

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)
)
Tesla, Inc.)
) ET Docket No. _____
Request for Waiver of Section 15.255(c)(3))
of the Commission's rules for Short Range)
Interactive Motion Sensing Devices)

REQUEST FOR WAIVER OF SECTION 15.255(c)(3)

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TABLE OF CONTENTS

A. Background.....	2
1. About Tesla.....	2
2. Description of the subject device.....	2
3. Proposed use cases.....	3
B. Regulation of Field Disturbance Sensors.....	5
1. Section 15.255.....	5
2. Prior waiver requests.....	6
C. Discussion.....	8
1. The subject device is a short-range interactive motion sensing device.....	8
2. OET should grant Tesla’s waiver on an expedited basis.....	10
3. Good cause exists to grant Tesla’s waiver request.....	11
D. Conclusion.....	13

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Tesla, Inc. (“Tesla” or the “Company”) respectfully requests a waiver of Section 15.255(c)(3) of the Commission’s rules to permit the marketing of a short-range interactive motion sensing device in the 57-71 GHz band at a higher power level than specified in the rule. The subject device, which could be integrated in passenger vehicle interiors, incorporates millimeter wave (mmWave) radar technology to detect movements within a vehicle and to classify vehicle occupants. The device could be used, *inter alia*, to reduce the risk of pediatric vehicular heatstroke, protect vehicle occupants from injury through advanced airbag deployment and seatbelt reminders, and enhance theft prevention systems. Because the public interest would be served by such safety and security benefits and because strict compliance with the rule would reduce the accuracy and effectiveness of the device, good cause exists to grant this request. Moreover, the Commission has previously waived the power level requirements for a device operating under identical technical parameters. As a result, the Office of Engineering and Technology (“OET”) should grant this request on an expedited basis, without the need for a lengthy notice and comment period.

A. Background.

1. About Tesla.

Tesla is the world's leading manufacturer of fully electric vehicles ("EVs") and has been instrumental in reviving consumer interest in EVs with the introduction of the Roadster in 2008, the Model S in 2012, the Model X in 2015, the Model 3 in 2017, and the Model Y earlier this year. With each model, Tesla has proved that modern EVs can deliver performance, range, technology, safety, and style, all in a completely emissions-free package.

On the technology and safety front, new Tesla vehicles come equipped with eight cameras and twelve ultrasonic sensors, all of which support a growing suite of advanced driver assistance features. Tesla also designs its vehicles to allow for continual improvements via remote, over-the-air ("OTA") software updates, which it employs to provide customers with additional safety and convenience features as quickly as it develops and validates them.

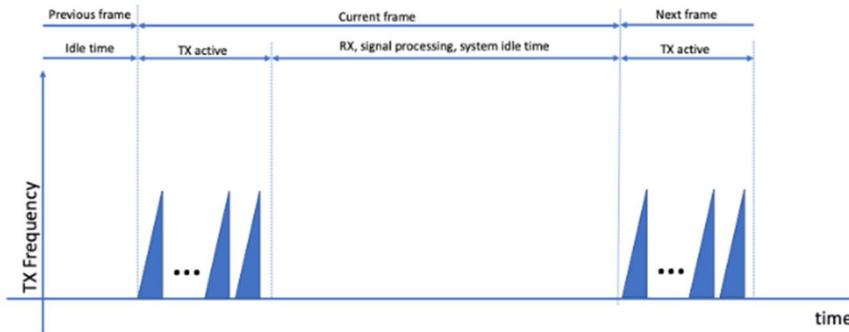
2. Description of the subject device.

The subject device is a millimeter wave ("mmWave") radar sensor that will operate in the 60-64 GHz band. It will have a maximum conducted power of +10 dBm, a maximum EIRP of +13 dBm and will operate with a maximum duty cycle of 10%. The application of the sensor would be focused on the interior of the vehicle, but it may be capable of scanning up to 2 meters outside of the vehicle.

The subject device will utilize 4 transmit and 3 receive antennas driven by a highly configurable radar front-end unit. In-vehicle radar modulation will consist of consecutive frames, including an acquisition sequence comprised by a repetition of frequency chirps or stepped chirps, a listening period, then a signal processing. The acquisition sequence is followed by idle time where antennas are not transmitting. The frequency chirps will span over the 60-64 GHz

band and for each acquisition sequence, the number of chirps and chirp duration can be adjusted depending on system requirements so that the total duty cycle will be less than 10%. This is illustrated in the following diagram.

Radar frame



3. Proposed use cases.

It is generally well-recognized that the vehicle fleet, as a whole, is getting safer.¹ This is due, in large part, to an increase in the types and availability of advanced safety technologies, many of which rely on radiofrequency (RF)-emitting devices. Until recently, most of these technologies have focused on sensing outside the vehicle (*e.g.*, cameras, sensors, and radar used for forward collision warning, automatic emergency braking, lane keep assist). However, there are numerous safety and security benefits of using RF devices for sensing inside the vehicle, both while the vehicle is stationary and while it is in motion.

One safety issue, which in-vehicle radar sensing is well-suited to address, is the risk of heatstroke in children inadvertently left in hot cars. According to the National Highway Traffic

¹ See, *e.g.*, <https://www.nhtsa.gov/newer-cars-are-safer-cars> (last accessed July 31, 2020) (“Vehicle safety has changed drastically over the years, and today newer cars are safer than ever before.”).

Safety Administration, more than 50 children died from vehicular heatstroke in both 2018 and 2019, the majority of which had been left in the vehicle because someone forgot the child was there.² mmWave radar technology can detect a child left in a vehicle and has some advantages over other sensing systems, including camera-based systems or in-seat occupant detection systems. Unlike cameras, mmWave provides depth perception and can “see” through soft materials, such as a blanket covering a child in a child restraint. And, unlike in-seat sensors, mmWave can differentiate between a child and an object left on the seat, reducing the likelihood of false alarms. In addition, mmWave is capable of detecting micromovements like breathing patterns and heart rates, neither of which can be captured by cameras or in-seat sensors alone.

In-cabin mmWave can provide other safety benefits, such as advanced airbag deployment and seat belt reminders. Radar imaging can assess body size to discriminate between adults and children and optimize airbag deployment in a crash – more effectively than existing weight-based, in-seat sensor systems. In addition, the technology’s ability to detect breathing patterns and heart rates permits discrimination between people and inanimate objects to more accurately limit system responses – *e.g.*, seatbelt reminders when people are detected, passenger airbag suppression when objects are detected.

mmWave radar can also provide vehicle security benefits. It can be used to enhance theft prevention systems by detecting a broken window or vehicle intrusion. While other sensors may also be used for this purpose, mmWave is more efficient. For example, a camera-based sensor operates by taking multiple frames and comparing them, whereas radar takes a single scan and more accurately and efficiently acquires the same information. Thus, mmWave can increase the robustness of these security systems.

² <https://www.nhtsa.gov/child-safety/help-prevent-hot-car-deaths> (last accessed July 31, 2020).

B. Regulation of Field Disturbance Sensors.

1. Section 15.255.

Section 15.255 prohibits the operation of “field disturbance sensors” within the 57-71 GHz band except in two circumstances: field disturbance sensors “employed for fixed operation” and “short-range devices for interactive motion sensing.” 47 C.F.R. 15.255(a)(2). A field disturbance sensor is “a device that establishes a radio frequency field in its vicinity and detects changes in that field resulting from the movement of persons or objects within its range.”³ The Commission has previously concluded that vehicle radar is one type of field disturbance sensor.⁴

Neither “fixed operation” nor “interactive motion sensing” are defined in the regulation. The exception for “fixed operation” was added to the rule in 1997 to address the specific use of field disturbance sensors in stationary machinery in a manufacturing plant.⁵ While the Commission did not further elaborate on the bounds of “fixed operation,” the amended rule specified that the exception included sensors “installed in fixed equipment, even if the sensor itself moves within the equipment.”⁶ The Commission later provided a handful of examples of sensing that may be operated in fixed equipment, such as “speed control, fluid level, and motion detection functions, etc.”⁷

The exception for “short-range devices for interactive motion sensing” was added to section 15.255 in 2016, to account for mobile sensors like Google’s Soli project, a sensor capable of capturing motion in a three-dimensional space using a radar beam and intended to benefit

³ 47 C.F.R. § 15.3.

⁴ See 47 C.F.R. § 15.255(a)(2) (“[f]ield disturbance sensors, including vehicle radar systems”); see also Spectrum Bands above 24 GHz for Mobile Radio Services, 31 FCC Rcd 8014 at ¶ 335, n.915 (2016) (“Spectrum Frontiers Order”).

⁵ Amendment of Parts 2, 15, and 97 of the Commission’s Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications, Memorandum Opinion and Order and Fourth Further Notice of Proposed Rulemaking, 12 FCC Rcd 12214-12215 at ¶¶ 6-11 (1997).

⁶ 47 C.F.R. § 15.255(a)(2).

⁷ Spectrum Frontiers Order at ¶ 334.

users with mobility, speech and tactile impairments by enabling touchless control of device functions and features.⁸ In enacting this exception, the Commission found that “the narrow application of mobile radars in short-range devices for interactive motion sensing, such as that described in Google’s Project Soli, – where a radar is used to detect hand gestures very close to a device to control the device without touching it – could be allowed without causing harmful interference to other authorized users.”⁹ As a result, and as a “cautious first step,” the Commission decided to permit such devices to operate at the same power levels as those employed for “fixed operation.”¹⁰

If a field disturbance sensor (*i.e.*, radar device) meets either of these two exceptions, section 15.255(c)(3) limits the power range at which it may be operated in the 60 GHz band. For both fixed field disturbance sensors occupying more than 500 MHz of bandwidth and short-range devices for interactive motion sensing, “the peak transmitter conducted output power shall not exceed -10 dBm and the peak EIRP level shall not exceed 10 dBm.”¹¹ This power level restriction was part of the spectrum etiquette developed to facilitate co-existence of all unlicensed 60 GHz devices in the 57-64 GHz band, and was adopted into the Commission’s rules in 1998.¹²

2. Prior waiver requests.

Since the enactment of the “short-range interactive motion sensing” exception, there have been five requests to waive the power level limit at which devices may be operated. The first request came from Google in connection with its Soli project.¹³ In support of its waiver request,

⁸ Spectrum Frontiers Order at ¶ 337.

⁹ *Id.*

¹⁰ *Id.*

¹¹ 47 C.F.R. § 15.255(c)(3).

¹² See Revision of Part 15 of the Commission’s Rules Regarding Operation in the 57-64 GHz Band, Third Report and Order, 13 FCC Rcd 15074 (1998).

¹³ *In the Matter of Google LLC*, ET Docket No. 18-70.

Google explained that the waiver was necessary because the power levels specified in section 15.255(c)(3) were too restrictive to adequately enable the Soli sensor's intended functions, resulting in missed motions and fewer effective interactions.¹⁴ While Google had originally requested a waiver to operate at power levels consistent with European Telecommunications Standards Institute (ETSI) standard EN 305 550 (*i.e.*, a conducted power of +10 dBm, a mean PSD EIRP of +13 dBm/mHz, and a mean EIRP of +20dBm), it later indicated that it could operate Soli sensors under a waiver incorporating a lesser peak power limit than it initially sought.¹⁵ The Commission ultimately granted Google's request on the following terms: limited power levels at +10 dBm conducted power, +13 dBm EIRP and +13 dBm/MHz spectral power density, and observance of a maximum 10% duty cycle (*i.e.*, transmissions no longer than 3.3ms in any 33ms time period).¹⁶ In doing so, the Commission concluded that the Soli sensor would pose minimal risk of harmful interference to other spectrum users and that granting the waiver would serve the public interest by providing for innovative device control features.¹⁷

Since then, four additional companies have sought waivers, three involving technologies similar to the subject device. First, in late 2019, Vayyar Imaging Ltd. submitted a waiver request for its V60G sensor, a radar device that the company explains has an identical spectrum "footprint" as the Google Soli sensor, and that can be used in medical settings and for in-vehicle safety purposes.¹⁸ Second, Valeo North America, Inc. submitted a waiver request earlier this year for its in-vehicle safety-related monitoring device, which it too explains will utilize the same

¹⁴ *Google LLC Request for Waiver of Section 15.255(c)(3) of the Commission's Rules Applicable to Radars used for Short-Range Interactive Motion Sensing in the 57-64 GHz Frequency Band*, Order, 33 FCC Rcd 12542 at ¶ 3 (OET 2018) ("Google Waiver Order").

¹⁵ *Id.* at ¶ 5.

¹⁶ *Id.* at ¶ 14.

¹⁷ *Id.* at ¶ 12.

¹⁸ *Vayyar Imaging Ltd., Request for Waiver of Section 15.255(c)(3) of the Commission's Rules for Interactive Motion Sensing Devices*, ET Docket No. 20-15 (Nov. 13, 2019) ("Vayyar Waiver Request").

technical parameters that the Commission approved for Google’s Soli device.¹⁹ Third, last week, Infineon Technologies Americas Corp. submitted a waiver request for its BGT60-based systems, which include automotive gesture recognition applications.²⁰ The fourth request was submitted by Leica Geosystems Ltd. last September.²¹ While Leica sought a waiver of section 15.255(c)(3),²² its requested power levels and duty cycle are different than what was permitted for the Google Soli sensor (and than what is requested here).

The Commission has not yet decided any of the pending waiver requests. However, the comments have been almost universally supportive. They have accepted the technology as a “short-range device for interactive motion sensing” and have not pointed to any increased risk of interference that would be caused by the limited increase in power levels.

C. Discussion.

1. The subject device is a short-range interactive motion sensing device.

While “short-range device for interactive motion sensing” is not defined in the regulation, Tesla’s device meets the plain meaning of this term, as well as the definitions suggested in the Vayyar and Valeo proceedings. As noted by Vayyar, when the term was added to section 15.255, it was intended to “describe a subset of field disturbance sensors capable of determining an object’s location and movement in three-dimensional space.”²³ As explained above, this language sought to incorporate into the regulation technology like the Google Soli project, which was described as including both short-range touchless control and “longer range applications

¹⁹ *Valeo North America, Inc. Request for Waiver of Section 15.255(c)(3) of the Commission’s Rules for Short Range Interactive Motion Sensing Devices*, ET Docket No. 20-121 (Mar. 31, 2020) (“Valeo Waiver Request”).

²⁰ *In the Matter of Infineon Technologies Americas Corp.*, docket pending (July 23, 2020) (“Infineon Request”).

²¹ *In the Matter of Leica Geosystems Ltd., Request for Waiver of Part 15 of the Commission’s Rules to Market a UAV Collision Avoidance Radar*, ET Docket 19-350 (Sept. 5, 2019).

²² Leica has primarily argued that its device is not a field disturbance sensor and, in the alternative, has requested a waiver of both sections 15.255(a)(2) (short-range device for interactive motion sensing) and (c)(3) (power levels).

²³ Vayyar Waiver Request at p. 5, n. 17.

such as in-room activity tracking.”²⁴ While the Commission stated that it was limiting the power levels to more short-ranged sensing (*e.g.*, hand gestures near a watch or tablet), it nevertheless allowed for power levels that would permit sensing up to some undefined point beyond that range.²⁵ Valeo did not offer a definition for the term, but assumed it included its in-vehicle device and generally agreed with Vayyar’s definition and that of the commenters.²⁶ Infineon cited the record developed in the Valeo proceeding to support its position that the BGT60 sensor system constitutes a “short-range device for interactive motion sensing.”²⁷

While Tesla generally agrees with Vayyar and Valeo on the meaning of short-range interactive motion sensing and assumption that it applies to in-vehicle sensors, it disagrees to the extent that either suggests the term could not be interpreted to include intrusion detection and security systems – *i.e.*, devices directed toward “non-users.”²⁸ While the term “interactive” certainly encompasses interactions with or between users, it is broad enough to also include situations where people or things influence or have an effect on each other, regardless of whether one is “using” the device.²⁹ In its comments in the Valeo proceeding, Wiley Rein proposed that interactive motion sensing include, *inter alia*, the use of a field disturbance sensor to “allow a device to monitor a person by the person interacting with the device.”³⁰ Tesla agrees with this common-sense description. As applied to the subject device, a person will interact with – and influence – the device through movements within the vehicle (including micromovements like

²⁴ Vayyar Waiver Request, Modification of Request for Limited Waiver at p 2 (May 5, 2020).

²⁵ Spectrum Frontiers Order at ¶ 336.

²⁶ See Valeo Waiver Request at p. 3; *see also* Valeo Waiver Request, Reply Comments of Valeo North America, Inc. at p. 4 (June 23, 2020).

²⁷ Infineon Waiver Request, Request for Waiver at pp. 14-15 (July 23, 2020).

²⁸ Valeo Waiver Request, Comments of Vayyar Imaging Ltd. in Support of Waiver Request by Valeo North America Inc. at p. 3 (June 8, 2020).

²⁹ <https://www.lexico.com/definition/interactive> (last accessed July 31, 2020).

³⁰ Valeo Waiver Request, Comments of Wiley Rein, LLC at p. 5 (June 8, 2020).

respiration and larger movements such as intrusion) and that interaction constitutes “interactive motion sensing.”³¹

Moreover, in-vehicle interactive motion sensing should always be deemed “short-range,” as it is principally limited to the confines of the vehicle cabin. Indeed, the plain meaning of “short-range” includes those devices that are “only able to be used or be effective over short distances.”³² However, drawing a line between a short distance and longer one can be difficult. Because the range of an interactive motion sensing device can be limited by the power level at which it is allowed to operate, Tesla encourages the Commission to focus on the power level and risk for interference rather than drawing an arbitrary line between what should be considered “short-range” versus “long-range.” This approach would be consistent with the one taken by the Commission in enacting the exception in the first place.³³³⁴

2. OET should grant Tesla’s waiver on an expedited basis.

Because Tesla’s device is a short-range device for interactive motion sensing, it is generally permitted to be operated in the 60 GHz band, subject to certain power limits.³⁵ However, if the subject device is operated at those levels, it will not be as accurate or efficient and the safety and security benefits will be greatly reduced. Thus, to achieve the full potential of this life-saving technology, the sensor must be operated at slightly higher power levels, although not more than those granted to Google for the Soli project.

³¹ If the Commission disagrees and concludes that interaction with a user is a requirement for interactive motion sensing, Tesla urges it to conclude that when the vehicle is stationary, the sensor is operating in a fixed state, which is permissible under section 15.255(a)(2).

³² See <https://www.lexico.com/en/definition/short-range> (last accessed July 31, 2020).

³³ See Spectrum Frontiers Order at ¶ 337.

³⁴ Alternatively, if the Commission is unable to decide or declare that the subject device is a short-range interactive motion sensing device outside of a broader rulemaking or declaratory action, then Tesla seeks a waiver from section 15.255(a)(2).

³⁵ 47 CFR 15.255(c)(3).

OET has the authority to grant follow-on (“me too”) requests for products that operate within the same technical parameters as a previous waiver without soliciting comments and Tesla urges it to do so in this instance.³⁶ OET’s authority to grant follow-on waiver requests for RF devices that are technically and functionally equivalent to previously waived devices exists where there are no novel issues.³⁷ In such circumstances, all relevant interference issues have been studied and resolved, and no purpose would be served by the administrative delay occasioned by a repetitive solicitation of comments on the same issues. Because the RF characteristics and spectrum impact of the subject device is identical to the Soli waiver, OET should exercise its authority and grant the waiver request on an expedited basis.

Both the requesters and commenters in the pending waiver proceedings encouraged the Commission to commence a comprehensive rulemaking, including to revise the power level restriction. Tesla agrees that a rulemaking to update the technical rules for the 60 GHz band is appropriate. However, because the rulemaking process can be quite lengthy, and the benefits of the technology are significant, OET should avoid needless delay in the implementation of this technology by granting this waiver request on an expedited basis, along with the other waiver requests that meet the same technical parameters, and then undertaking a larger rulemaking to evaluate the scope of appropriate changes to the rule.

3. Good cause exists to grant Tesla’s waiver request.

The Commission is authorized to grant a waiver of its rules where good cause exists.³⁸ Good cause may be found “where particular facts would make strict compliance inconsistent with the public interest.”³⁹ To satisfy this public interest requirement, the waiver cannot

³⁶ See Valeo Waiver Request, Comments of Wiley Rein, LLC at p. 7-8 (June 8, 2020).

³⁷ 47 C.F.R. 0.31(i); Cf. 47 C.F.R. 0.0241(a)(3).

³⁸ 47 C.F.R. § 1.3; *ICO Global Communications (Holdings) Limited v. FCC*, 428 F.3d 264 (D.C. Cir. 2005).

³⁹ *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990).

undermine the purposes of the rule, and there must be a stronger public interest benefit in granting the waiver than in applying the rule.⁴⁰

Here, the public interest would not be served by strict compliance with the rule. First, the requested waiver would not undermine the purpose of the rule, which is to reduce the potential for harmful interference within the 60 GHz band.⁴¹ In connection with the Google Soli waiver, the Commission has already found that the Soli sensor, when operating under specified power and duty cycle conditions identical to those requested here, posed no threat of harmful interference to other spectrum users.⁴² Because the subject device operates within the same technical parameters, this finding should apply equally here. In addition, the placement of the sensor inside a vehicle further reduces the risk. Regardless of whether the vehicle is stationary or in motion, the requested power level is not strong enough to detect anything beyond approximately 2 meters of the perimeter of the vehicle. Thus, the zone of possible interference is quite small. Finally, when the vehicle is in motion, any interference that may occur would be fleeting, reducing the risk of harmful interference even further. Because Tesla's device will pose no greater risk of harmful interference than those devices already permitted under the existing rules, a grant of the requested waiver does not undermine the purpose of the rule.

In addition, there is a stronger public interest benefit in granting this waiver, as opposed to strictly applying the rules. The benefits of the technology are significant. As explained above, it has the potential to save lives, reduce injuries, and provide enhanced security. Strict compliance with the stated power levels, on the other hand, would stifle such innovation, and

⁴⁰ See, e.g., *WAIT Radio v. FCC*, 418 F.2d 1153, 1157 (D.C. Cir. 1969) (stating that even though the overall objectives of a general rule have been adjudged to be in the public interest, it is possible that application of the rule to a specific case may not serve the public interest if an applicant's proposal does not undermine the public interest policy served by the rule); *Northeast Cellular*, 897 F.2d at 1166 (stating that in granting a waiver, an agency must explain why deviation from the general rule better serves the public interest than would strict adherence to the rule).

⁴¹ Spectrum Frontiers Order at ¶ 334, n. 913.

⁴² Google Waiver Order at ¶ 12.

make it difficult, if not impossible, for the technology to reach its full potential.⁴³ Indeed, there is a risk of degraded performance as the return signal received (in some areas of the field of view) will not be sufficiently above the noise floor of the system for accurate detection. Therefore, if the sensing can only be performed at the stated power levels, it would not be as accurate or effective, and the public interest would not be served.

D. Conclusion.

The subject device will provide numerous safety and security benefits to vehicle occupants, without risking additional, harmful interference to other spectrum users. Because the public interest will be served by such safety and security benefits and because strict compliance with the rule would reduce the accuracy and effectiveness of the device, good cause exists to grant this waiver request. Moreover, the Commission has already waived the power level requirements for the Google Soli sensor – a device operating under identical technical parameters as the subject device. As a result, OET should grant this request on an expedited basis.

Respectfully submitted,


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⁴³⁴³ See 47 U.S.C. § 157(a) (“It shall be the policy of the United States to encourage the provision of new technologies and service to the public.”).