

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

In the Matter of )
Massachusetts Institute of Technology )
Request for Waiver of Part 15 of the ) ET Docket No. 19-89
Commission's Rules Applicable to Ultra- )
Wideband Devices )

ORDER

Adopted: April 30, 2020

Released: April 30, 2020

By the Acting Chief, Office of Engineering and Technology:

I. INTRODUCTION

1. By this Order, we grant a request by Massachusetts Institute of Technology (MIT), for a waiver of Sections 15.31(c), 15.503(d), and 15.521(d) of the Commission's Part 15 rules to permit the certification and marketing of indoor health monitoring devices that it calls the WiTrack system.

II. BACKGROUND

1. The WiTrack is a wall-mounted system that provides non-invasive health and safety monitoring for patients and senior adults. A WiTrack device is designed to measure physiological characteristics such as gait, breathing, heart rate, and sleep, and facilitates the detection of potentially life-threatening events, such as falls.

2. WiTrack devices will operate under the Commission's Part 15 rules governing the operation of ultra-wideband (UWB) devices. Part 15 permits low-power radio frequency devices to operate without an individual license from the Commission.

1 Petition of Massachusetts Institute of Technology Request for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices filed December 27, 2018 (MIT Waiver Request). See also 47 CFR §§ 15.31(c), 15.503(d), 15.521(d).

2 MIT Waiver Request at 1- 2; Letter from Dina Katabi, Director Center for Wireless Networks and Mobile Computing, MIT, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 19-89 at 3 (filed Aug. 7, 2019) (MIT August 7 Ex Parte).

3 47 CFR §§ 15.1 et seq.

4 47 CFR §§ 15.501-15.525.

5 47 CFR. § 15.5.

will sweep at different ranges within the 6-8.5 GHz band.<sup>6</sup>

3. In its waiver request, MIT requests that the following three rules are waived to allow for the certification and marketing of their WiTrack system: Sections 15.503(d), 15.31(c), and 15.521(d) of the Commission's rules. Section 15.503(d) defines an ultra-wideband transmitter as an intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth. MIT states that the WiTrack system would not satisfy this definition since each frequency step is less than 500 MHz in bandwidth "at any point in time" even though the total bandwidth needed for optimal performance exceeds 500 MHz.<sup>7</sup> Section 15.31(c) defines the measurement standards for unlicensed devices to demonstrate compliance with applicable emission limits and requires that swept frequency equipment measurements be made with the frequency sweep stopped. Section 15.521(d) defines the measurement procedure to demonstrate the operation of UWB devices is within the applicable limits provided within the Commission's rules. MIT seeks to measure WiTrack devices using an average detector with the transmitter operating in its normal mode, *i.e.*, with the stepping function active.

4. The Office of Engineering and Technology issued a Public Notice on March 29, 2019 seeking comment on the MIT request.<sup>8</sup> Leo Pharma Science & Tech Hub, AARP, and Dr. Brent Forester of Harvard Medical School filed comments in support of the request.<sup>9</sup> The Wi-Fi Alliance sought additional detail regarding the coexistence of the WiTrack System with unlicensed devices used for radio local area networking. Ron Anderson raised concerns that the system would "raise the noise floor" (*i.e.* generate additional unwanted signal noise) in the frequencies over which it operates.<sup>10</sup> Cisco and Hewlett Packard also objected in handling this waiver request, along with other waiver requests involving ultra-wideband applications in an ad-hoc basis, and sought the commencement of a more comprehensive proceeding to address these issues.<sup>11</sup>

### III. DISCUSSION

5. We are authorized to grant a waiver under Section 1.3 of the Commission's rules if the petitioner demonstrates good cause for such action.<sup>12</sup> Good cause, in turn, may be found and a waiver granted "where particular facts would make strict compliance inconsistent with the public interest."<sup>13</sup> To make this public interest determination, the waiver cannot undermine the purpose of the rule and there

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<sup>6</sup> MIT Waiver Request at 8.

<sup>7</sup> MIT Waiver Request at 14 ("While the WiTrack System sweeps a continuous wave signal through a bandwidth of about 2 GHz, at each point in the sweep, the transmitted signal has a bandwidth less than 500 MHz, resulting in an instantaneous fractional bandwidth of less than 0.2 and individual transmissions of less than 500 MHz.).

<sup>8</sup> *Office of Engineering and Technology Seeks Comment on Massachusetts Institute of Technology Request for Waiver for Part 15 Ultra-Wideband rules for WiTrack Medical Device*, Public Notice, 34 FCC Rcd 2004 (OET 2019).

<sup>9</sup> *See generally* Comments of LEO Science Pharma and Tech Hub, ET Docket 19-89 (filed Apr. 17, 2019); Comments of David Certner, Legislative and Policy Director, AARP, ET Docket 19-89 (filed Apr. 17., 2019); Comments of Brent Forester, MD, MSc, Harvard Medical School Associate Professor and McLean Hospital Division Chief, ET Docket 19-89 (filed Apr. 17, 2019).

<sup>10</sup> *See generally* Wi-Fi Alliance Reply; Ron Anderson Comments.

<sup>11</sup> Letter from Mary Brown, Cisco Systems and Chuck Lukaszewski, Hewlett Packard Enterprise Company to Marlene Dortch, Secretary, FCC, ET Docket Nos. 19-241, 19-242, 19-246, 19-155, 19-217, 19-89, 18-284, 18-295, and GN Docket No. 17-183, (filed Nov. 13, 2019) (Cisco/HPE UWB Letter).

<sup>12</sup> 47 CFR § 1.3. *See also* *ICO Global Communications (Holdings) Limited v. FCC*, 428 F.3d 264 (D.C. Cir. 2005); *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990); *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

<sup>13</sup> *Northeast Cellular*, 897 F.2d at 1166; *see also* *ICO Global Communications*, 428 F.3d at 269 (quoting *Northeast Cellular*); *WAIT Radio*, 418 F.2d at 1157-59.

must be a stronger public interest benefit in granting the waiver than in applying the rule.<sup>14</sup>

6. The UWB technical and operational standards in Part 15 were adopted to ensure that UWB devices, including indoor UWB systems, do not cause harmful interference to authorized radio services.<sup>15</sup> We find nothing in the record to indicate that the WiTrack devices would differ from other UWB devices such that they would pose an increased risk of causing harmful interference to authorized radio services.

7. We agree with MIT that the WiTrack system is functionally equivalent to other UWB devices that use stepped frequency that have previously been granted waivers of Section 15.503(d).<sup>16</sup> Waiving the UWB transmitter definition in the rule for the WiTrack device is warranted because doing so will not increase the risk of harmful interference and is consistent with the Commission's longstanding efforts to support technological innovation through unlicensed use of the band.

8. Regarding the request to waive Sections 15.31(c) and 15.521(d), MIT observes that, in the time since this rule was adopted, the Commission has permitted other UWB transmitters operating above 960 MHz that use frequency stepping techniques to be measured using an average detector with the transmitter operating with the stepping function active, and asserts that there is no reason to require it to conduct measurements with the stepping function stopped.<sup>17</sup> MIT claims that its WiTrack system will meet all other emission limits and technical requirements under the UWB rules when measured with the stepping function active.

9. Prior waivers of the measurement procedures for UWB transmitters that permitted emissions to be measured with the transmitter operating in its normal transmission mode recognized that the interference aspects of a transmitter employing frequency hopping, frequency stepping, or gating are quite similar, as viewed by a receiver, in that transmitters using these burst formats appear to the receiver to emit for a short period of time followed by a quiet period.<sup>18</sup> The Commission concluded that any requirement to stop the frequency hopping, band sequencing, or system gating serves only to add another unnecessary level of conservatism to already stringent UWB standards.<sup>19</sup> Furthermore, we have found that allowing stepped frequency devices to be measured with the stepping function on would not increase the interference potential of the device above that of impulse UWB devices if all other emission limits and technical requirements are met.<sup>20</sup>

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<sup>14</sup> See, e.g., *WAIT Radio*, 418 F.2d at 1157 (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).

<sup>15</sup> *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, First Report and Order, ET Docket No. 98-153, 17 FCC Rcd 7435 (2002) (*UWB First R&O*); see also, 47 CFR. §§ 15.501-15.525.

<sup>16</sup> MIT Waiver at 13. See *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, ET Docket No. 04-352, Order, 20 FCC Rcd 5528 (2005) (MBOA-SIG Waiver), as well as *Curtiss-Wright Controls Inc. Request for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices*, ET Docket No. 10-167, Order, 27 FCC Rcd 234, (OET 2012) (CWCI Waiver) and *Kyma Medical Technologies Ltd., Request for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices*, ET Docket No. 15-119, Order, 31 FCC Rcd 9705 (OET 2016) (Kyma Waiver).

<sup>17</sup> See, MBOA SIG Waiver, CWCI Waiver, and Kyma Waiver

<sup>18</sup> See, e.g., MBOA-SIG Waiver, 20 FCC Rcd at 5535.

<sup>19</sup> *Id.*, 20 FCC Rcd at 5534.

<sup>20</sup> See CWCI Waiver, 27 FCC Rcd at 242; see also, MBOA-SIG Waiver, 20 FCC Rcd at 5531-5536.

10. We believe that MIT's request represents an analogous situation, and will waive Sections 15.31(c) and 15.521(d) of the rules to permit MIT to demonstrate compliance with the UWB emission limits with the stepping function active.<sup>21</sup> To ensure that the WiTrack system does not emit in any individual 10 MHz, 20 MHz, or 40 MHz narrow band continuously – which would negate the “bursty” nature of UWB transmissions that is integral to our analysis – we are conditioning this waiver so that the dwell time during any step shall not exceed 0.04 percent of the device's minimum scan/cycle rate.<sup>22</sup>

11. We do not find Ron Anderson's arguments about the potential increase of the noise floor because of the WiTrack devices to be persuasive. MIT is not seeking higher power than what is already allowed under the Commission's rules for UWB devices. Further, the Commission has previously observed the ability of UWB technologies to coexist with licensed services because UWB signals quickly fall to levels below the background noise due to high propagation losses at radio frequency above 2 GHz.<sup>23</sup> Moreover, the operation of WiTrack devices in indoor environments, and along with the specialized healthcare use model, it can be expected to result in relatively limited device proliferation. This further limit the potential for signal aggregation to become a matter of concern.

12. We also find good cause to grant the MIT waiver without first resolving the issues Cisco and Hewlett Packard have raised in their letter.<sup>24</sup> MIT's request is narrowly tailored, can be granted without raising the potential for causing harmful interference to authorized services, and can help realize important health benefits. By contrast, Cisco and Hewlett Packard raise general questions of Commission practice and policy that will remain available for our consideration later and in an appropriate context.

13. With respect to the second prong of our waiver analysis, we find that there is a stronger public interest benefit in granting the waiver than in applying the rule. Comments filed in support of the waiver generally argue that passive, non-intrusive health monitoring service provided and enabled by WiTrack could reduce the cost of medical care, enable drug development, and improve health outcomes for patients.<sup>25</sup> These are compelling arguments. Moreover, we recognize that the WiTrack system could be a uniquely beneficial tool for addressing the COVID-19 pandemic, as it could remotely monitor elderly and immunocompromised individuals, residents of assisted living facilities, and those who need in-home care.

14. Although the Wi-Fi Alliance did not oppose the MIT waiver, it expressed concerns regarding coexistence between WiTrack devices and wireless local area networks, which also operate under the Part 15 unlicensed rules and asked that MIT provide further technical and operational information.<sup>26</sup> It also notes that the Commission has proposed to modify its rules to permit unlicensed devices, including radio local area networks, to use the 6 GHz band and that “it is in the interest of all potential users of the band to be able to assess potential coexistence issues that may arise in cases of geographic proximity and simultaneous operations.”<sup>27</sup> MIT, in subsequent *ex parte* submissions provided additional information to addressing these matters.<sup>28</sup>

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<sup>21</sup> Our reliance on the MBOA-SIG Waiver and the CWCI Waiver decisions in this instance is only relative to the measurement procedure in Section 15.521(d).

<sup>22</sup> Additional constraints beyond those already designed into the system do not appear to be warranted. MIT provides the dwell time for its WiTrack system on any one frequency as 2 microseconds. *See* MIT Waiver Request at 18.

<sup>23</sup> *UWB First R&O*, 17 FCC Rcd at 7453, para. 38.

<sup>24</sup> *See* Cisco/HPE UWB Letter.

<sup>25</sup> MIT August 7 *Ex Parte* at 2.

<sup>26</sup> *See* Wi-Fi Alliance Reply at 1-6.

<sup>27</sup> *Id.* at 2.

<sup>28</sup> MIT August 7 *Ex Parte* (responding to Wi-Fi Alliance Reply); Letter from Bruce A. Romano, Counsel for Massachusetts Institute of Technology, to Marlene H. Dortch, Secretary, FCC, December 23, 2019 (providing, for

15. As a fundamental matter, devices operating pursuant to Part 15 of the Commission's rules are not afforded any right of interference protection and the Part 15 rules are applicable and available to all unlicensed users. In the instant case, the record also shows that MIT has considered the ability of the WiTrack system to tolerate interference from other unlicensed users as well as its potential to cause interference, and it has found that the WiTrack's design and use can serve to promote coexistence between it and other unlicensed devices. For example, MIT notes that because WiTrack devices are mounted on the wall with spatial distance from furniture and clutter, it will be "natural and convenient" to provide the nominal standoff of few meters between Wi-Fi devices and WiTrack that can further promote coexistence.<sup>29</sup> Also, given that WiTrack devices operate indoors and with signal levels significantly below the noise floor tolerated by radio local area network devices, device placement is a reasonable and practical method to mitigate potential interference between unlicensed devices.<sup>30</sup> Finally, we agree with MIT that the risk of WiTrack device causing harmful interference to incumbents in the frequency bands it proposes to use is low.<sup>31</sup>

16. MIT also has addressed the Commission's recently adopted 6 GHz band proceeding, which proposes to permit the introduction of new unlicensed operations into the band.<sup>32</sup> It asserts that because WiTrack devices are designed to function without protection from harmful interference and to be robust in the face of the other RF signals and noise, they will be able to tolerate potential new sources of interference in the 6 GHz band. Because the WiTrack device sweeps through a wide bandwidth (around 2 GHz) and stays in any frequency for a minuscule period of time, and because the system combines signals across an entire device cycle to create a measurement, it tolerates interference well.<sup>33</sup> Moreover, high interference environments affect the WiTrack's coverage as opposed to the reliability and accuracy of its measurements.<sup>34</sup>

17. Lastly out of abundance of caution, we are conditioning this waiver to include coordination requirements to protect the passive Radio Astronomy Service observing in the operating bands of the WiTrack device. Given that indoor use of the device for medical monitoring, its low power levels, and the remote location of radio astronomy observatories, we do not foresee a heightened risk of interference to the service from the WiTrack to Radio Astronomy Observations. Based on these conditions, we strongly urge that appropriate language be included in the WiTrack's marketing literature, and, or user manual so the consumers, and users of the device are aware of these limitations and can take appropriate measures to comply with all the applicable conditions of this waiver.

18. Moreover, we find that granting a waiver for WiTrack's operations would not undermine the purpose of the rule because use of stepped frequency is functionally equivalent to other UWB

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example, additional technical and operational data that includes information obtained from the tests MIT has conducted under experimental call sign WH2XWL) (MIT December 23 *Ex Parte*).

<sup>29</sup> MIT August 7 *Ex Parte* at 6 (Stating that a small standoff of two meters reduces the WiTrack power at an RLAN receiver by about 50 to 60 dB).

<sup>30</sup> See MIT August 7 *Ex Parte* at 6-7

<sup>31</sup> MIT Waiver Request at 18 -20 (Stating that non-UWB incumbent receivers are all outdoors, and are typically at significant height from the ground, in contrast to the MIT WiTrack device, which is intended for indoor operation.)

<sup>32</sup> *Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 18-295, and GN Docket No. 17-183 (2020).

<sup>33</sup> MIT Waiver Request at 10 (Device cycle includes a full array cycle that ends in a "quiescent period." The duration of that period is chosen to ensure that the device meets the FCC average power limit of -41.3 dBm, with the average power calculated over the duration of the device cycle. In the current version, each cycle lasts between 16 and 64 milliseconds.)

<sup>34</sup> See MIT December 23 *Ex Parte* at 1-3.

devices,<sup>35</sup> and it is in the public interest to permit deployment of WiTrack devices to improve public health, especially at a time of a pandemic like the one we are currently experiencing. We therefore grant the waiver request. Specifically, we limit the waiver to use of MIT’s WiTrack system as described in the waiver request and waive the Commission’s rules with respect to: 1) The “at any point in time” requirement of Section 15.503(d) which would require the WiTrack transmitter to have a fractional bandwidth equal to or greater than 0.20 or UWB bandwidth equal to or greater than 500 MHz; and 2) the requirements in Sections 15.31(c) which directs that the emissions from the WiTrack device to be measured with the transmitter operating with the stepping function stopped, and 15.521 (d) which defines the measurement procedure to demonstrate that operation of an UWB device is within applicable limits. The waiver is also subject to the following conditions:

- The MIT WiTrack device shall be certified by the Commission.<sup>36</sup>
- The MIT WiTrack device dwell time on any one frequency shall not exceed 2 microseconds.
- The dwell time during any step of the MIT WiTrack device shall not exceed 0.04 percent of the devices minimum scan/cycle rate.
- WiTrack’s Device cycle shall not exceed 64 milliseconds.
- WiTrack devices shall meet the average power limit of -41.3 dBm calculated over the duration of the device cycle.
- Signal bandwidth at any time shall be less than 50 kHz for certification testing. The measurement of emissions from the MIT WiTrack device shall be conducted with the stepping function active for all possible frequency step sizes.
- WiTrack device shall be used for indoor operations only.
- The MIT WiTrack device shall comply with all other technical and operational requirements applicable to UWB devices under Part 15, Subpart F of the Commission’s rules.
- WiTrack device usage shall be registered with the National Science Foundation at [esm@nsf.gov](mailto:esm@nsf.gov) when devices are located within the geographic area bounded by: 31.367224N, 109.031505W, and 34.386150N, 103.077521W, except for the city limits of Las Cruces, Alamogordo, Roswell, and Carlsbad in NM, and El Paso, TX.
- Operation of WiTrack System devices within the National Radio Quiet Zone (NRQZ) defined in 47 CFR Section 1.924(a) is prohibited without coordination with the NRQZ administrator. Operation of WiTrack System devices within the Puerto Rican Coordination Zone defined in 47 CFR Section 95.42 shall be coordinated with the Interference Office at Arecibo Observatory.
- Operation of WiTrack System devices within 25 km of the sites listed below shall be coordinated through the National Science Foundation’s Electromagnetic Spectrum Management unit at [esm@nsf.gov](mailto:esm@nsf.gov).

State	VLBA Station	Lat. (N)	Long. (W)
AZ	Kitt Peak	31° 57' 23"	111° 36' 45"
CA	Owens Valley	37° 13' 54"	118° 16' 37"
HI	Mauna Kea	19° 48' 05"	155° 27' 20"
IA	North Liberty	41° 46' 17"	091° 34' 27"
NH	Hancock	42° 56' 01"	071° 59' 12"
NM	Los Alamos	35° 46' 30"	106° 14' 44"
NM	Pie Town	34° 18' 04"	108° 07' 09"
TX	Fort Davis	30° 38' 06"	103° 56' 41"
VI	Saint Croix	17° 45' 24"	064° 35' 01"
WA	Brewster	48° 07' 52"	119° 41' 00"

<sup>35</sup> The Commission has granted similar waivers in the past. See MBOA-SIG Waiver, CWCI Waiver, and Kyma Waiver)

<sup>36</sup> The filing for certification should include a copy of this waiver order.

19. Accordingly, pursuant to authority in Sections 0.31, 0.241, and 1.3 of the Commission's rules, 47 C.F.R. §§ 0.21, 0.241, and 1.3, and Sections 4(i), 302, 303(e), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 302, 303(e), and 303(r), IT IS ORDERED that the Request for Waiver filed by Massachusetts Institute of Technology, IS GRANTED, consistent with the terms of this Order. This action is effective upon release of this Order.

FEDERAL COMMUNICATIONS COMMISSION

Ronald T. Repasi  
Acting Chief, Office of Engineering and Technology