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

In the Matter of	)	
	)	
Amendment of Parts 2 and 25 to Implement	)	
the Global Mobile Personal Communications	)	IB Docket No. 99-67
by Satellite (GMPCS) Memorandum	)	
of Understanding and Arrangements	)	
and	)	
Petition of the National Telecommunications	)	
and Information Administration to Amend	)	RM No. 9165
Part 25 of the Commission's Rules	)	
To Establish Emission Limits for Mobile and	)	
Portable Earth Stations Operating in the	)	
1610-1660.5 MHz Band	)	

COMMENTS OF THE
NATIONAL ACADEMIES'
COMMITTEE ON RADIO FREQUENCIES

The National Academies, through the National Research Council's Committee on Radio Frequencies (hereinafter, CORF; see attached roster), hereby submits its comments in response to the Commission's March 5, 1999, Notice of Proposed Rulemaking in the above-captioned docket (NPRM). In these Comments, CORF expresses concern about the potentially harmful impact of Global Mobile Personal Communications by Satellite (GMPCS) system hand unit uplink transmissions on radio astronomy observations in the protected 1610.6-1613.8 and 1660.0-1660.5 MHz bands.

In regard to the lower of those two bands, CORF suggests that GMPCS hand unit rules explicitly state that transmissions in that band are subject to the emission limitations in Section 25.202 of the Commission's Rules and to the protection zones established in Section 25.213(a)(1) of the Commission's Rules. CORF also suggests that the Commission prohibit transmissions in the 1660-1660.5 MHz band until (1) International Telecommunication Union (ITU) studies on sharing conditions between the Mobile Satellite Service (MSS) and the Radio Astronomy Service (RAS) are completed, (2) MSS service rules are established for the 1660-1660.5 MHz band, and (3) the provisions of Section 25.202(f) or proposed Section 26.216(a) are applied to emissions into that band.

I. Introduction: The Importance of Radio Astronomy Observations in the 1610.6-1613.8 and 1660-1660.5 MHz Bands, and the Unique Vulnerability of Radio Astronomy to Man-Made Transmissions.

CORF has a substantial interest in this proceeding, since it represents the interests of the radio astronomy community, as well as that of other scientific users of the radio spectrum. As the Commission has long recognized, radio astronomy is a vitally important tool used by scientists to study our Universe. Through the use of radio astronomy, scientists have in recent years 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. Radio astronomy measurements have discovered ripples in the cosmic microwave background, generated in the early universe, which later formed the stars and galaxies we know today. Observations of supernovas witness the creation and distribution of heavy elements essential to the formation of planets like Earth and of life itself. Furthermore, in addition to increasing knowledge of our world and the Universe, radio astronomy has produced substantial benefits through the development of very-low-noise receivers and many other applications used in a variety of other radio applications. In addition, 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 frequencies that they need to study or over the character of the "transmitted" signal. These parameters are set by the laws of nature. Furthermore, the emissions that radio astronomers observe are extremely weak, in spite of the large collecting areas of their antennas. A typical radio telescope receives only about one-trillionth of a watt from even the strongest cosmic source. Because radio astronomy receivers are designed to detect such remarkably weak signals, its facilities are therefore particularly vulnerable to interference from man-made transmission from licensed and unlicensed users of neighboring and shared bands.

Of particular concern in this proceeding is interference to radio astronomy observations in the 1610.6-1613.8 and 1660.0-1660.5 MHz bands. Both of these bands are allocated on a co-primary basis to the Radio Astronomy Service. There is a reason for these primary allocations: observations in these frequency bands are among the most important for the science of radio astronomy, both for continuum measurements and spectral line observations of the hydroxyl (OH) radical. Such observations are of great importance to scientists studying stellar-envelope expansion velocities and extremely high rotational velocities near massive black holes. The best evidence for a massive black hole comes from measurements of OH radical clouds near the center of a nearby galaxy. The 1610-1613.8 MHz band is especially important in that it gives a window to study the nuclei of infrared-luminous galaxies, whose radiation at the 1612 MHz OH resonance is enhanced,

and whose radiation (from some galaxies) due to the 1667 MHz ground-state resonance of OH is red shifted (or lowered in frequency due to their motion outward from our Galaxy) down to this frequency band. Indeed, the *ITU Handbook on Radio Astronomy* (Geneva, 1995) lists the 1660-1670 MHz band as one of the preferred bands of the spectrum for continuum observations (Id. at Section 3.2, Table 1[1]). In addition, the *Handbook* includes observations of the OH radical at the rest frequencies of 1612.231, 1665.402, and 1667.359 MHz as being among the spectral lines of greatest importance to radio astronomy (Id. at Section 3.3, Table 2).

In sum, radio astronomy observations in these bands are very important, and, like all radio astronomy observations, are uniquely vulnerable to interference from man-made emissions. Such observations are particularly vulnerable to emissions from mobile transmitters, due to the ubiquity of the transmitters of popular mobile services and to the fact that in analyzing observational data, the impact of intermittent transmissions from mobile transmitters cannot be recognized or accounted for with the same ease as transmissions from known, stationary (fixed) sources.

II. For Protection of Radio Astronomy Observations in the 1610.6-1613.8 MHz Band, GMPCS Rules Should Explicitly Require Compliance with Existing Requirements on Emission Limitation and Protection Zone Requirements in Sections 25.202 and 25.213(a)(1) of the Commission's Rules.

For the reasons set forth above, CORF remains greatly concerned about the impact of GMPCS hand unit transmissions on radio astronomy observations. Yet, in the interest of protecting radio astronomy observations in the 1610.6-1613.8 MHz band, there are solutions that may reduce the harmful impact of GMPCS transmissions.

As the Commission correctly points out in Paragraph 19 of the Notice, GMPCS service providers are issued blanket authorizations for mobile earth terminals (hand units), and such blanket authorizations detail certain specific requirements for the protection of other radio services, including the emission limitation and protection zone requirements set forth in Sections 25.202(f) and 25.213(a)(1) of the Commission's Rules[2] (NPRM at note 29). These existing regulatory requirements can significantly reduce the impact of GMPCS on radio astronomy observations. Accordingly, while the requirements in these rules already apply to GMPCS hand units, CORF recommends that the GMPCS rules make specific reference to compliance with the requirements of Sections 25.202(f) and 25.213(a)(1). This cross-reference would be particularly helpful in light of the new participants in the GMPCS hand unit manufacturing and service provision industries, and the location of these entities in various countries around the world. Such reference could be placed in proposed Section 25.215(d) or in a new subsection of proposed Section 25.216 (which would have to be re-titled accordingly to reflect the expanded subject matter of that subsection).

III. Additional Requirements Are Necessary in Order to Protect Radio Astronomy Observations in the 1660-1660.5 and 1660.5-1670 MHz Band.

While there is some existing precedent, and specific Commission regulation, that applies to the sharing of the 1610.6-1613.8 MHz band between the Radio Astronomy Service and the Mobile Satellite Service, there is no existing precedent and fewer regulations that on their face apply to the sharing of the 1660.0-1660.5 MHz band. Based on footnote 29 of the NPRM, it appears that the provisions of Section 25.202(f) of the Commission's rules apply to GMPCS transmissions in and into 1660.0-1660.5 MHz and into the 1660.5-1670 MHz band. However, CORF believes that in light of the lack of existing operational precedent and in light of the great importance of this band to the RAS, the public interest would be best served by enacting specific regulations addressing the sharing of this band and by prohibiting GMPCS transmissions at 1660.0-1660.5 MHz until such a regulatory scheme is created. CORF recommends the following approach to sharing the 1660.0-1660.5 MHz band:

- A protection zone/coordination requirement similar to that set forth in Section 25.213(a)(1) of the rules; and

- An out-of-band emission limitation for GMPCS transmissions at 1610-1660 MHz, into the 1660.0-1660.5 and 1660.5-1670 MHz bands. Such a limitation could be similar to the limitation in Section 25.213(a)(1)(iii), or alternatively, similar to the proposed Section 25.216(a). In regard to creating an approach similar to that proposed in Section 25.216(a), CORF notes that it should be much easier for GMPCS hand units to protect the small band between 1660.0 and 1660.5 MHz, than to protect the much larger Aeronautical Radionavigation Satellite band at 1559-1585.42 MHz.

Any regulatory scheme for shared use of this band should comply with the Requirements of International Footnote S5.376A, as well as the other international actions.[3]

CORF believes that due to the complexity of the issues, the best course would be for the Commission to open a new proceeding, or issue a further notice of proposed rulemaking in this proceeding, on the matter of sharing the 1660.0-1660.5 MHz band, and GMPCS emissions into the 1660.5-1670 MHz bands. Alternatively, however, the above proposals could be addressed in this stage of the proceeding.

IV. Conclusion.

Observations in the protected 1610.6-1613.8 and 1660.0-1660.5 MHz bands are very important to radio astronomy and are vulnerable to interference from GMPCS mobile earth terminals. As noted above, the Commission should protect observations in the lower of the two bands by making explicit in the GMPCS rules references to the requirement to comply with other existing Part 25 rules. Furthermore, in order to protect observations in the higher of the two bands, the Commission should enact specific regulations addressing

the sharing of this band and should prohibit GMPCS transmissions at 1660.0-1660.5 MHz until such a regulatory scheme is created.

Respectfully submitted,
NATIONAL ACADEMIES'
COMMITTEE ON RADIO
FREQUENCIES

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FOOTNOTES

[1]That table is reproduced from Table 3 of Recommendation ITU-R RA.314.8.

[2]Section 25.202(f) states:

> "(f) Emission limitations. The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
>
> > (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

(2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;

(3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: an amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

(4) In any event, when an emission outside the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section."

[3]Footnote S5.376A states, "Mobile earth stations operating in the band 1660.0-1660.5 MHz shall not cause harmful interference to stations in the radio astronomy service." Resolution 125 of WRC-97 resolves that a future conference should evaluate frequency sharing between the Mobile Satellite Service and the Radio Astronomy Service in the bands 1610.6-1613.8 MHz and 1660.0-1660.5 MHz.