilo, Hawaii. CORF also fully supports the proposal to list, in Part 73 of the Rules, the RA sites (other than

Green Bank) that conduct observations in the 608-614 MHz band and that are entitled to protection. Such a listing will better alert new applicants and prevent inadvertent filing and the granting of applications that fail to properly protect RA sites. Lastly, while CORF is pleased that the Commission proposes to make explicit the protection to which those RA facilities are entitled, the use of minimum distance separations set forth in Section 73.610 is required under footnote US74, and in any case is the best public policy for RA frequency protection.

Respectfully submitted,
NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

By: Bruce Alberts
Bruce Alberts
President

March 31, 1995

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