



NATIONAL RADIO ASTRONOMY OBSERVATORY

520 EDGEMONT ROAD CHARLOTTESVILLE, VA 22903-2475

TELEPHONE 434-296-0211 FAX 434-296-0278

27 January 2015

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

In the Matter of)	
)	
Use of Spectrum Bands Above 24 GHz For Mobile Radio Services)	GN Docket No. 14-177
)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band)	RM-11664
)	
Petition for Declaratory Ruling Regarding Treatment of Rulemakings and Waivers Related to new services at Frequencies Above 95 GHz)	ET Docket 13-259
)	
Battelle Memorial Institute, Inc. Petition for Rulemaking to Adopt Service Rules for the 102 – 109.5 GHz Band)	RM-11713
)	
)	

**Reply Comments to Marcus Spectrum Solutions, LLC
by
National Radio Astronomy Observatory**

Introduction

1. Here, the National Radio Astronomy Observatory (“NRAO” or “the Observatory”) replies to recent remarks by Marcus Spectrum Solutions, LLC (“Marcus”) in the matter of opening the spectrum above 95 GHz for use by active services.
2. NRAO (<http://www.nrao.edu>) is the largest observatory dedicated to radio astronomy and one of the largest astronomical observatories in the world. NRAO pioneered the use of mm-wave radio astronomy spectrum at its Kitt Peak 36’ antenna in 1967 and a 12m antenna is still operated there by the Arizona Radio Observatory. NRAO’s 100m Robert C Byrd Green Bank Telescope will commission a new receiver operating up to 115 GHz in the coming months. NRAO is the North American partner in the new 66-

element international ALMA Observatory in Chile that currently observes at frequencies from 85 - 950 GHz.

3. As noted by Marcus, the Committee on Radio Frequencies (CORF) of the National Research Council foresees shared use of spectrum above 95 GHz: CORF's remarks applied specifically to the band 102 – 109.5 GHz whose use for fixed links was requested by Battelle Memorial Institute ("Battelle"). Of the several active services and many possible service applications in existing allocations above 95 GHz, fixed use may well be the most benign with regard to radio astronomy. Indeed, there is a proven track record for the NTIA's web-based red-light, green-light system that has successfully coordinated many thousands of fixed links at 81 – 86 GHz. NRAO participated in testing this website prior to its release for general use.
4. As also noted by Marcus, not all spectrum above 95 GHz is regulated identically. That is, there are passive service bands specifically allocated only to the passive services subject to US 246, there are bands shared between active and passive services usually covered by US 342 and there are bands with no passive service allocation. The 102 – 109.5 GHz band of interest to Battelle in RM-11713 is allocated to radio astronomy on a shared co-primary basis subject to US 342, and bracketed on both ends by passive service bands that are exclusively allocated to passive services and subject to US 246.
5. Radio astronomy use of passive service bands under US 246 is also subject to US 74 which states "*The radio astronomy service shall be protected from unwanted emissions 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 in which it operates.*"

RM-11713 is a very specific case

6. In RM-11713 the Commission has before it a very specific case where the number of radio astronomy sites is small and coordination to assure compatibility in the 102 – 109.5 GHz band should be easily achieved. The situation with regard to protection of the adjacent passive bands at 100 – 102 GHz and 109.5 – 111.8 GHz is less clear and the circumstances of RM-11713 should not be overly generalized. In particular there are two considerations that require further attention before the mm-wave spectrum is further developed:
 - ◆ Passive service bands are allocated to the earth-exploration satellite service and such use requires protection *everywhere*
 - ◆ Protection of passive service bands requires setting appropriate limits on unwanted emissions from transmitters operating in other bands.

A vivid example of interference to the passive service band at 1400 – 1427 MHz

7. Shown in Figure 1 is a global map of RFI *within* the passive service band at 1400 – 1427 GHz, made by NASA’s Aquarius mission¹. The soil moisture and ocean salinity measurements collected by Aquarius and other missions using the band are vital to understanding global climate and global climate change. However, the reddest areas represent locations where all samples are lost to interference.
8. Some of the interference is caused by illicit use of equipment specifically intended for broadcasting inside the band². Other contributions to the interference arise from unwanted emissions by transmitters operating in adjacent or nearby spectrum: one example is airport radar (as noted on the Aquarius website).
9. The Americas are relatively free of interference into the 1400 MHz band but some administrations elsewhere have allocated adjacent spectrum to mass-market unlicensed devices (cell phones) with weak constraints on their unwanted emissions. The result is that nearly the entire inhabited area of some nations, and much or most of northern Europe and East Asia is inaccessible to Aquarius measurements.

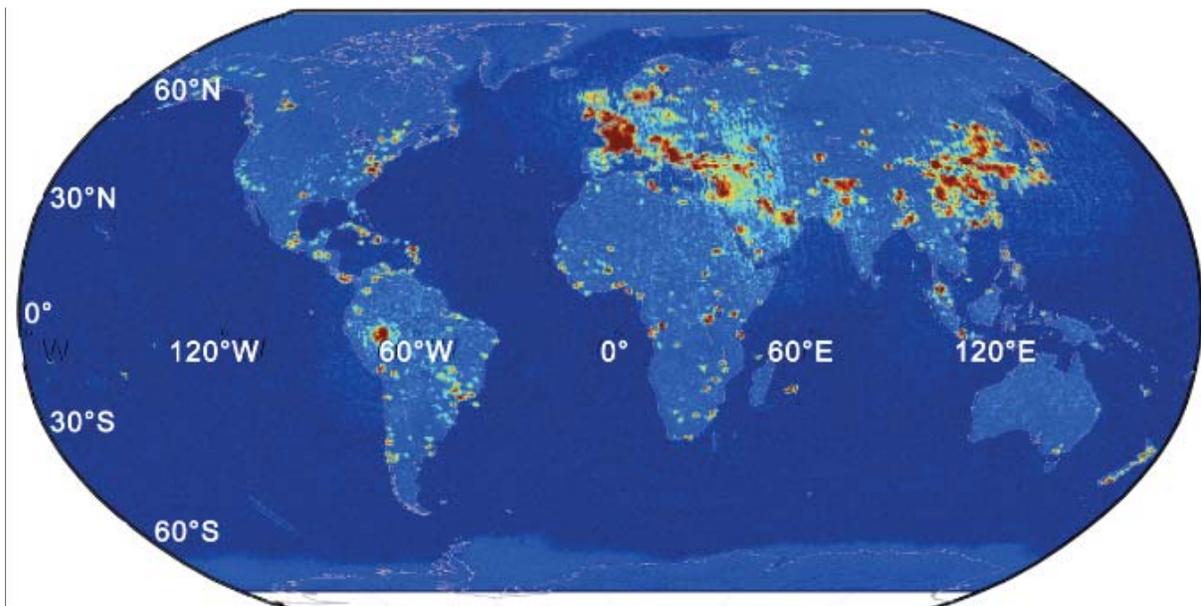


Figure 1: The April 2014 map of global RFI into the protected 1400 – 1427 MHz band measured by NASA’s Aquarius mission (http://aquarius.umaine.edu/cgi/gal_radiometer.html)

Caveats to opening up the spectrum above 95 GHz

10. When the Commission proposes operating rules in the relatively uncharted mm-wave spectrum, it should consider the impact of unwanted emissions on passive service

¹ http://aquarius.umaine.edu/cgi/gal_radiometer.htm

² <http://rf-links.com/newsite/transmitters/1400.html>

bands, including passive service bands overlapped by higher harmonics of an allocation above the fundamental.

11. For the radio astronomy service, ITU-R Recommendation RA.769 defines the most commonly cited interference thresholds. Rules governing unwanted emissions should provide at least this degree of protection to passive service bands where, according to RR. 5.340, "All emissions are prohibited"
12. Until proven otherwise, the rules should protect passive service bands everywhere, not just around a few radio astronomy sites.

Respectfully submitted,
National Radio Astronomy Observatory

A handwritten signature in blue ink that reads "Harvey S. Liszt". The signature is fluid and cursive, with the first name being the most prominent.

Harvey S. Liszt
Astronomer and Spectrum Manager

Direct correspondence to:

Dr. Harvey S. Liszt (hliszt@nrao.edu)
Spectrum Manager
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475