

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

In the Matter of )
)
Piper Networks Inc. Request for Waiver of Section ) ET Docket No. 19-246
15.519(a) and Section 15.519(a)(2) of the )
Commission's Rules

ORDER

Adopted: November 13, 2020

Released: November 13, 2020

By the Acting Chief, Office of Engineering and Technology:

I. INTRODUCTION

1. By this action, we grant a request by Piper Networks, Inc. (Piper) to waive both the introductory text of Sections 15.519(a) and 15.519(a)(2) of the Commission's rules to permit the certification and operation of Piper's ultrawideband (UWB) train positioning system in the 4243-4743 MHz frequency band in the greater New York City area and in Harris County, Texas. For the reasons discussed below, we find that there is good cause to grant Piper's request for waiver.

II. BACKGROUND

2. Piper's system, which it calls the Enhanced Transit Location System (ETLS), is designed for use on subways and commuter trains to calculate the position of a moving train and provide that information to the trains' communication-based train control system. The ETLS provides position information of trains but does not control them. It consists of three components — anchors, tags, and tag controllers. Anchors are installed along the wayside or tunnel perimeter walls of the train track as fixed infrastructure and use an UWB radio and a directional antenna to communicate at distances of 50 to 500 meters. Tags are mounted on the front and back of a train and are responsible for gathering ranging and distance information from the anchors. Tag controllers are installed onboard the train and act as the processing unit for ranging data to compute a train's location. The tag controllers also send and receive network data from within the train to the train's on-board computer, also called the vehicle on-board computer (VOBC).

3. On June 6, 2019, Piper filed a request for waiver of Sections 15.519(a)(2) and 15.250(c)-(d) of the Commission's rules to allow it to obtain equipment certification for the installation and operation of its ETLS. In its request, Piper stated that it was in the process of developing and testing ETLS to operate under the Part 15 UWB rules in the 3200-3700 MHz and 4243-4743 MHz bands, as well as under

1 Request by Piper Networks, Inc. for Waiver of Section 15.250(c)-(d), and 15.519(a) of the Commission's Rules, ET Docket 19-246 (filed Jun. 6, 2019) (Piper Waiver Request). Letter from Brain D. Weimer, Counsel to Piper Networks, Inc. to Marlene H. Dortch, Secretary, FCC, ET Docket No. 19-246 (filed Aug. 6, 2020) (Piper August 2020 Ex Parte). Also, Letter from Brain D. Weimer, Counsel to Piper Networks, Inc. to Marlene H. Dortch, Secretary, FCC, ET Docket No. 19-246 (filed Oct. 20, 2020) (Piper October 2020 Ex Parte).

2 Letter from Brain D. Weimer, Counsel to Piper Networks, Inc. to Marlene H. Dortch, Secretary, FCC, ET Docket No. 19-246 (filed Apr. 27, 2020) at attachment p. 5 (Piper April 2020 Ex Parte); Piper Waiver Request at 2-4.

3 Piper April 2020 Ex Parte at attachment, p. 2. Also, See Piper Waiver Request at 4-5.

the Part 15 wideband rules in the 6240-6740 MHz band.<sup>4</sup> However, once built, the ETLS deployment would require use of only one of these three frequency bands.<sup>5</sup> Piper subsequently narrowed its request to seek permission to operate only in the 4243-4743 MHz band, which eliminated its need for a waiver of Section 15.250 (c)-(d).<sup>6</sup> It further specified that it is seeking a waiver of Section 15.519(a).<sup>7</sup> Piper's system would be deployed on rail transit facilities in the greater New York City area, to include the states of New York, New Jersey, and Connecticut, in addition to Harris County, Texas.

4. Section 15.519(a), which applies to the 4243-4743 MHz band, requires UWB devices to be hand-held and not employ a fixed infrastructure. This section further prohibits the use of antennas mounted on outdoor infrastructure.<sup>8</sup> Because Piper plans to affix its devices to trains, tunnel walls, and short wayside structures, it seeks a waiver of this rule.

5. The Office of Engineering and Technology issued a Public Notice on September 3, 2019 seeking comment on Piper's request.<sup>9</sup> One party, Aviation Spectrum Resources Inc. (ASRI), filed comments and Piper filed reply comments. ASRI expressed concerns about potential interference from Piper's ETLS to aviation services, especially to radio altimeters operating in the 4200-4400 MHz band.<sup>10</sup> Its primary concern is the possibility of desensitization of radar altimeters resulting from a large scale UWB communication system deployed on outdoor infrastructure.<sup>11</sup> It argued that the information submitted by Piper was insufficient for assessing the potential impact on these systems and requested that Piper submit additional information on the ETLS.<sup>12</sup> Piper submitted additional information on its system, including measurement results, and Piper and ASRI subsequently reached an agreement on a number of technical and operational conditions on the ETLS that would alleviate ASRI's concerns about interference to radio altimeters.<sup>13</sup> Also, in a filing submitted after the comment deadline, Cisco and Hewlett Packard Enterprise objected to the Commission handling this and other waiver requests involving UWB applications on an ad-hoc basis, arguing that the issues raised are better resolved through a more comprehensive proceeding.<sup>14</sup>

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<sup>4</sup> Piper Waiver Request at 6.

<sup>5</sup> *Id.*

<sup>6</sup> Piper April 2020 *Ex Parte* at attachment, p.8. Section 15.250 governs use of the 5925-7250 GHz band.

<sup>7</sup> Piper August 2020 *Ex Parte*.

<sup>8</sup> 47 CFR §§ 15.519(a) and 15.519(a)(2).

<sup>9</sup> *Office of Engineering and Seeks Comment on Piper Networks Inc. Request for Waiver of Part 15 Rules for Enhanced Transit Locations System*, Public Notice, 34 FCC Rcd 7882 (OET 2018).

<sup>10</sup> ASRI Comments at 2.

<sup>11</sup> *Id.* at 4-5 (“The loss of sensitivity from raising the noise floor can degrade altimeter tracking performance during the most critical phases of flight, take-off and approach and landing”).

<sup>12</sup> *Id.* at 2.

<sup>13</sup> Letter from Brian D. Weimer, Counsel to Piper, and Edward A. Yorkgitis, Counsel of ASRI to Marlene H. Dortch, Secretary, FCC, ET Docket No. 19-246, at 3-4, (filed May 21, 2020) (Piper/ASRI *Ex Parte*). These conditions include requiring Piper radios to incorporate a detect-and-avoid function to protect radio altimeters, transmitter duty cycle and antenna beamwidth limits, limiting deployment to subways and commuter rail systems in the New York metropolitan area, and providing a point of contact in case interference occurs.

<sup>14</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).

### III. DISCUSSION

6. 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>15</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>16</sup> To make this public interest determination, the waiver cannot undermine the purpose of the rule, and there must be a stronger public interest benefit in granting the waiver than in applying the rule.<sup>17</sup>

7. We find that Piper’s ETLS promises to deliver strong public interest benefits. It will promote safety for railway passengers and personnel by helping prevent train-to-train collisions and identifying unauthorized train movements in work zones.<sup>18</sup> By making it easier for transit operators to place more trains into service, it will also promote the more efficient use of existing rail lines.<sup>19</sup> Furthermore, it will facilitate the deployment of communications-based safety systems on public transit and short rail train systems in a cost-effective manner.<sup>20</sup> Considering the importance of passenger rail safety and the potential for the Piper’s ETLS system to improve rail safety and efficiency, we find that there is a stronger public interest benefit in granting the waiver than in applying the rule.

8. In recognition that its ETLS will operate on an unlicensed basis and must accept interference that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator,<sup>21</sup> Piper has outlined the steps it will take to protect its system from potential interference. Specifically, Piper describes how it analyzes the radiofrequency environment before installation of its radios and uses real-time testing of installed equipment to adjust the location of wayside radios to avoid those areas where Piper’s radios might experience interference.<sup>22</sup> Further, it discusses the elements of its system design and operation that incorporate redundancy, prioritize safety, and mitigate the possibility of disruption due to interference from other radio sources after installation.<sup>23</sup> For example, UWB ranging occurs over multiple attempts to receive a signal from the moving train. This results in the ETLS being able to withstand nominal and short-term radiofrequency interference to its system without disrupting the

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<sup>15</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>16</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.

<sup>17</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>18</sup> Piper Waiver Request at 1-2.

<sup>19</sup> *Id.*

<sup>20</sup> *Id.*, identifying communication-based train control and positive train control applications. See also Piper April 2020 *Ex Parte* at attachment. The term “positive train control” is used to describe systems that are integrated command, control, communications, and information systems for controlling train movements with safety, security, precision, and efficiency. U.S. Department of Transportation, Federal Railroad Administration, *Positive Train Control (PTC) Information (R&D)*, <https://railroads.dot.gov/train-control/ptc/positive-train-control-ptc-information-rd>.

<sup>21</sup> 47 CFR § 15.5(b).

<sup>22</sup> Piper April 2020 *Ex Parte* at attachment, pp. 5-6.

<sup>23</sup> *Id.*

accuracy and reliability of its calculations. Piper further states that its radio also filters out-of-band interference which further eliminates interference in its operating channel.<sup>24</sup>

9. In addition, Piper points out that the possibility of interference to the ETLS does not create a potential safety hazard, as the system neither drives the train nor provides automated train control functionality. Although decisions for train movement take into account the data provided by ETLS, ultimate decisions will be made by a separate communication-based train control system. Piper states that the ETLS will not provide positioning data to the communication-based train control system when the ETLS is unable to make train positioning calculations.<sup>25</sup>

10. We also conclude that, with appropriate operational and technical restrictions to prevent harmful interference to authorized services, granting Piper's request for waiver does not undermine the purpose of the rules, i.e., to prevent harmful interference to authorized services. In adopting rules for handheld UWB devices, the Commission recognized that the greatest concerns of interference in the record centered on the potential for uncontrolled proliferation of these devices.<sup>26</sup> To address these concerns, the Commission established requirements for handheld devices that include in-band emission limits comparable to those permitted under Section 15.209 of the rules and out-of-band emission limits that are more stringent than those for other types of UWB devices.<sup>27</sup> It also permitted transmissions by handheld UWB devices only when they are in communication with an associated receiver and prohibited the use of handheld devices in fixed infrastructure.<sup>28</sup>

11. The Piper ETLS complies with the limits on in-band and out-of-band emissions, as well all other handheld UWB devices rules, with the exception of the requirements that devices must be handheld and may not be used in fixed infrastructure.<sup>29</sup> We find that the information that Piper supplied in its filings demonstrates that harmful interference to existing services is unlikely and addresses the concerns that ASRI initially raised. The anchors of the ETLS do not continuously transmit and do so only when a train is near the trackside anchor.<sup>30</sup> Further, the signals emitted by tags and anchors have a narrow beamwidth and are directionally focused down the track.<sup>31</sup> The directional nature of the antennas, and narrow antenna beamwidth greatly reduce the risk of interference to authorized services.<sup>32</sup> As noted by Piper, in order to receive harmful interference from Piper's system, a radio altimeter would have to be within 17 feet and positioned directly above a Piper radio, which is highly unlikely to occur in an urban

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<sup>24</sup> *Id.*

<sup>25</sup> *Id.*

<sup>26</sup> *Revision of Part 15 of the Commission Rules Regarding Ultra-Wideband Transmission Systems*, ET Docket No. 98-153, Report and Order, 17 FCC Rcd 7435, 7460, para. 67 (2002) (*2002 UWB R&O*).

<sup>27</sup> *Id.* at 7460, para. 67. Section 15.209 permits Part 15 intentional radiators to operate in most frequency bands, excluding certain designated restricted bands, at relatively low field strength levels. The limit above 960 MHz is 500 microvolts per meter, measured at a distance of 3 meters, which corresponds to an EIRP of -41.3 dBm. 47 CFR § 15.209(a).

<sup>28</sup> *2002 UWB R&O*, 17 FCC Rcd at 7460-7461, paras. 67-68.

<sup>29</sup> 47 CFR § 15.519(a).

<sup>30</sup> Piper April 2020 *Ex Parte* at attachment, p. 6 (stating that an anchor only emits a periodic status signal as a safety precaution to identify if another anchor in the vicinity is malfunctioning or dislocated from its intended position).

<sup>31</sup> *Id.* (tags and anchors have a beamwidth of 30 degrees or less).

<sup>32</sup> *Id.* at attachment, pp. 6-7.

area.<sup>33</sup> We also note that Piper and ASRI have agreed on a set of technical and operating conditions to minimize the likelihood of interference from the ETLS, and based on that agreement, ASRI does not oppose the waiver.<sup>34</sup> For these reasons, we agree that the likelihood harmful interference by ETLS to aviation services is extremely low.<sup>35</sup>

12. We do not believe that permitting the use of the ETLS in fixed infrastructure will result in an uncontrolled proliferation of these devices. The modules will be used only in limited types of locations along railroad rights-of-way, including inside tunnels, and will communicate only over short distances and for short time intervals. The devices will comply with the requirement that they transmit only when in communication with an associated receiver. Thus, their operation will be similar in nature to the short-range, peer-to-peer communication model envisioned by the Commission when it adopted the rules for handheld UWB devices.<sup>36</sup>

13. Finally, we find good cause to grant the Piper waiver request without first resolving the issues Cisco and Hewlett Packard have raised in their letter.<sup>37</sup> Piper's request is narrowly tailored, can be granted without raising the potential for causing harmful interference to authorized services, and can help realize important transit benefits that will serve the public interest. 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.

14. We emphasize that the terms of the waiver only allow for the use of Piper's equipment in the greater New York City area, and in Harris County, Texas. Operation in any other geographic area is not permitted. Should Piper, at a future date, choose to pursue the authority to operate on an expanded basis, through a waiver modification or the filling of a new waiver request, we would expect it to identify any reports of harmful interference that it had received during its operations to date, describe how such complaints were resolved, and propose any modifications to its operations or waiver terms that might be necessary to ensure that such situations would be unlikely to occur in the future.

15. In conclusion, we find that granting a waiver in this case will not undermine the policy which the introductory text of Section 15.519(a), and Section 15.519(a)(2) is designed to serve, is in public interest, and will not result in increased interference potential to the incumbent users of the bands so long as Piper operates its unlicensed UWB ETLS devices in accordance with the operational and technical restrictions listed below. Grant of this waiver is conditioned on the following:

- 1) Piper's ETLS devices shall be certified by a designated Telecommunication Certification Body.<sup>38</sup>
- 2) Each Piper ETLS radio located on the wayside of a rail line shall continuously monitor the RF environment for radio altimeter emissions from any radio altimeter operating within the 4200-4400 MHz range at a level of -53 dBm or higher, employing peak power, and measurement

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<sup>33</sup> *Id.* at attachment, p. 7. The analysis is based on International Telecommunications Union's Recommendation ITU-R M.2059-0; *See also* Piper April 2020 *Ex Parte* at attachment, p. 17 (Stating that in its estimation, this scenario is very unlikely, if not impossible, even in a heavily populated urban area such as New York City)

<sup>34</sup> Piper/ASRI *Ex Parte*.

<sup>35</sup> Piper April 2020 *Ex Parte* at attachment, pp. 5-6 (stating that Piper performs an installation test of in-band and out-of-band interference against all other radios in operation and completes an exhaustive analysis of the RF spectrum for the entire rail line during Piper's survey of the wayside's geography and geometry).

<sup>36</sup> 2002 UWB R&O, 17 FCC Rcd at 7460, para. 67.

<sup>37</sup> Cisco/HPE UWB Letter at 5-7.

<sup>38</sup> The filing for certification should include a copy of this waiver order.

bandwidth of 200 megahertz. If a Piper radio detects such an emission, then the radio shall automatically cease transmission within 300 microseconds.

- 3) Each Piper ETLIS radio shall have a maximum duty cycle of 5% per transmitter per second.
- 4) The sum of the transmitter off time shall be greater than 950 milliseconds per second. The sum of the transmitter on time shall be less than 18 seconds per hour.
- 5) Each Piper radio antenna shall transmit directionally down the tracks with the main beam below 30 degrees above the horizon; any transmissions at an elevation 30 degrees above the horizontal shall be reduced at least 6 dB from the main beam.
- 6) All ETLIS devices must comply with the out-of-band emission limits in Section 15.519(d).
- 7) Piper ETLIS devices shall be mounted no higher than 12 feet above the track surface.
- 8) The fixed infrastructure radios under the waiver shall be deployed only along the wayside of any subway or commuter rail line operated in New York, New Jersey, or Connecticut in the New York City Metropolitan Area, and in Harris County, Texas. Piper's radios deployed on a train shall only transmit outdoors while the train is moving or in a train yard for marshalling purposes.
- 9) Wireless communication between fixed infrastructure shall be limited to diagnostic information only. All available mitigation techniques should be used to minimize transmission time and duty cycle.
- 10) Piper shall provide and keep a record of the device locations (latitude and longitude) and a point of contact to the Commission and ASRI to resolve any interference complaints in a timely manner.

#### IV. ORDERING CLAUSES

16. Accordingly, pursuant to authority in Sections 0.31, 0.241, and 1.3 of the Commission's rules, 47 CFR §§ 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 Piper Networks, Inc IS GRANTED, consistent with the terms of this Order. This action is effective upon release of this Order.

17. IT IS FURTHER ORDERED that if no petitions for reconsiderations or applications for review are timely filed, this preceding SHALL BE TERMINATED, and ET DOCKET 19-246 IS CLOSED.

FEDERAL COMMUNICATIONS COMMISSION

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