NATIONAL RADIO ASTRONOMY OBSERVATORY

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25 December 2010

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

In the Matter of Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations.	)	IB Docket No. 97-95

Comments of the
National Radio Astronomy Observatory
Charlottesville, VA 22903

1. The National Radio Astronomy Observatory (NRAO) is pleased to provide comments responding to the Commission's Third Notice of Proposed Rulemaking, FCC 10-186 ("the 3rd NPRM"), regarding allocation and designation of spectrum in the band 37.5 – 42.5 GHz ("the V-band").

2. NRAO (http://www.nrao.edu), operated by Associated Universities, Inc., (http://www.aui.edu) under a cooperative agreement with the National Science Foundation, is the largest observatory dedicated to radio astronomy and one of the largest observatories of any kind in the world. It operates one dozen stations in rural and remote regions of the United States (see Appendix 1), all of which operate in the affected V-band spectrum. NRAO also serves as the North American operating partner in the new ALMA telescope in Chile, which is planned to operate in the V-band in the near future (http://www.nrao.edu/explorer/alma).

3. The 3rd NPRM addresses a wide variety of issues related to the continuing operation of the Radio Astronomy Service (RAS) in the band 42.5 – 43.5 GHz, which is exclusively allocated to RAS in the US non-Federal Table of Frequency Allocations. This band is sometimes used for broadband observations of the continuous spectrum of cosmic

radiation. However, it is allocated to RAS primarily to foster observation of spectral lines of silicon monoxide (SiO), which in its gaseous form in interstellar space in the nearby Universe is sometimes found to be a natural maser. This very special circumstance affords exceptionally sensitive observations of cosmic phenomena related to the formation and evolution of distant stars.

4. The 3rd NPRM was occasioned in part by concerns expressed by the NTIA for the continued operation of the RAS at 42.5 – 43.5 GHz, given the absence of a guard band between RAS spectrum and that allocated to, especially, the Broadcast-Satellite Service (BSS) at 42 – 42.5 GHz. Although sharing and/or compatibility between RAS and other services can often be achieved by such means as geographic separation, the ubiquitous nature of the desired coverage of broadcasting and the presence of a signal originating on the sky in direct line of sight appears to make compatibility between BSS and RAS problematic.

5. The Commission has expressed its willingness to consider an allocation to the Fixed-Satellite Service (space-earth) in the 42 – 42.5 GHz band, if the BSS allocation there is suppressed. Compatibility between such FSS (space-earth) and RAS operations may be somewhat easier to achieve given the fact that FSS (space-earth) use does not require such ubiquitous coverage, and that RAS operations occur in only a dozen or so locations[1], but the examples cited by the Commission in the 3rd NRPM do not demonstrate that this is likely to be the case. In particular, at ¶51 of the 3rd NPRM a case is noted whereby the signal falls by 12 dB only at a distance of some 750 miles from the pointing center of the FSS beam. At first blush the NRAO sees little advantage to RAS in trading such operations for those of the BSS.

6. The Commission solicits suggestions for protection of RAS operations. Given the brief comment period and the absence of detailed information on the nature of active-service operations that might be implemented, the NRAO can only suggest that the protections for RAS operations presently embodied in ITU-R footnotes 5.551H and 5.551I should be used. The protection levels in these footnotes might need to be revised for use by the FCC if actual FSS systems deviate from those employed in the ITU-R studies that served as the basis of the protection levels in the footnotes.

7. At ¶24 the Commission asks "whether a viable GSO FSS or BSS system could be operated in a way that meets the less stringent PFD limits for NGSO FSS and BSS in footnote 5.551H," where, by "less stringent," the Commission notes that the limits for GSO systems (5.551I) are to be observed at all times while those for NGSO systems (5.551H) apply for 98% of the time. The discussion glosses over the fact that ePFD levels are used to assess interference from NGSO systems, as noted below.

8. There are other measures of stringency beside such time criteria, most notably the flux levels at which interference thresholds are actually set. In this regard, the NRAO does not understand the Commission's mixing of threshold criteria for GSO and non-GSO operations such as are entertained at ¶24 in the 3rd NPRM, where the Commission asks

[1] See Appendix 1 for the locations of the NRAO instruments operating in the V-band

whether it would be possible for GSO FSS or BSS systems to operate under "less stringent PFD limits established for NGSO FSS/BSS" while providing protection to RAS.

9. The ePFD thresholds mentioned in 5.551H for non-GSO systems arise from a computational modeling methodology described in ITU-R Recommendation S. 1586 that is *specific* to such systems[2]. The methodology is based on the fact that non-GSO systems have relatively large numbers of relatively rapidly-moving (on the sky) stations in low or medium earth orbit that appear with time-varying random orientations and positions with respect to RAS operations. This is as opposed to the presence of and PFD limits on individual GSO stations in more nearly fixed sky positions within the geosynchronous satellite band. GSO satellites may usually be avoided during RAS operations by waiting for a cosmic object of interest to appear elsewhere on the sky, whereas non-GSO satellites unavoidably wander over the beam pattern of an RAS telescope no matter where it is pointed.

10. For the reasons described in the preceding paragraphs, NRAO suggests that it is not pertinent to ask whether GSO operations can operate under the criteria (5.551H) formulated for non-GSO systems. Moreover, it is actually not necessary to do so given ITU-R Resolution 743, noted in the 3rd NPRM at footnote 34, which explicitly provides a 2% time exemption for GSO systems in the sub-band 42.5 – 42.77 GHz of the RAS allocation. Thus the time criteria for GSO and non-GSO systems are actually comparable in this aspect of their stringency while their flux thresholds must be considered differently, as is appropriate to the nature of these systems.

11. NRAO asks if the Commission did not express itself imprecisely at ¶22 where the text reads " … neither GSO FSS nor BSS operations in the 42.5 – 43.5 GHz band may produce PFD in the 42.0 – 42.5 GHz band, exceeding …". This text seems to confuse the allocations to RAS and other services.

12. At ¶22 of the 3rd NPRM the Commission asks whether the allocation for the Mobile Service in the 40.5 – 42.5 GHz band should be changed to exclude the Aeronautical Mobile Service (AMS). RAS operations would generally benefit from such a change. However, some AMS use might still be compatible with RAS operations if sufficient geographic separation was observed and sufficient attention paid to individual cases. An example is AMS use of C-band spectrum near 4.9 GHz for metropolitan helicopter video surveillance, a localized operation at low elevation in heavily populated areas that is coordinated with RAS on a case-by-case basis as described in FCC 03-99.

13. At ¶16 the Commission requests comment on whether to delete the allocation to the Broadcasting Service in the band 42 – 42.5 GHz, and asks if broadcasting in this band could adequately protect RAS from harmful interference in the 42.5 – 43.5 GHz band. NRAO is unfamiliar with the nature of BS operations at frequencies 100 times higher

[2] See also ITU-R Recommendation RA.1513 describing the 2% data loss criterion for RAS and Recommendations SM. 1542 and SM. 1633 discussing V-band compatibility issues. ITU-R M. 1583 is analogous to S. 1586, for the case of MSS systems.

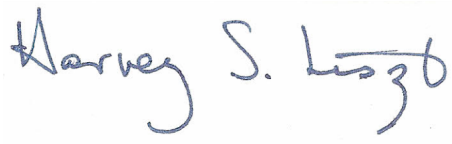
than those of the usual TV bands, but compatibility might be achieved through geographic separation, given the nature of signal propagation at 43 GHz.

14. In summary, NRAO:

    a. Agrees that compatibility between RAS operations in its band at 42.5 – 43.5 GHz and BSS operating at 42 – 42.5 GHz is problematic;
    b. Is not convinced that an allocation to FSS (space-earth) at 42 – 42.5 GHz would be compatible with RAS operations;
    c. Suggests that the protection levels described in international footnotes 5.551H and 5.551I, together with ITU-R Resolution 743, may provide a basis for achieving compatibility with RAS operations at 42.5 - 43.5 GHz if an allocation to FSS (space-earth) at 42 – 42.5 GHz is made, if FSS systems are consistent with those employed in ITU-R studies;
    d. Suggests that some aeronautical mobile use of the band 40.5 – 42.5 GHz might be possible if sufficient attention is paid to coordination with and geographic separation from RAS operations at 42.5 – 43.5 GHz;
    e. Does not understand the nature of possible Broadcast Service use of the band 42 – 42.5 GHz well enough to opine on whether such use might be compatible with RAS operations in the band 42.5 – 43.5 GHz.

Respectfully submitted,

National Radio Astronomy Observatory
By:



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Appendix 1.

NRAO Instruments Operating in the V-band

NRAO Telescope	West Longitude	North Latitude	Height
Robert C. Byrd Green Bank Telescope (GBT)	79° 50' 24"	38° 25' 59"	825 m
Expanded Very Large Array (eVLA)	107° 37' 04"	34° 04' 44"	2126m
Very Long Baseline Array (VLBA):			
Brewster, WA	119°40' 55"	48° 07' 53"	255 m
Fort Davis, TX	103° 56' 39"	30° 38' 06"	1615m
Hancock, NH	71° 59' 12"	42° 56' 01"	309 m
Kitt Peak, AZ	111° 36' 42"	31° 57' 22"	1916m
Los Alamos, NM	106° 14' 42"	35° 46' 30"	1967m
Mauna Kea, HI	155° 27' 29"	19° 48'16"	3720m
North Liberty, IA	91° 34' 26"	41° 46' 17"	241 m
Owens Valley, CA	118° 16' 34"	37° 13' 54"	1207m
Pie Town, NM	108° 07' 07"	34° 18' 04"	2371m
St. Croix, VI	64° 35' 03"	17°45’31"	16m