15-30

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

In the Matter of	)	
	)	
Request by iRobot Corporation	)	
For Waiver of Section 15.250(c)	)	File No. _____
of the Commission's Rules	)	

To: Chief, Office of Engineering and Technology

REQUEST FOR WAIVER

iRobot Corporation ("iRobot"), pursuant to Section 1.3 of the Federal Communications Commission's ("FCC" or "Commission") rules,[1] hereby requests a waiver of Section 15.250(c),[2] which prohibits the use of fixed wireless infrastructure, in order to obtain equipment certification for and market a robotic lawn mower. Grant of this request is consistent with the intent of the rule, and will make available to the public a device that will reduce deaths and injuries related to lawn mowing, will reduce emissions and noise pollution, and will improve quality of life.

BACKGROUND

iRobot, headquartered in Bedford, MA, with more than 463 employees in the U.S., views itself as The Robot Company. iRobot designs and builds robots for both consumer and military use; these robots are designed in the U.S. and manufactured here and abroad.

iRobot is in the early design phase of developing a Robotic Lawn Mower ("RLM"). Use of RLMs improves the health and safety of consumers, is better for the environment than

[1] 47 C.F.R. § 1.3.
[2] 47 C.F.R. § 15.250(c).

gasoline mowers, makes lawn cutting more accessible to the elderly and disabled, and gives people free time to spend with their families and loved ones. RLMs are well-accepted in Europe. Presently, however, the only RLMs available in the United States must be installed by the placement of underground electric fences, which require digging a trench and installing buried wire, a cumbersome and costly process that has limited greatly the public's adoption of RLM technology.

The iRobot RLM will not require buried wire, but instead will rely on stakes (*i.e.* portable beacons) in the yard that transmit to the robot to map out and stay within the designated mowing area.[3] The stakes will be no higher than 24 inches above ground level and will communicate with the mower in the X-Y plane. iRobot estimates that a typical user – one with a residential lawn of one-quarter or one-third of an acre – will require between four and nine stakes. Users will need to set out the stakes in their lawn each spring and run a set up procedure to establish the confined mowing area. This is the only time, of a few minutes duration, during which the portable beacons will communicate with each other; during the remainder of the mowing season, the beacons will communicate only with the robot.[4] The iRobot RLM uses a two-way ranging communication protocol to determine the time of flight of a transmitted packet, with only one beacon communicating with the robot at any given time.[5] Neither the beacons nor the robot will communicate with any other devices pursuant to Section 15.250.[6]

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[3] *See* Attachment A (Example Deployment and System Operation diagrams).
[4] iRobot estimates that typical operation of its RLM will be for several hours per week during the mowing season.
[5] During mowing sessions, the duty cycle will be 0.57% (1-5 transmissions per second) and during inactive periods the duty cycle will be 0.0038% (190 micro-seconds per every 5 seconds).
[6] This does not foreclose iRobot from developing models in which the robot would communicate with other devices using other technologies and frequency bands outside Section 15.250.

DISCUSSION

iRobot seeks a waiver of Section 15.250 because the underlying purpose would not be served by application of the rule and because grant of the waiver is in the public interest.

A. **Request for Waiver.**

The iRobot RLM will be able to operate on the Part 15 wideband 6 GHz frequency in compliance with all FCC rules except that the RLM requires placement of outdoor portable beacons during the mowing season.

While Section 15.250(c) prohibits "fixed outdoor infrastructure," the use of the portable beacons is consistent with the intent of the rule because it does not establish a wide area communications system or network. The underlying purpose of the rule is to prevent the creation of networks, such as wide area networks of devices, in order to control interference to existing authorized services, including cellular, PCS and GPS systems employed in E-911 applications.[7] The Commission first adopted this prohibition in the original ultra-wideband proceeding, where it prohibited fixed outdoor infrastructure by hand held outdoor UWB devices. It stated:

> [W]e remain concerned that permitting UWB devices to be used outdoors could result in the development of large communications systems that could adversely impact the authorized services. For that reason, we are prohibiting the use of antennas attached to outside structures or any form of fixed outdoor infrastructure.[8]

In a subsequent proceeding, where the FCC adopted rules for unlicensed wideband operations under Section 15.250, it took a "cautious approach" for the same reason: To prevent the creation of wide area communications systems that could pose a risk of

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[7] *See, e.g., In the Matter of Ultra-Wideband Transmission Systems*, First Report and Order, 17 FCC Rcd 7435, 7503 (2002) ("Ultra-Wideband Order").
[8] *Id.*

interference to authorized users.[9] The FCC explained that, while it believed that the technical rules were more than sufficient to protect other users, it would adopt additional requirements at NTIA's request:

> While we do not believe that the power levels being permitted in the 5925-7250 MHz band are sufficient to permit the establishment of wide-area communication systems, we also want to ensure that such systems cannot develop until greater experience is gained with unlicensed operation in this band. To ensure that this does not occur, as requested by NTIA we are prohibiting the use of fixed outdoor infrastructures in the 5925-7250 MHz band . . . . This should be sufficient to prevent the establishment of wide area communication systems . . . .[10]

The ten years since authorization of wideband devices should give the Commission sufficient experience on which to consider iRobot's waiver request.

The iRobot RLM will not (and cannot) create a wide area communications system or network. Following setup, the portable beacons will communicate only to the robot, and unique addressing will prevent transmitters from communicating with devices off the property. Thus, even if several neighbors operate iRobot RLMs at the same time, there would be no communications between these RLMs; communications would be confined to each individual lawn. And except for the brief set-up period, beacons will transmit only ranging messages to the robot; there is no networking between RLMs.[11] Finally, the beacons are designed to be placed in the lawn only seasonally, not permanently. Customers will be instructed to remove the beacons at the close of the mowing season, which is necessary to prevent battery drain and protect the beacons from damage due to environmental elements.

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[9] *In the Matter of Ultra-Wideband Transmission Systems*, Second Report and Order and Second Memorandum Opinion and Order, 19 FCC Rcd 24558, at 24568-24571 (2004).

[10] *Id.* at 24571.

[11] And the iRobot RLM is not a mesh network, as the transmitters do not process and relay packets.

The iRobot RLM is similar in key respects to the operation of level probing radars (LPRs) using a comparable technology in the same band, which the Commission has determined may operate outdoors consistent with the intent underlying the Section 15.250 usage restriction.[12] The Commission detailed its reasoning as follows:

> While there may be multiple LPRs installed at a single site, each device would be pointed at and computing readings from its particular target (coal or gravel piles, waterways at a specific location, etc.) to perform the level measurement and would not be communicating with the other LPRs at the same site.[13]

In considering an objection by EIBASS to the operation of LPRs outdoors, given the Section 15.250 prohibition on fixed outdoor infrastructure, the Commission reiterated that "LPR devices are not by their nature used to establish local or wide area networks because LPRs are designed to measure the level of a substance at a single, circumscribed site (e.g., a pile of coal or gravel, or water in a tank or under a bridge)."[14] In a similar way, the iRobot beacons are designed to send ranging messages at a single, circumscribed site so that the robot can calculate its position. By design, the iRobot portable beacons will be prevented from establishing local or wide area networks.

B. Public Interest.

When Congress constituted the Commission in 1934, it did so in part "for the purpose of promoting safety of life and property through the use of wire and radio communications."[15] iRobot's RLM directly serves this purpose. A device capable of protecting people from harm, reducing deaths, and deterring theft of equipment is presumptively in the public interest.

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[12] *Amendment of Part 15 of the Commission's Rules*, Further Notice of Proposed Rulemaking, 27 FCC Rcd 3660, 3668 (2012).
[13] *Amendment of Part 15 of the Commission's Rules*, Report and Order and Order, 29 FCC Rcd 761 at n.6 (2014).
[14] *Id.* at 779-780.
[15] 47 U.S.C. § 151.

Use of the iRobot RLM will increase lawn mower safety.[16] According to the U.S. Consumer Product Safety Commission, "[f]rom 2010 through 2012, an average of 38,000 people were treated in hospital emergency rooms for walk-behind power mower injuries."[17] In fact, "emergency surgery is sometimes required to treat severe injuries resulting from hand or foot contact with the rotating blade; toe amputations are not uncommon with homeowners cutting grass."[18] An estimated 1,517 lethal accidents occurred with lawn mowers through the years 1997 to 2010.[19] It is reasonable to assume that many of these injuries and deaths would not occur if consumers used a robotic mower and were able to maintain a safe distance while their lawns are mowed.[20]

The iRobot RLM also will benefit the environment. In 2012, approximately 4.8 million walk-behind lawn mowers were sold in the United States.[21] The U.S. EPA has estimated that a push lawn mower emits as much hourly pollution as eleven cars.[22] More than 17 million gallons

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[16] The RLM will be compliant with International Electrotechnical Commission standard IEC 60335-2-107, which imposes much stricter safety requirements, and thus ensures greater safety, than traditional lawn mowers.

[17] CPSC Fact Sheet, Power Lawn Mowers, Publication 5126 (May 2013), *available at* http://www.cpsc.gov/Global/Safety%20Education/Home%20Garden%20Outdoors/5126.pdf. The CPSC additionally cautions that "[o]bjects have been struck by the mower blade and thrown out from under the mower, resulting in severe injuries and deaths." *Id.* at 3.

[18] *Id.* at 1.

[19] *See* http://www.hospital-data.com/accidents/lethal/1439-lawn-mowers/index.html (last visited Jan. 21, 2015).

[20] iRobot notes that the micro-mulching and nibbling manner in which the robot cuts the grass reduces the force that is being applied under the mower, which should reduce the risk of objects being discharged out of the mower.

[21] Dr. Evan W. Barrington, U.S. Econometric Forecast for Consumer Products, Commercial Turf Care Products, Handheld Equipment, prepared for the Outdoor Power Equipment Institute (September, 2012), *available at* http://opei.org/content/uploads/2012/10/OPEI-Econometric-Forecast-September-20124.pdf.

[22] *See* U.S. Environmental Protection Agency, News Release, *Small Engine Rule to Bring Big Emission Cuts* (April 17, 2007).

of fuel, mostly gasoline, are spilled each year while refueling lawn equipment.[23] A battery-powered RLM will reduce emissions, gasoline spills, fires and other such accidents. Additionally, RLMs produce significantly less noise pollution than gasoline powered lawn mowers, which will reduce noise levels in the residential environment.

Finally, the iRobot RLM will benefit elderly, disabled and many other consumers. Mowing the lawn with a gasoline powered push mower is an inconvenience to many, and cannot be easily accomplished by elderly or disabled people. The iRobot RLM will make this necessary chore easier and more accessible.

There is negligible risk of interference to other users, as the interference potential of the iRobot RLM is no greater than for a Section 15.250 compliant device because no network is formed. With regard to the 6-7 GHz point-to-point and satellite users (Fixed Wireless, auxiliary broadcasting and CARS), they will not see the iRobot signals given proximity to the ground of the robot and beacon antennas, the low power and duty cycles, and height and directivity of victim receive antennas. Moreover, because the beacons will communicate with the robot only intermittently and one at a time, there will be negligible increase in the noise floor.

iRobot recognizes that the Dedicated Short Range Communications Service ("DSRCS") in the Intelligent Transportation Systems (ITS) Radio Service operates in the 5.850-5.925 GHz band (5.9 GHz).[24] iRobot will operate well outside of this frequency range, at 6240-6740 MHz.

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[23] *See* New York State Department of Environmental Conservation, "Reducing Air Pollution from Lawn and Garden Equipment," *available at* http://www.dec.ny.gov/chemical/8554.html (last visited Jan. 21, 2015).

[24] *See Amendment of the Commission's Rules Regarding Dedicated Short-Range Communication Services in the 5.850-5.925 GHz Band (5.9 GHz Band); Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services*, Report and Order, 19 FCC Rcd 2458 (2004) ("DSRC Report and Order").

The Section 15.250 out-of-band limits at DSRC frequencies are only -51.3 dBm.[25] The iRobot RLM will not be a threat to DSRC, as power levels into the DSRC band will be well below the DSRC power levels, and average power over time will be even lower, given the very low duty cycle of the iRobot RLM.

Additionally, iRobot recognizes that the Radio Astronomy Service ("RAS") uses 6650-6675.2 MHz for spectral line observations. Because this use is location specific, there is little risk of interference as homeowners will not be operating the RLMs near observatories, especially those located in desert or mountainous regions. As well, the above ground attenuation of the RLM, ground clutter, and the curvature of the earth will combine to protect RAS.

iRobot will commit to placing a notice in the user manual and on the robot that states: "Consumer use only; use must be limited to residential areas." This should ensure that the RLMs are not operated near highways, where DSRC operations will occur, or near observatories, where there is RAS use of the spectrum.

C. Legal Basis.

The Commission assesses waiver requests according to the standards set out in *WAIT Radio v. FCC*.[26] In that case, as here, the applicant sought authority in contravention of the rules while explaining how it would nonetheless accomplish the purpose of the rules.[27] The court required the

[25] 47 C.F.R. § 15.250(d)(1).

[26] 418 F.2d 1153 (D.C. Cir. 1969). See also, *2002 Biennial Regulatory Review*, 18 FCC Rcd 13620 at para. 85 n.130 (2003) (citing *WAIT Radio* as "setting out criteria for waivers of Commission rules.")

[27] WAIT Radio operated an AM broadcast station. It was limited to daylight hours so as to afford protection to "white areas" that had no local service, and that relied on nighttime skywave propagation from another station. WAIT Radio proposed to transmit at night using a directional antenna that would limit its signal in the white areas. *WAIT Radio v. FCC*, 418 F.2d at 1154-55.

Commission to consider the request:

> [A] general rule, deemed valid because its overall objectives are in the public interest, may not be in the "public interest" if extended to an applicant who proposes a new service that will not undermine the policy, served by the rule, that has been adjudged in the public interest.[28]

The meaning is clear: Waiver is appropriate where the applicant furthers the public interest inherent in the underlying rules.

The waiver requested here meets the *WAIT Radio* standard: it proposes a device that will advance the policy served by the rules. The Part 15 rules are designed to ensure that "there is a low probability that these unlicensed devices will cause harmful interference to authorized users."[29] iRobot will provide a useful and life-saving device to consumers with no added risk of harmful interference to authorized users, and the use of the portable beacons is consistent with the intent of the usage restriction. The requested waiver fits easily into the boundaries drawn by *WAIT Radio*.

The Court of Appeals emphasized the importance of waiver procedures as part of the regulatory scheme:

> The agency's discretion to proceed in difficult areas through general rules is intimately linked to the existence of a safety valve procedure for consideration of an application for exemption based on special circumstances.[30]

Thus, it said, "allegations such as those made by petitioners, stated with clarity and accompanied by supporting data … must be given a 'hard look."[31] Here, too, the request fully qualifies. The

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[28] *WAIT Radio v. FCC*, 418 F.2d at 1157.
[29] *See Multispectral Solutions, Inc. Request for Waiver of Section 15.250 of the Commission's Rules*, Order, 22 FCC Rcd 9831 (2007) ("Multispectral Solutions").
[30] *WAIT Radio v. FCC, 418 F.2d at 1157.*
[31] *Id.* (citation footnote omitted).

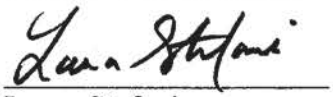
"safety valve" of the waiver procedure is needed to make available a device not otherwise available. The requested waiver is in the public interest, not only in terms of benefits to the public, but also in the absence of any downside. The request is entitled not only to the "hard look" mandated in *WAIT Radio,* but to a grant of the waiver. [32]

CONCLUSION

For the foregoing reasons, iRobot respectfully requests that the Office of Engineering and Technology ("OET") grant waiver of the rules so that iRobot may obtain equipment certification of its RLM. Alternatively, iRobot requests that OET issue a rule interpretation for the same purpose.

Respectfully submitted,

iROBOT CORPORATION



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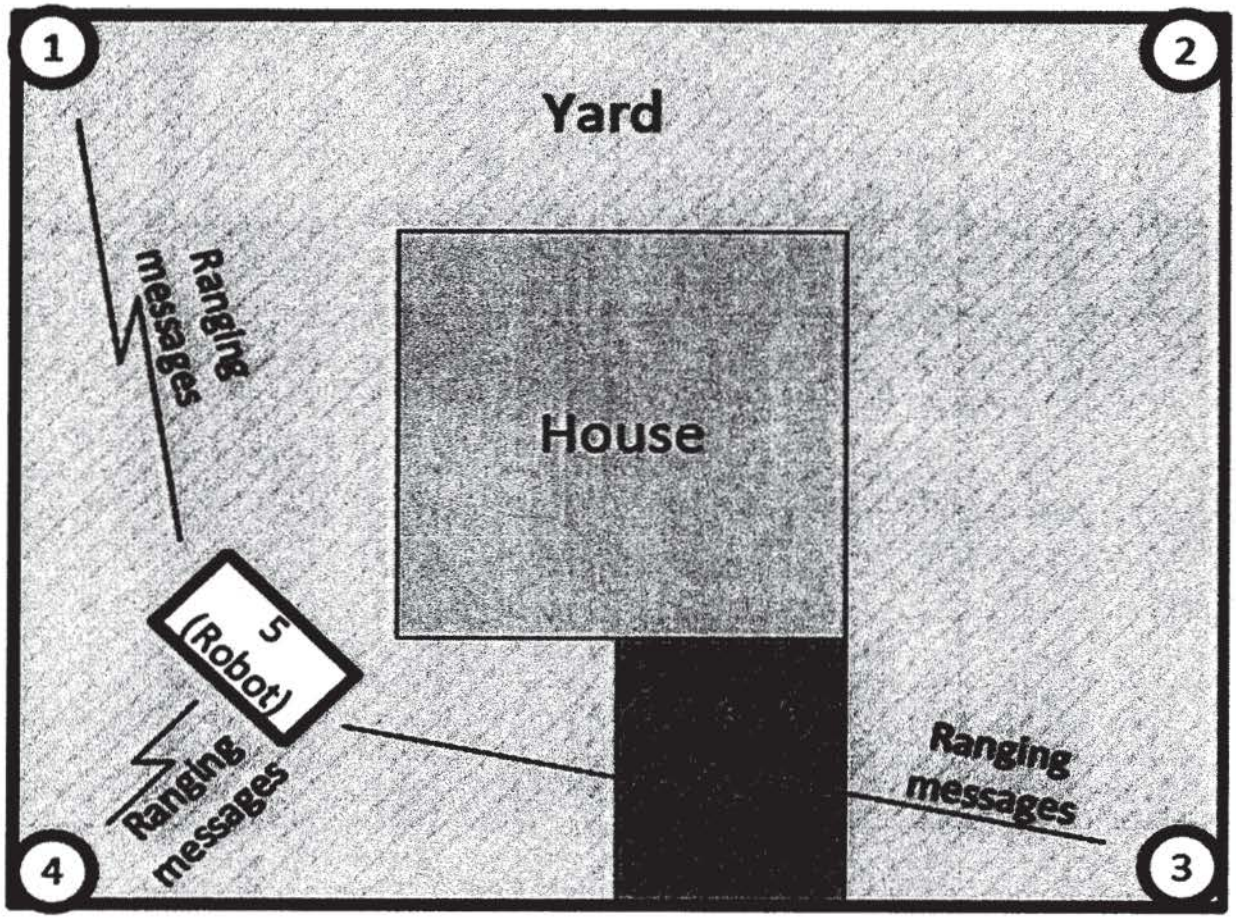
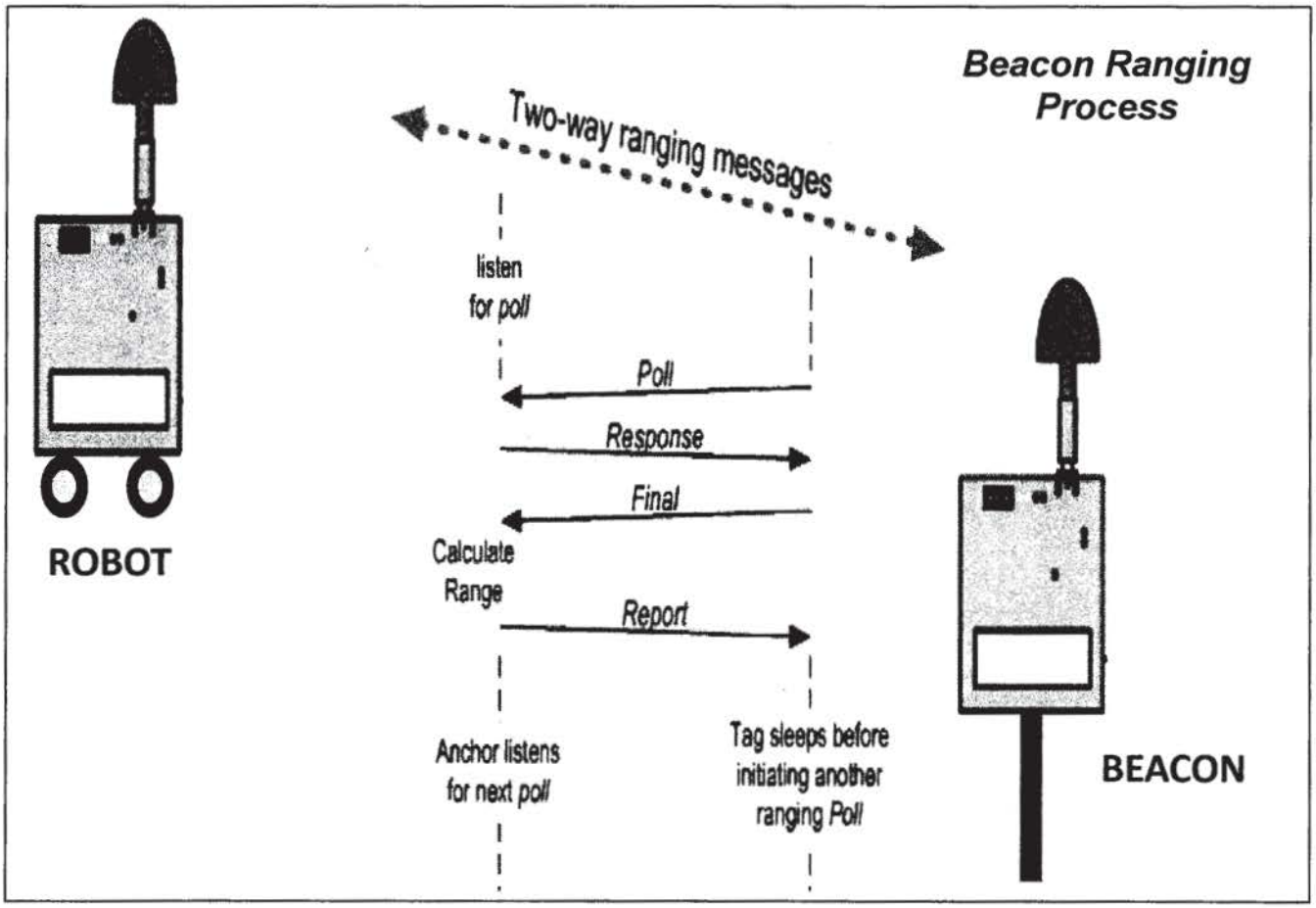
[32] *See e.g. Multispectral Solutions, Inc.* (granting a waiver of the peak power limit provision of Section 15.250(d)(3) because it will serve the public interest in that it will help improve safety of life for personnel working in high risk industrial facilities).

ATTACHMENT A

iRobot RLM Example Deployment Scenario



iRobot RLM System Operations Diagram



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