



NATIONAL RADIO ASTRONOMY OBSERVATORY

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Before the Federal Communication Commission

Request by iRobot Corporation for waiver)
of Section 15.250(c) of the Commission's) ET Docket No. 15-30
rules)

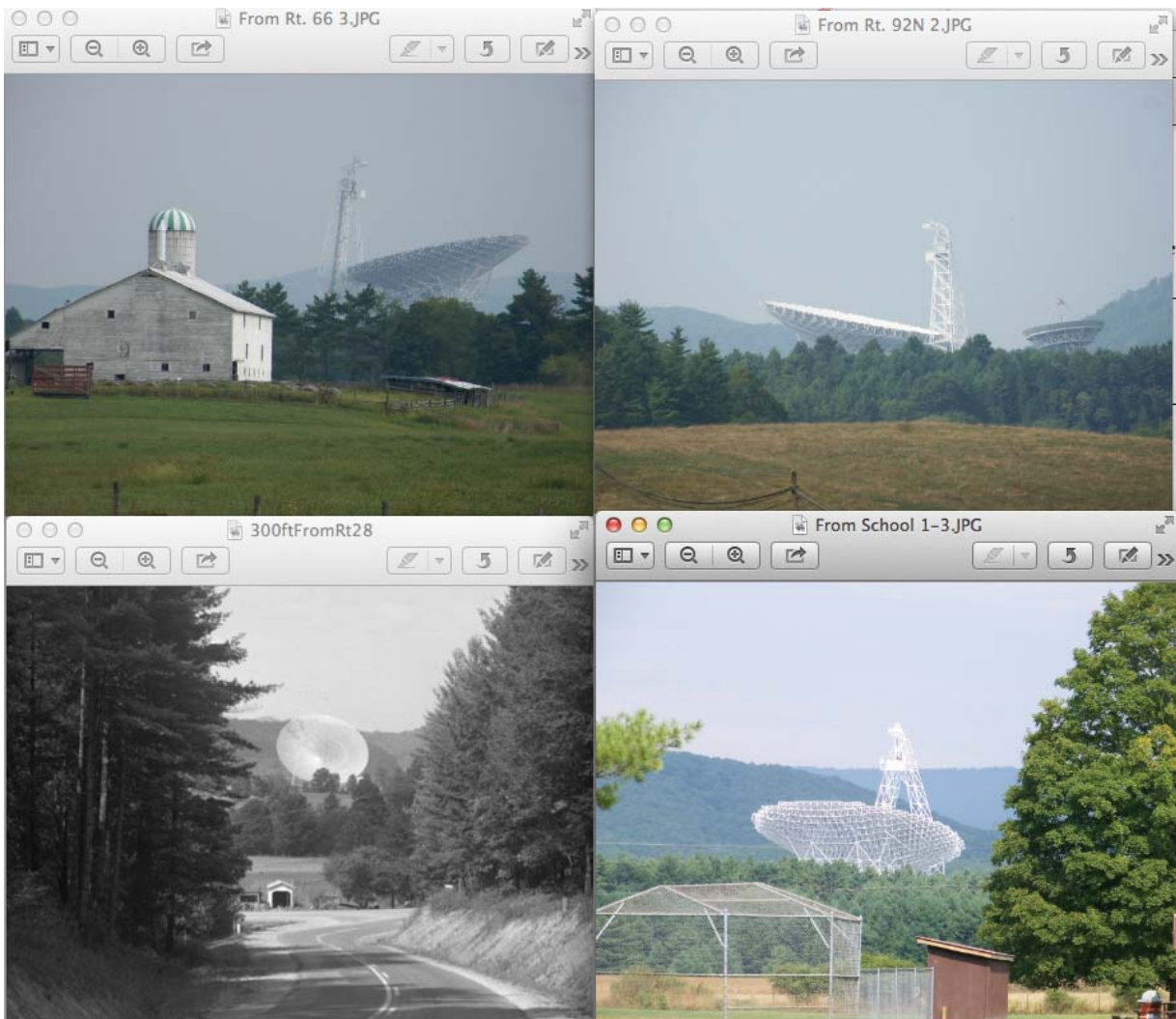
Reply comments on remarks by the iRobot Corporation concerning its waiver request to allow outdoor UWB use for wireless robotic lawn mowers

by
National Radio Astronomy Observatory

1. Here, the National Radio Astronomy Observatory (“NRAO” or “the Observatory”) responds to reply comments dated 3/25/15 by the iRobot Corporation (“iRobot”) in the matter of their request for a waiver of Section 15.250(c) of the Commission’s rules to allow outdoor use of robotic lawn mowers (RLMs) and their control beacons in the frequency band 6240 - 6740 MHz.
2. The observatory was not wrong in applying the continuum spectrum limits $-241 \text{ dB W/m}^2\text{-Hz}$ from Tables 1 and 3 of ITU-R 769 to calculate a coordination distance. Although the spectrum band at issue is primarily (but not exclusively) used to observe a spectral line of interstellar wood alcohol, the signal generated by the iRobot devices is a broad continuum that will be detected over its full frequency extent in the astronomy spectrum after a short while. The out of band flanks of this pulse will also be detected. Hence the iRobot emission will have to be removed before the astronomical content of any measurement can be assessed, and the stronger the iRobot signal is, the more difficult and error-prone this task becomes.
3. Moreover, the 500 MHz width of the iRobot pulses is comparable to the clock rates and gating speeds in our detecting electronics that typically treat a GHz of spectrum in a small number of chunks. There could be a quite complex and disruptive interaction between the iRobot emissions and our signal chain. The Observatory is now uncertain whether its earlier suggestion for iRobot to notch out the protected band would have the desired palliative effect.
4. The Observatory did not take pains to distinguish the protection criteria for its various telescopes because, absent other considerations, an iRobot device does not know where it will be used when it is sold and with which telescope it will (perhaps) interfere. Thus all iRobot devices must be prepared to protect all telescopes. The Observatory did propose a scheme (geo-location) under which the coordination radius could be tailored to individual telescopes but this was rejected in comments by iRobot.

5. The Observatory failed to remark in its original comment that the iRobot system consists of at least 5 transmitters (4 corner beacons and the mower for the simplest configuration) so that an iRobot lawn mowing system could have emissions 7 dB or more stronger than were discussed previously in this proceeding.

6. iRobot admits that the VLA site is unshielded by terrain or foliage but asserts that there are no lines of sight to (the primary feed of) the GBT that are not shielded by terrain and by 100m of foliage providing an additional 45 dB of attenuation. This claim is most charitably characterized as silly. The GBT is visible for miles around on the local public roads and from various private properties as shown in the photomontage below. The telescope at lower left is the old 300' antenna, previously located on an immediately adjacent plot of land to the GBT before slowly collapsing one fateful evening late in 1988 when a crucial gusset plate succumbed to metal fatigue at a rivet.



7. In a strange twist, iRobot cites a proceeding for mm-wave level-probing radar as evidence that the Observatory's antennas do not need protection from iRobot devices operating around 6.5 GHz. Even disregarding the inapplicability of the situation for

downward-pointing LPR devices operating at 12 times higher frequency, one of the main reasons cited by the Commission for denying special protection was that the LPR would be used in industrial and commercial areas, and radio telescopes were not co-located. Now, iRobot is using that to assert that telescopes do not need protection in residential areas. The comparison with LPR is simply not apt.

8. In its initial waiver request iRobot cited multiple statistics of grim accidents and spilt gasoline to assert the public benefit of approving its wireless robotic lawn mowers. However, there is already a competitive market for robotic lawn mowers using wire loops, which has somehow failed to stanch the stream of ghastly accidents and spilt gasoline that iRobot associates with the mundane practice of lawn-mowing. Robotic lawn devices are expensive, typically several thousand dollars, and meant for situations where mowing is performed far more frequently than in the typical front yard.
9. The Commission should weigh the unproven need for another kind of robot lawn mower against the implications of waiving the rules against outdoor UWB use in order that an iRobot device, using a specifically protected radio astronomy frequency, would be allowed to operate outdoors within line of sight of a radio telescope, generating interference to it.
10. The Observatory reiterates from its earlier comments that the iRobot devices certainly may operate over the vast majority of the US without interfering with radio astronomy, but equally restates its belief that a toothless admonition to use only in residential areas does not suffice to satisfy the obligation to take all practicable steps to protect radio astronomy that is imposed by US 342.

Respectfully submitted,
National Radio Astronomy Observatory



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