

NATIONAL RESEARCH COUNCIL  
COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND APPLICATIONS

2101 Constitution Avenue Washington, D.C. 20418

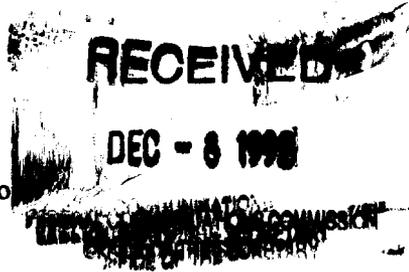
BOARD ON  
PHYSICS AND ASTRONOMY

(202) 334-3520  
FAX: (202) 334-2791  
BPA@NAS.EDU

ORIGINAL  
FILE

December 8, 1992

Ms. Donna R. Searcy  
Secretary  
Federal Communications Commission  
1919 M Street, N.W.  
Washington, D.C. 20554



Re: ET Docket No.92-28; RM-7771, RM-7773,  
RM-7805, RM-7806, PP-29, PP-30, PP-31, PP-32,  
PP-33

In the Matter of

Amendment of Section 2.106 of  
the Commission's Rules to  
Allocate the 1610-1626.5 MHz  
and the 2483.5-2500 MHz Bands  
for Use by the Mobile-Satellite  
Service, Including Non-  
Geostationary Satellites

Dear Ms. Searcy:

Transmitted herewith by the National Academy of Sciences—National Research Council's  
Committee on Radio Frequencies are an original and nine (9) copies of its Motion to Accept Late-  
Filed Comments and its Comments in the above-referenced proceedings.

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

Sincerely,

Robert L. Riemer  
Associate Director

Enclosure

No. of Copies rec'd  
List A B C D E

049

BEFORE THE  
Federal Communications Commission

WASHINGTON, D.C. 20554

RECEIVED

ORIGINAL FILE

DEC - 8 1992

In the Matter of )  
 )  
Amendment of Section 2.106 of )  
the Commission's Rules to )  
Allocate the 1610-1626.5 MHz )  
and the 2483.5-2500 MHz Bands )  
for Use by the Mobile-Satellite )  
Service, Including Non- )  
geostationary Satellites )

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

ET Docket No. 92-28

COMMENTS OF THE COMMITTEE  
ON RADIO FREQUENCIES OF THE  
NATIONAL ACADEMY OF SCIENCES

NATIONAL ACADEMY OF SCIENCES  
Dr. Frank Press, President

December \_\_, 1992

Direct correspondence to:

Dr. Robert L. Riemer  
Committee on Radio Frequencies  
National Research Council  
HA-562  
2101 Constitution Ave., N.W.  
Washington, DC 20418

Please also serve:

Mr. Richard G. Gould  
Telecommunications Systems  
1629 K Street, N.W.  
Suite 600  
Washington, DC 20006

BEFORE THE  
Federal Communications Commission

WASHINGTON, D.C. 20554

RECEIVED

DEC - 8 1992

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of )  
)  
Amendment of Section 2.106 of )  
the Commission's Rules to ) ET Docket No. 92-28  
Allocate the 1610-1626.5 MHz )  
and the 2483.5-2500 MHz Bands )  
for Use by the Mobile-Satellite )  
Service, Including Non- )  
geostationary Satellites )

COMMENTS OF THE COMMITTEE  
ON RADIO FREQUENCIES OF THE  
NATIONAL ACADEMY OF SCIENCES

I. Introduction

The National Academy of Sciences, through the Committee on Radio Frequencies ("CORF") of the National Research Council, hereby offers its Comments on the above-captioned matter.

In its Notice of Proposed Rulemaking and Tentative Decision (NPRM), released on September 4, 1992, the Commission proposed, inter alia, to allocate the 1610-1626.5 and 2483.5-2500 MHz bands to the Mobile-Satellite Service (MSS), including non-geostationary satellite systems such as those using low-Earth-orbit (LEO) satellites.

The Commission noted that the proposed allocations are consistent with decisions made at the 1992 World Administrative Radio Conference (WARC-92), which allocated these bands internationally. It also noted that the 1610.6-1613.8 MHz band is allocated to the Radio Astronomy Service on a co-primary basis, to the Radiodetermination-Satellite Service (RDSS) for Earth-to-space transmissions, and also to the aeronautical radionavigation service. The Commission sought comment on the technical feasibility of space-to-Earth transmissions in the 1613.8-1626.5 MHz band, particularly as it could affect the Radio Astronomy Service in the 1610.6-1613.8 MHz band.

CORF has already expressed to the Commission its concern over the interference that could be caused to radio astronomy in two bands from MSS and RDSS emissions. CORF noted that interference could be caused to radio astronomy operations in the 1610.6-1613.8 MHz band from Earth-to-space transmissions of the MSS and the RDSS in the same band and in the adjoining 1613.8-1626.5 MHz band; and from space-to-Earth transmissions of the MSS in the adjoining band. Moreover, CORF noted that interference could be caused to radio astronomy operations in the

4990-5000 MHz band from the second harmonic of space-to-Earth transmissions from the RDSS and MSS in the 2483.5-2500 MHz band.

Radio astronomers receive unique information about the physical conditions within celestial objects from studying specific transitions of atoms and molecules. The 1610.6-1613.8 MHz band is unique because of the information received from the transition of the hydroxyl molecule OH. This spectral line has many astronomical uses; for example, it provides details of the atmospheres of red giant stars that cannot be derived in another way or at a different frequency.

The concerns, and the restrictions proposed by CORF in its prior Comments, except as qualified herein, are incorporated into these Comments by reference.

II. MSS and RDSS uplink transmissions in the 1610.6-1626.5 MHz band must not cause interference to radio astronomy operations in the 1610.6-1613.8 MHz band.

Interference to radio astronomy operations in the 1610.6-1613.8 MHz band can be caused by uplink MSS or RDSS transmissions (that is, from terrestrial portable and mobile terminals) in the same and adjoining bands. MSS and RDSS uplink transmissions in the 1610.6-1626.5 MHz band must not cause interference to radio astronomy operations in the 1610.6-1613.8 MHz band (See Footnote RR 733E, Final Acts of WARC-92, International Telecommunications Union).

In its previous Comments, CORF stated that uplink RDSS transmissions in the 1610.6-1626.5 MHz band must comply with the requirements established for sharing with radio astronomy. That is still the view of CORF, with the additional proviso that uplink MSS transmissions in that band must also comply with the sharing requirements. In other words, the sum of interfering signals reaching observatories from MSS and RDSS terrestrial terminals must be below the level  $-237 \text{ dBW/m}^2/\text{Hz}$  set forth in CCIR Report 224.

One way to comply with this requirement, and to enable the RDSS and the MSS to still use the 1610.6-1626.5 MHz band for uplink transmissions, would be to establish a sufficiently large exclusion zone around each radio astronomy observatory that conducts operations in that band. A terrestrial terminal located within such a zone would then not be permitted to operate on frequencies that would cause radiation above the harmful interference level in the radio astronomy band at 1610.6-1613.8 MHz. Such a prohibition would require MSS and RDSS system operators to incorporate in their systems a method to detect that a given mobile terminal is within or nearing an exclusion zone, and automatically to block such a terminal from transmitting on

any channel in this band during the entire time it is located within such a zone.

Before being licensed to operate in this segment of the overall allocations available to the MSS and RDSS, system operators should be required to demonstrate to the Commission that their system can provide protection in this manner.

Another technique that has been suggested to comply with the sharing requirement is to measure true path loss. This requires cooperation from the radio observatories and additional capability in the ground-based terminal. A beacon operating sufficiently far away in frequency so that it would not cause interference at the observatory but still be within the band of frequencies used by the mobile terrestrial terminals, and activated only during observatory operations, could be sensed by the receiver of a mobile terminal. If a beacon signal above a predetermined threshold were detected, the mobile terminal would automatically include that information in its channel request (or "off-hook" signal) in the transmission it initiates on the system control channel. The control center, on sensing that information, would then assign to the mobile terrestrial terminal a channel available for uplink transmissions in another band.

Another possible technique is the use of a system in which the provider of the service knows where the transmitter is and knows the location of the observatory and the boundaries of an exclusion zone. An electronic link from the observatory to the control center could then be used to signal when the observatory was operating on the pertinent frequencies. The service provider could block out offending frequencies when the transmitter was within the exclusion zone.

These suggestions do not mean that CORF now agrees that radio astronomy beacons are a way to prevent interference to radio astronomy operations.<sup>1/</sup> Rather, CORF suggests that a system operator could be licensed to use the 1610.6-1626.5 MHz band for uplink transmissions if it demonstrates, through detailed technical submissions and actual tests and demonstrations, that its proposed beacon system will protect radio astronomy operations in this band. CORF is also concerned with the complexity of the implementation for the required protection scheme. Any effective system should be simple and automated, requiring a minimum of special equipment and administrative effort for the parties involved.

---

<sup>1/</sup> For example, the beacon system would not work in the case of aeronautical mobile stations. Therefore, to ensure protection, the positions of aeronautical mobile stations would have to be known at all times, and such stations would have to be excluded from transmitting on frequencies that would interfere with radio astronomy observatories located over large areas, with radii possibly as large as 1000 km.

III. Downlink MSS transmissions in the 1613.8-1626.5 MHz band must not cause interference to radio astronomy operations.

Interference to radio astronomy operations could also be caused by out-of-band and spurious emissions from downlink MSS transmissions from MSS and RDSS systems in the adjacent 1613.8-1626.5 MHz band. CORF's previous Comments expressing concern over interference to radio astronomy operations from MSS or RDSS use of the 1610.6-1613.8 MHz band apply equally to interference caused by spurious and out-of-band emissions from transmissions in the adjacent band.

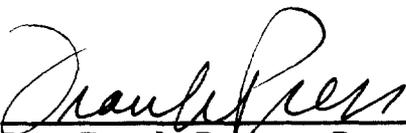
It is CORF's view that MSS and RDSS systems should only be authorized following a showing, supported by the submission of system design details and testing results, that interference levels in the 1610.6-1613.8 MHz band from adjacent band transmissions will not exceed the  $-237 \text{ dBW/m}^2/\text{Hz}$  level set forth in CCIR Report 224 for this band. This level can be achieved by a combination of MSS and RDSS system design factors.

Filtering of the satellite RF amplifier of both geostationary and non-geostationary satellites can contribute some of the required attenuation. Another measure is one that would be applicable primarily to non-geostationary satellites. Frequencies near the adjoining band edge would have to be avoided by satellites when they are both within line-of-sight and have sufficient equivalent isotropically radiated power (e.i.r.p.) in the direction of a radio astronomy observatory to cause interference. Specific observatories would be identified as requiring protection during stated periods of time.

IV. Downlink MSS and RDSS transmissions in the 2483.5-2500 MHz band must not cause interference to radio astronomy operations in the 4990-5000 MHz band.

CORF reiterates the concerns expressed in its previous Comments and the requirements proposed therein to protect radio astronomy operations in the 4990-5000 MHz band from the second harmonic of MSS and RDSS transmissions in the 2483.5-2500 MHz band. The required protection level is  $-241 \text{ dBW/m}^2/\text{Hz}$ , as set forth in CCIR Report 224 for this band. Any rule to be adopted by the Commission should require that spurious emissions into the 4990-5000 MHz band from MSS and RDSS transmissions in the 2483.5-2500 MHz band do not exceed that level. Prospective MSS and RDSS system operators should be required to demonstrate by actual measurements that their systems will comply with this requirement.

NATIONAL ACADEMY OF SCIENCES'  
COMMITTEE ON RADIO FREQUENCIES

By:   
Dr. Frank Press, President

December 8, 1992

Direct correspondence to:

Dr. Robert L. Riemer  
Committee on Radio Frequencies  
National Research Council  
HA-562  
2101 Constitution Ave., N.W.  
Washington, DC 20418

Please also serve:

Mr. Richard G. Gould  
Telecommunications Systems  
1629 K Street, N.W.  
Suite 600  
Washington, DC 20006