

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

In the Matter of)	
)	
Expanding Flexible Use in Mid-Band)	GN Docket No. 17-183
Spectrum Between 3.7 and 24 GHz)	
)	

REPLY COMMENTS OF IROBOT CORP.

iRobot welcomes this opportunity to comment on the FCC’s Notice of Proposed Rulemaking.

1. INTRODUCTION

iRobot, a world-renowned advanced technology company headquartered in Massachusetts, designs and builds robots for consumer use. In January 2019, iRobot announced the launch of Terra[®] a new a robotic lawn mower. The iRobot robotic lawn mower is for residential use and operates within the 6 GHz band. As recognized by the Commission in the iRobot Corporation Request for Waiver of Section 15.250 of the Commission’s Rules, Order, 30 FCC Rcd. 8377 (2015) (the “Waiver”), iRobot’s robotic lawn mower has the potential for improving quality of life for residential lawn mowing, reducing emissions and noise pollution, and reducing deaths and injuries associated with traditional lawn mowers.¹

¹ iRobot has applied for and received a waiver to operate its wideband system outdoors. *iRobot Corporation Request for Waiver of Section 15.250 of the Commission’s Rules*, Order, 30 FCC Rcd. 8377 (2015).

2. USE OF 6 GHZ BAND FOR IROBOT

The iRobot robotic lawn mower is a Part 15 device designed to operate in the 6240-6740 MHz frequency range. The robotic lawn mower will operate outdoors and will rely on stakes with attached transmitters that will be placed in the ground to communicate with the robotic lawn mower. The robotic lawn mower relies on wideband technology for positioning and communication between the transmitters and the robotic lawn mower. Due to its low power levels, this technology can effectively use large bandwidths while not interfering with other radio services or electronic devices.

With the increased adoption of IoT devices, location awareness will continue to rise in importance and the number of devices using wideband technology will continue to increase. The wide bandwidth available under FCC Subpart C 15.250 and Subpart F have given rise to devices with unequalled capabilities for accurate and real-time localization systems, including iRobot's robotic lawn mower system. These systems are used in a wide variety of low cost, low complexity applications, offering previously non-existing benefits to society. The transmit powers and duty cycle typically associated with broadband networks will overwhelm the transmit powers (which are less than 1 milliwatt max) of existing UWB Part 15 deployed devices, thereby rendering them ineffective. For example, each of the beacons in the iRobot robotic lawn mower system operates at Peak power of less than 0dBm (1mW), average power is below -41.3 dBm/Mhz, as required by the iRobot waiver from the FCC.² In contrast, the proposed rules would allow broadband to operate at 1,000 times more transmit power in the same band of operation as the iRobot robotic lawn mower and with no cap on duty cycle.

iRobot specifically selected the technology for its robotic lawn mower for its high bandwidth and high accuracy. Now, following years of significant investment in research and development, iRobot would be required – at great financial expense – to potentially re-evaluate and re-work its entire robotic lawn mower system should the Commission move forward with the proposed regulations without modifications such as those proposed below. Indeed, the technology currently utilized by iRobot in its robotic lawn mower will be rendered ineffective should the Commission adopt the proposed regulations without modifications.

² Id.

3. COEXISTENCE, WHILE NOT PREFERABLE, MIGHT BE POSSIBLE WITH EITHER BAND RESTRICTIONS OR POWER AND DUTY CYCLE LIMITATIONS

The FCC has stated that it expects that unlicensed wideband and ultra-wideband systems will coexist with all other systems within the 6GHz band in the NPRM. If the iRobot robotic lawn mower and other IoT devices relying on UWB for localization are to coexist with broadband in the 6 GHz band, either limits on the bandwidth and out of band emissions or a duty cycle restriction and transmit power limits are necessary to contain the potential for interference.

Regarding potential bandwidth restrictions that would allow coexistence, iRobot recommends that the FCC authorize new unlicensed Broadband to 5.925 - 6.1 GHz (i.e., provide and additional 175 MHz of spectrum for use by broadband but not allow use of the full 1.2 GHz as drafted in the NPRM) and specify OOB to -61 dBm/MHz for devices operating in this new band. This restriction will inspire innovation and conservative use of the available bandwidth which is beneficial to all users, including the broadband community itself. In this potential solution for coexistence, a tight OOB mask is a key technical tool for maximizing capacity and band sharing and should be written into any new rules.

Regarding duty cycle restriction and transmit power limits that would allow coexistence, NPRM proponents have pointed to the RKF study to prove coexistence is realistic; however their assumptions on duty cycle, transmit power, and adoption rate of their technology are critical to this coexistence and therefore need to be enforced by rule.³ iRobot's robotic lawn mower and other UWB systems are extremely sensitive to transmit duty cycle and power and will be in close proximity to 6 GHz band broadband devices in the consumer's home.

iRobot therefore proposes that a 0.5% duty cycle limit over any period of 1 second per access point and mobile device is enforced by regulation, i.e. written into any new rules. Transmit power control is also extremely helpful to enable coexistence when combined with duty cycle limits and we encourage the FCC to also require intelligent transmit power control in any new rule.

³ The RKF study assumes the following: market share of 45% in 2025 for 6GHz RLAN devices, 10% high duty cycle transmit devices at 0.44%, 90% low duty cycle transmit devices at 0.00022%

4. CONCLUSION

UWB applications such as the iRobot robotic lawn mower will not be able to coexist under the rules proposed in this NPRM. If adopted, the expansion of IoT devices providing the benefit of efficient localization with long battery life currently offered by UWB would be sacrificed. Accordingly, iRobot requests the Commission consider the 6 GHz band not be opened to broadband usage, or, in the alternative, either:

- Authorize new unlicensed Broadband to 5.925 - 6.1 GHz only and specify OOB to -61 dBm/MHz for operation in this band.

OR

- Require that any device be subject to a 0.5% duty cycle limit per access point over any period of 1 second and require mandatory transmit power control.

Respectfully submitted,

iRobot Corporation

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Dated: February 15, 2019