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

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| In the Matter of | ) | |
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| Amendment of Parts 2 and 95 of | ) | ET Docket No. 99-255 |
| the Commission's Rules to Create a | ) | |
| Wireless Medical Telemetry Service | ) | |

MOTION TO LEAVE TO FILE AND COMMENTS
OF THE NATIONAL ACADEMIES'
COMMITTEE ON RADIO FREQUENCIES

The National Academies, through the National Research Council's Committee on Radio Frequencies[1] (hereinafter, CORF), hereby submits Comments in response to the Commission's July 16, 1999, Notice of Proposed Rulemaking in the above-captioned docket (NPRM).[2] In these Comments, CORF generally supports the Commission's proposal to establish rules for a Wireless Medical Telemetry Service (WMTS). The proposal in the NPRM would benefit users of the Earth-Exploration Satellite Service (EESS) and Radio Astronomy Service (RAS) who make observations in the 608-614 and 1400-1427 MHz bands. Of the spectrum allocation options identified in paragraphs 22 and 23 of the NPRM, CORF recommends adoption of Option 1 (608-614 MHz/1395-1400 MHz/1429-1432 MHz).

I. Introduction: The Importance of RAS and EESS Observations in the 1400-1427 MHz Band, and the Unique Vulnerability of Passive Services to Out-of-Band and Spurious Emissions.

CORF has a substantial interest in this proceeding, as it represents the interests of the scientific users of the radio spectrum, including users of the RAS and EESS bands. Both RAS and EESS observers perform extremely important, yet vulnerable, research.

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 have witnessed the creation and distribution of heavy elements essential to the formation of planets like Earth, and of life itself.

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[1]The roster of the CORF membership is listed in the Appendix.

[2]CORF hereby moves for leave to file these Comments after the filing deadline. CORF believes this late filing will not prejudice any parties, since there is still significant time for such parties to review and comment on the matters set forth herein. Most importantly, CORF believes that these Comments contain significant and substantial information that will contribute to reasoned decision making in this proceeding.

The EESS represents both a critical and a unique resource for monitoring the global atmospheric and surface state, operationally and experimentally. Passive and active satellite-based microwave remote sensing measurements represent the only practical approach to obtaining uniform-quality atmospheric and surface data encompassing the most remote oceans as well as densely populated areas of Earth. EESS data have contributed substantially to the study of meteorology, atmospheric chemistry, oceanography, and global change. Currently, instruments operating in the EESS bands provide regular and reliable quantitative atmospheric, oceanic, and land measurements to support an extensive variety of scientific, commercial, and government (civil and military) data users. Applications of the data include aviation forecasts, hurricane and severe storm warning and tracking, seasonal and interannual climate forecasts, decadal-scale monitoring of climate variability, medium-range forecasting, and studies of the ocean surface and internal structure, as well as many others.

These current benefits of scientific research, 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 and Earth scientists have no control over the frequencies at which they must observe, or over the character of the "transmitted" signal. These parameters are set by the laws of nature.

Furthermore, the emissions that radio astronomers review are extremely weak—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 pick up remarkably weak signals, such facilities are particularly vulnerable to interference from spurious and out-of-band emissions from licensed and unlicensed users of neighboring bands, and from those that produce harmonic emissions that fall into the RAS bands. Similarly, the emissions received by passive EESS radiometers in Earth orbit are weak by comparison with emissions from other services.

Of particular concern in this proceeding is protection of RAS and EESS observations in the 608-614 and 1400-1427 MHz bands. Currently, the 608-614 MHz band is allocated solely to the RAS. There is a reason for this: the band is among the most important to radio astronomy for use in making continuum observations, which define the frequency variation of radiation in sufficient detail to enable conclusions to be reached concerning the physical mechanisms of the interstellar magnetic fields and high-energy particles responsible for such emissions. So important are the observations in this band that even though the band constitutes Channel 37, the Commission does not allocate it for broadcast television use.

Observations in the 1391-1400 and 1429-1432 MHz bands are also very important to both radio astronomers and Earth scientists. The 21-centimeter line (1420.406 MHz) of neutral atomic hydrogen is the single most important radio spectral line. Over 90 percent of the atoms in the universe are hydrogen, and most of those are in the ground state. As a result, the discovery and regular observations of this spectral line have revolutionized mankind's understanding of the structure of our galaxy, and indeed, the entire universe. Numerous and detailed studies of neutral hydrogen distribution in our own and other galaxies are being used to investigate the state of interstellar matter, the dynamics and distribution of interstellar gas, the rotation of our own and other galaxies, and the potential for star formation in other galaxies, and to estimate the masses of galaxies.

Because the universe is expanding, more distant objects appear to be moving with increasingly higher velocities away from Earth. Because of the Doppler effect, the radiation of the 21-centimeter line is shifted from its rest frequency (1420 MHz) to lower frequencies. The amount of frequency shift (redshift) is an indicator of the distance to the emitting source, and, accordingly, readings of such redshifts have provided distance measurements to more than 6,000 galaxies, contributing significantly to our understanding of the structure of galaxy distribution, and thus to the history of the universe. By assigning the 1395-1400 MHz band to medical telemetry, the RAS will benefit from an extended frequency range at which most observatories can make interference-free observations of red-shifted, unionized hydrogen (HI).

The 1400-1427 MHz band is also heavily used for radio astronomy continuum observations. Continuum observations are very sensitive to corruption by unwanted emissions from transmitters in nearby bands. By assigning the 1395-1400 and 1429-1432 MHz bands to medical telemetry, the Commission would allow the RAS to benefit from a reduced likelihood of unwanted emissions in the 1420-1427 MHz band.

Radio astronomy research using observations in the 1400-1427 MHz band has been substantial from the start, and observations in the band continue unabated. In the United States alone, observations are conducted at the Green Bank, West Virginia, and Socorro, New Mexico, sites of the National Radio Astronomy Observatory (NRAO); with the NRAO's Very Long Baseline Array (VLBA) facility of 10 radio astronomy antennas, distributed across the continental United States, Hawaii, and the Virgin Islands; and at the Arecibo, Puerto Rico, observatory of the National Astronomy and Ionosphere Center (NAIC). Approximately 30 percent of radio astronomy telescope time at these facilities is spent on observations in this band, and this percentage of use is expected to continue.

The frequency band 1400-1427 MHz is also important for Earth scientists who intend to utilize the band for passive observations of upwelling Earth emission to monitor land and ocean surface parameters. Upwelling microwave emission over land near 1.4 GHz is a strong function of surface soil moisture. Measurements of soil moisture are important for initializing and calibrating climate models and for forecasting and monitoring floods and droughts. Although, there are currently no microwave sensors optimized for soil and surface measurements such as moisture, surface temperature, and vegetation biomass, the need for these measurements and such a sensor is well established and studies have shown that measurements near 1.4 GHz potentially offer greatly enhanced capability to follow soil moisture trends in the presence of vegetation, and areas of increased surface roughness compared to the capability obtained from utilization of the higher EESS frequencies such as 6.6 GHz and above. Programs currently under way are investigating and/or developing passive microwave sensors for EESS that utilize the 1.4 GHz band primarily for soil moisture measurements.

There is also significant interest in 1.4 GHz Earth observations from space by oceanographers desiring sea surface salinity measurements. There may be additional scientific value from sea ice observations in this band as well. Observations of sea surface microwave emission at 1.4 GHz represent a potential major advance in global ocean remote sensing capability and are being considered for planned future satellite missions.

In sum, scientific observations in the bands at issue in this proceeding are very important, yet like all passive scientific observations, are uniquely vulnerable to interference from out-of-band and spurious emissions. Accordingly, obtaining allocations in these and nearby bands that would be "good neighbors" (unlikely to cause interference to passive scientific observations) makes good sense: such allocations promote spectrum efficiency by allowing for multiple uses, while the presence of the new service provides additional reasons for not allocating the bands to other uses (such as satellite downlinks) that have a higher likelihood of interfering with scientific research.

## II. CORF Supports the Commission's Proposal, Including Spectrum Allocation Option 1.

CORF believes that the proposal in the NPRM would serve the public interest. However, the proposal must be enacted in its entirety, including the proposed service rules on eligibility, frequency coordination with RAS facilities, the necessity to protect RAS observations from interference, and technical standards (including field strength and out-of-band emission limitations). Failure to enact part of the proposal (e.g., RAS coordination or field strength limits) could largely or completely undercut the ability of the WMTS to successfully co-exist with RAS and other scientific users of the bands at issue.

Of the spectrum allocation options identified in paragraphs 22 and 23, CORF supports Option 1. CORF agrees with the observations made in paragraph 22 of the NPRM that this option

has the benefit of giving the American Hospital Association the same amount of spectrum that it requested, while reducing the risk of interference to government radar operations. Similarly, while the 1429-1432 MHz band would not be available for Little LEO[3] downlinks, one benefit of this result is the reduction or elimination of potentially substantial interference to radio astronomy observations in this band from Little LEO downlinks.

III. Conclusion

CORF supports the Commission's proposal in this proceeding, with adoption of spectrum Option 1, assuming that the proposal is enacted in its entirety and will effectively address, and meet, all of the technical standards. As such, the proposal will promote spectrum efficiency, medical practices, and protection of critical passive scientific observations.

Respectfully submitted,

NATIONAL ACADEMIES'
COMMITTEE ON RADIO FREQUENCIES

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[3]Non-voice, non-geostationary, low-Earth-orbit Mobile Satellite Service satellites.