

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

In the Matter of )
Amendment of Parts 2 and 25 of the ) IB Docket No. 17-95
Commission's Rules to Facilitate the Use of Earth )
Stations in Motion Communicating with )
Geostationary Orbit Space Stations in Frequency )
Bands Allocated to the Fixed Satellite Service )
and )
Facilitating the Communications of Earth Stations ) IB Docket No. 18-315
in Motion with Non-Geostationary Orbit Space )
Stations )

SECOND REPORT AND ORDER IN IB DOCKET NO. 17-95 AND
REPORT AND ORDER IN IB DOCKET NO. 18-315 AND
FURTHER NOTICE OF PROPOSED RULEMAKING

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## I. INTRODUCTION

1. In this *Second Report and Order in IB Docket No. 17-95* and *Report and Order in IB Docket No. 18-315 (Report and Order)* and *Further Notice of Proposed Rulemaking (Further Notice)*, the Commission continues to facilitate the deployment of, and reduce the regulatory burdens on, Earth Stations in Motion (ESIMs).<sup>1</sup> First, we allow ESIMs to communicate in additional frequency bands with geostationary-satellite orbit (GSO) satellites operating in bands allocated to the fixed-satellite service (FSS). Second, we adopt rules for ESIMs to communicate with non-geostationary orbit (NGSO) satellites in specific frequency bands allocated to the FSS. Finally, we seek to further develop the record regarding potential interference from out-of-band emissions of ESIMs in the 28.35-28.6 GHz band into the adjacent 27.5-28.35 GHz band used by Upper Microwave Flexible Use Service (UMFUS). These actions will promote innovative and flexible use of satellite technology, as well as provide regulatory equity between GSO and NGSO FSS systems.

## II. BACKGROUND

2. Although FSS traditionally involves communications between satellites in orbit and earth stations in fixed locations, the growing demand for broadband communications to vessels, land vehicles, and aircraft has resulted in increased use of FSS for mobility applications.<sup>2</sup> ESIMs enable the provision of very high data rate broadband communications, navigation, situational awareness, and other services to mobile platforms that often cannot be served using other communications technologies.<sup>3</sup> Licensees use ESIMs to deliver broadband to ships, vehicles, trains, and aircraft using the same frequency bands, hardware, satellites, transponder beams, and control stations used to serve earth stations at fixed locations.<sup>4</sup>

3. In September 2018, the Commission adopted rules governing communications of ESIMs

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<sup>1</sup> The term “ESIMs” is the collective designation for three types of earth stations that the Commission authorizes to transmit while in motion: Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs), and Earth Stations Aboard Aircraft (ESAAs) to communicate with space stations using frequencies allocated to the fixed satellite service. Broadly stated, Earth Stations on Vessels refers to earth stations that communicate with a satellite while located on maritime vessels such as boats, cargo ships or cruise ships, whereas Vehicle-Mounted Earth Stations and Earth Stations Aboard Aircraft refer to earth stations that communicate with satellites while located on land-based vehicles or aircraft, respectively.

<sup>2</sup> A detailed account of the regulatory changes that permitted the increased use of FSS for mobility applications has been set forth previously in this proceeding and is not repeated here. See *Amendment of Parts 2 and 25 of the Commission’s Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed-Satellite Service*, Notice of Proposed Rulemaking, 32 FCC Rcd 4239, 4241-42, paras. 3-6 (2017) (*GSO ESIMs NPRM*).

<sup>3</sup> *Amendment of Parts 2 and 25 of the Commission’s Rules to Facilitate the Use of Earth Stations in Motion Communicating with Non-Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed-Satellite Service*, Notice of Proposed Rulemaking, 33 FCC Rcd 11416, para. 2 (rel. Nov. 16, 2018) (*NGSO ESIMs NPRM*).

<sup>4</sup> *Id.* at 11416-17, para. 2.

with GSO satellites.<sup>5</sup> These rules addressed communications in the conventional C-, Ku-, and Ka-bands, as well as portions of the extended Ku-band.<sup>6</sup> At the same time, the Commission sought comment on allowing ESIMs to operate in all of the frequency bands in which earth stations at fixed locations operating in GSO FSS satellite networks can be blanket-licensed, including the following frequency bands: 10.7-10.95 GHz, 11.2-11.45 GHz, 17.8-18.3 GHz, 18.8-19.3 GHz, 19.3-19.4 GHz, 19.6-19.7 GHz (space-to-Earth); and 28.6-29.1 GHz (Earth-to-space).<sup>7</sup>

4. In November 2018, the Commission adopted a Notice of Proposed Rulemaking that sought comment on expanding the scope of the Commission's rules governing ESIMs operations to cover communications with NGSO FSS satellites.<sup>8</sup> Comment was sought on establishing a regulatory framework for communications of ESIMs with NGSO FSS satellites that would be analogous to that which exists for ESIMs communicating with GSO FSS satellites. In response to both the *GSO ESIMs FNPRM* and the aforementioned *NGSO ESIMs NPRM*, the Commission received many comments and reply comments.<sup>9</sup>

### III. SECOND REPORT AND ORDER AND REPORT AND ORDER

5. Because of the interrelated nature of the two proceedings, we address both proceedings in here. In the discussion below, we first address the addition of frequency bands in which ESIMs can communicate with GSO FSS satellites. Specifically, we adopt our proposal to allow ESIMs to operate in all of the frequency bands in which earth stations at fixed locations operating with GSO FSS satellite networks can be blanket-licensed, and to allow ESIMs to receive signals from GSO FSS satellite space stations in the Ka-band, with some restrictions. We then address the issues raised in the *NGSO ESIMs NPRM*, and adopt a regulatory framework for ESIMs communications with NGSO FSS systems that is analogous to that which currently exists for ESIMs communicating with GSO FSS systems, with the exception of the frequency bands 18.6-18.8 GHz, 28.35-28.4 GHz, and 29.25-29.5 GHz. We also extend blanket earth station licensing to ESIMs communicating with NGSO FSS systems. We defer consideration of our proposal to allow ESIMs to operate in the 28.35-28.4 GHz band while we study the potential interference from out-of-band emissions of ESIMs into the adjacent 27.5-28.35 GHz band.

#### A. ESIMs Communications with GSO Satellites in Additional Frequency Bands (IB Docket No. 17-95)

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<sup>5</sup> See *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, Report and Order and Further Notice of Proposed Rulemaking, 33 FCC Rcd 9327 (2018) (*GSO ESIMs Report & Order and FNPRM*, or, when referring solely to the further notice, *GSO ESIMs FNPRM*).

<sup>6</sup> *Id.* at 9328-29, paras. 3-5. The conventional C-band refers to the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) FSS frequency bands. The conventional Ku-band refers to the 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 (Earth-to-space) FSS frequency bands, and the extended Ku-band refers to the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), and 13.75-14.0 GHz (Earth-to-space) FSS frequency bands. The conventional Ka-band refers to the 18.3-18.8 GHz and 19.7-20.2 GHz (space-to-Earth), and 28.35-28.6 GHz and 29.25-30.0 GHz (Earth-to-space) frequency bands. 47 CFR § 25.103.

<sup>7</sup> *GSO ESIMs FNPRM*, 33 FCC Rcd at 9358, para. 91. In addition, at the World Radiocommunication Conference 2019 (WRC-19), the ITU added an international footnote to the Radio Regulations (provisionally numbered as footnote 5.A15), to permit ESIMs communicating with GSO FSS to operate in the 17.7-19.7 GHz and 27.5-29.5 GHz bands. The footnote states that: "The operation of earth stations in motion communicating with geostationary fixed-satellite service space stations within the frequency bands 17.7-19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) shall be subject to the application of Resolution COM5/6 (WRC-19)." See *Provisional Final Acts WRC-19* at 41, 415-422 ([itu.int/pub/R-ACT-WRC.13-2019/en](http://itu.int/pub/R-ACT-WRC.13-2019/en)).

<sup>8</sup> *NGSO ESIMs NPRM*, 33 FCC Rcd 11416.

<sup>9</sup> The parties providing comments and reply comments in both proceedings are listed in Appendix A.

6. In the *GSO ESIMs FNPRM*, the Commission sought comment on allowing ESIMs to operate in all of the frequency bands in which earth stations at fixed locations operating in GSO FSS satellite networks can be blanket-licensed. The Commission believed in this situation operation of earth stations in motion should not introduce a material change to the interference environment created or to the protection required.<sup>10</sup> Many commenters support these changes and no commenters opposed.<sup>11</sup> Boeing points out that among other benefits, the use of many of these frequencies by ESIMs will help to align the FSS frequencies that are available for use by ESIMs in different regions of the world, and that this alignment is important because many ESIMs—including those on airplanes and ships—do not limit their operations to single continents.<sup>12</sup> SES, O3b, and Intelsat note that expanding the frequencies available for GSO ESIM networks will allow more intensive spectrum use and is fully consistent with other authorized operations in these frequency bands.<sup>13</sup>

7. We agree that, for the reasons stated by commenters, the public interest is served by the addition of frequency bands in which ESIMs are allowed to communicate with GSO FSS satellites. We address the individual frequency bands in turn below. We then address general issues that are not specific to any particular frequency band.

### 1. The Extended Ku-band

8. The Commission sought comment on expanding the Ku-band frequency ranges in which ESIMs can be authorized to receive transmissions from GSO FSS satellites<sup>14</sup> to include the 10.7-10.95 GHz and 11.2-11.45 GHz bands.<sup>15</sup> These frequency bands are allocated on a co-primary basis to the fixed service and FSS (space-to-Earth), but GSO FSS use of both bands is limited to international systems (that is, to communications that do not originate and terminate within the United States).<sup>16</sup> The Commission noted, however, that in the 10.95-11.2 GHz (space-to-Earth) and 11.45-11.7 GHz (space-to-Earth) bands, communications of ESIMs with GSO satellites is allowed subject to the condition that these earth stations may not claim protection from transmissions of non-Federal fixed service stations.<sup>17</sup> The Commission requested comment on whether communications in the 10.7-10.95 GHz and 11.2-11.45 GHz (space-to-Earth) bands could also be allowed on an unprotected basis with respect to other services.<sup>18</sup>

9. Satellite operators overwhelmingly support allowing ESIMs to receive transmissions from GSO FSS satellites on an unprotected basis in these bands.<sup>19</sup> Commenters state that, because ESIMs operations are receive-only in the 10.7-10.95 GHz and 11.2-11.45 GHz bands, allowing ESIMs to operate in these frequency bands does “not increase the potential for harmful interference” to other spectrum

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<sup>10</sup> *GSO ESIMs FNPRM*, 33 FCC Rcd at 9358, para. 91.

<sup>11</sup> See, e.g., Boeing FNPRM Comments at 1; Hughes FNPRM Comments at 2; Inmarsat FNPRM Comments at 2.

<sup>12</sup> See Boeing FNPRM Comments at 3.

<sup>13</sup> SES, O3b and Intelsat FNPRM Reply Comments at 1-2.

<sup>14</sup> See 47 CFR § 2.106, NG527A.

<sup>15</sup> See *GSO ESIMs FNPRM*, 33 FCC Rcd at 9354, para. 90. As we noted in the *FNPRM*, the Commission’s part 25 rules currently allow for blanket licensing in the 10.7-10.95 GHz, 11.2-11.45 GHz, and 17.8-18.3 GHz (space-to-Earth) on an unprotected basis with respect to the fixed service.

<sup>16</sup> 47 CFR § 2.106, NG52 (“Except as provided for by NG527A, use of the bands 10.7-11.7 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space) by geostationary satellites in the [FSS] shall be limited to international systems, *i.e.*, other than domestic systems.”).

<sup>17</sup> 47 CFR § 2.106, NG527A. See also *GSO ESIMs FNPRM*, 33 FCC Rcd at 9340, para. 44.

<sup>18</sup> *GSO ESIMs FNPRM*, 33 FCC Rcd at 9355, para. 91.

<sup>19</sup> See, e.g., Boeing FNPRM Comments at 2-3; Hughes FNPRM Comments at 2-3; SES FNPRM Comments at 1-2; Viasat FNPRM Comments at 1, 3.

users.<sup>20</sup> In addition, they state that because ESIMs operate on mobile platforms (that is, in aeronautical, maritime and land-mobility applications) and often far from other co-frequency systems and services (for example, aircraft in flight or vessels in international waters), there is no need to protect ESIMs reception in these bands.<sup>21</sup> Commenters also assert that access to additional ESIM receive spectrum would enhance flexibility, data rates, and aggregate capacity for ESIM operators and consumers.<sup>22</sup>

10. Based on the record, including the lack of opposition to this proposal, we will allow communications from GSO FSS satellites to ESIMs in the 10.7-10.95 GHz and 11.2-11.45 GHz (space-to-Earth) bands on an unprotected basis vis-à-vis fixed service stations. We agree that ESIMs can receive transmissions from GSO FSS satellites in the 10.7-10.95 GHz and 11.2-11.45 GHz bands without requiring protection from fixed service stations that have primary status in these bands.<sup>23</sup> The Fixed Wireless Communications Coalition (FWCC) asks the Commission to clarify that fixed service will not be required to protect ESIMs in the 10.7-10.95 GHz and 11.2-11.45 GHz (space-to-Earth) bands from interference.<sup>24</sup> We so clarify. Accordingly, we amend footnote NG527A to include 10.7-10.95 GHz and 11.2-11.45 GHz (space-to-Earth) in the frequency bands in which ESIMs may be authorized to communicate with GSO satellites, subject to the condition that ESIMs may not claim protection from transmissions of non-Federal fixed service stations.<sup>25</sup> In addition, CORF notes that radio astronomers make important observations in the 10.6-10.7 GHz band,<sup>26</sup> and that the U.S. Table requires operators to protect radio astronomy service from satellite downlinks emissions into the 10.68-10.70 GHz portion of the band.<sup>27</sup> Footnotes to the U.S. Table already provide such protections,<sup>28</sup> and satellite licenses and grants of U.S. market access are issued by the Commission subject to such footnotes. Accordingly, no additional action is necessary.

## 2. The Ka-band

11. The Commission sought comment on allowing ESIMs to receive signals from GSO FSS satellites on a secondary basis in the 17.8-18.3 GHz (space-to-Earth) band and on a primary basis in the 19.3-19.4 GHz (space-to-Earth) and 19.6-19.7 GHz (space-to-Earth) bands.<sup>29</sup> The Commission also requested comment on whether to allow ESIMs to communicate with GSO FSS satellites in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands on an unprotected, non-interference basis with respect to NGSO FSS satellite systems.<sup>30</sup> It sought comment on any possible effects these proposals may have on existing or future services in these frequency bands or adjacent frequency bands

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<sup>20</sup> Panasonic FNPRM Comments at 2; *see also* Boeing FNPRM Comments at 3.

<sup>21</sup> *Id.*

<sup>22</sup> Panasonic FNPRM Comments at 2; *see also* Boeing FNPRM Comments at 3; SES FNPRM Comments at 2; Viasat FNPRM Comments at 3-4.

<sup>23</sup> GSO FSS downlink transmissions are already permitted in these frequency bands, subject to power flux density limit designed to protect fixed service stations from unacceptable interference. *See* International Telecommunication Union (ITU) Article 21.

<sup>24</sup> FWCC FNPRM Comments at 1-2.

<sup>25</sup> *See* Appendix B, 47 CFR § 2.106, NG572A(a).

<sup>26</sup> Although on page 7 of its FNPRM Comments CORF mentions 10.6-11.7 GHz, it is clear from the context that their intention was to reference the 10.6-10.7 GHz band which has a primary allocation to the Radio Astronomy Services. 47 CFR § 2.106.

<sup>27</sup> CORF FNPRM Comments at 7.

<sup>28</sup> *See, e.g.*, 47 CFR § 2.106, US211 and US246.

<sup>29</sup> *GSO ESIMs FNPRM*, 33 FCC Rcd at 9355, para. 91.

<sup>30</sup> *Id.*

and on any necessary changes to our rules that may be appropriate to accommodate them.<sup>31</sup>

12. We address each of these frequency bands in turn below. Specifically, we will allow ESIMs to receive signals from GSO FSS space stations on a secondary basis in the 17.8-18.3 GHz band and on a primary basis in the 19.3-19.4 and 19.6-19.7 GHz band. We will also allow ESIMs to operate with GSO FSS satellite networks in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands on an unprotected, non-interference basis with respect to NGSO FSS satellite systems.

13. *17.8-18.3 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz.*—Commenters observe that satellite space-to-Earth transmissions in the 17.8-18.3 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz bands are already subject to power flux density limits designed to protect terrestrial systems,<sup>32</sup> and reception of satellite signals by ESIMs has no effect on these power flux density levels set forth in the Commission's rules.<sup>33</sup> Satellite operators therefore state that ESIMs can co-exist with terrestrial fixed service operations in these bands.<sup>34</sup> Commenters also point out that the authorization of ESIMs to receive signals from GSO networks in the 17.8-18.3 GHz band will help to align the frequencies available to ESIMs in the United States with those that are available in the rest of the world.<sup>35</sup> In addition, ESIMs communications with GSO FSS satellites in these bands will be required to be coordinated with Federal FSS systems pursuant to the U.S. Table.<sup>36</sup> No commenters disagree with allowing ESIMs to receive signals from GSO FSS satellites in these bands.

14. We proposed allowing ESIMs to receive signals from GSO FSS satellites in the 17.8-18.3 GHz (space-to-Earth) band on a secondary basis. FSS is allocated in the space-to-Earth direction on a secondary basis to the fixed service in the 17.8-18.3 GHz band and no parties objected to our proposal. Thus, we add NG527A(d) in the U.S. Table of Allocations to allow ESIMs to receive signals from GSO FSS satellites in the 17.8-18.3 GHz (space-to-Earth) band on a secondary basis.

15. Further, we proposed allowing ESIMs to receive signals from GSO FSS satellites in the 19.3-19.4 GHz (space-to-Earth) and 19.6-19.7 GHz (space-to-Earth) bands on a co-primary basis with fixed service and Federal FSS. However, given the difficulties with coordinating ESIM operations with terrestrial stations, we conclude here, as proposed by FWCC,<sup>37</sup> that in the 19.3-19.4 GHz (space-to-Earth) and 19.6-19.7 GHz (space-to-Earth) bands, ESIMs should be allowed to operate on an unprotected basis with regard to fixed service and Federal FSS. Allowing such ESIM operations will not change the existing interference environment in these bands. FSS is already allocated in the space-to-Earth direction on a co-primary basis with fixed service in the 19.3-19.4 GHz and 19.6-19.7 GHz bands subject to power flux density limits designed to protect terrestrial systems. Accordingly, we revise NG527A(a) in the U.S.

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<sup>31</sup> *Id.*

<sup>32</sup> 47 CFR § 25.208(c).

<sup>33</sup> SES FNPRM Reply Comments at 2; *see also* Boeing FNPRM Comments at 3 (stating that the existence of ESIMs in these frequencies will not interfere with fixed service networks because they will continue to be protected by the power flux density limits on satellite downlink communications that are maintained by the ITU to protect primary terrestrial uses of the 17.7-18.3 GHz frequencies).

<sup>34</sup> SES FNPRM Comments at 2; Inmarsat FNPRM Comments at 2-3; Viasat FNPRM Comments at 3-4. *See also* Boeing FNPRM Comments at 4-5 (stating that ESIMs experiencing interference can either shift to a different receiving frequency or can move to a new location where the interference does not exist; further, given the relatively high speeds in which many ESIMs will be in motion, any unacceptable interference received from fixed service transmitters will only be momentary in duration and likely result in no detectable interference to the ESIM end user's services).

<sup>35</sup> Boeing FNPRM Comments at 4.

<sup>36</sup> 47 CFR § 2.106, US334.

<sup>37</sup> *See* FWCC Comments at 1, 3.

Table of Allocations to allow ESIMs to receive signals from GSO FSS satellites in the 19.3-19.4 GHz (space-to-Earth), and 19.6-19.7 GHz (space-to-Earth) bands on an unprotected basis.

16. *18.8-19.3 GHz and 28.6-29.1 GHz.*—The record supports a finding that allowing ESIMs to communicate with GSO FSS satellites in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands serves the public interest. Viasat asserts that such a change can expedite consumer access to mobile applications of satellite broadband services technologies.<sup>38</sup> Boeing believes that ESIMs communicating with GSO and NGSO satellites in these bands could complement each other by providing very robust coverage and throughput to end users using a combination of NGSO and GSO satellites.<sup>39</sup>

17. We find that it is possible with a high degree of coordination among operators for ESIMs to communicate with GSO FSS satellites in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands without causing interference to NGSO FSS systems. Inmarsat, for example, states that “[t]echniques for managing interference between FSS systems are well understood” and the “introduction of ESIMs into FSS spectrum does not materially change these interference scenarios.”<sup>40</sup> ViaSat concurs, asserting that “[i]t is well-established that ESIMs can perform within the same technical envelope as fixed earth stations through highly accurate antenna pointing mechanisms and compliance with appropriate power limits” and “[t]herefore, in the 18.8-19.3 GHz and 28.6-29.1 GHz (Earth-to-space) bands, where the Commission has determined that the GSO FSS successfully can operate on a secondary basis to the NGSO FSS, adding ESIMs would not change this conclusion.”<sup>41</sup>

18. We agree with these commenters that it is technically feasible for ESIMs to communicate with GSO FSS space stations in these bands without causing interference to NGSO FSS systems provided the operators coordinate their operations. GSO earth stations transmitting to a GSO space station would have to stop transmissions whenever an NGSO space station using the same frequency band is within the earth station transmitting beam. Similarly, during transmissions from GSO space stations, GSO space station operators will need to take into account the presence of a beam through which an earth station is receiving co-frequency signals from an NGSO space stations. Such co-existence will necessitate a high degree of coordination between the GSO and NGSO systems to ensure interference does not result to NGSO FSS operations and, when authorizing ESIMs to communicate with GSO FSS satellites in these bands, the secondary nature of such communications will need to be fully taken into account.<sup>42</sup>

19. We agree with Boeing that the priority of NGSO FSS systems in these frequencies is critical to their growth and operation.<sup>43</sup> As explained by Telesat, the demand for “mobile aeronautical, maritime and land services is one of the key drivers of the burgeoning NGSO demand for this spectrum.”<sup>44</sup> While recognizing that it would be inequitable to alter the regulatory status between NGSO and GSO FSS systems in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) frequency bands, allowing communications between ESIMs and GSO FSS satellites in these frequency bands on an unprotected, non-interference basis with respect to NGSO FSS satellite systems leads to

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<sup>38</sup> Viasat FNPRM Comments at 2.

<sup>39</sup> Boeing FNPRM Reply Comments at 4.

<sup>40</sup> Inmarsat FNPRM Comments at 3.

<sup>41</sup> Viasat FNPRM Comments at 3.

<sup>42</sup> The Commission has been requiring that, in these bands, GSO operations with fixed earth stations must accept interference from and not cause harmful interference to NGSO operations. *See, e.g.* Satellite Policy Branch Information Action Taken, Report No. 01258 (IBFS File No. SAT-LOA-20160624-00061) Aug. 4, 2017, Jupiter 2 Grant at condition 5. A similar condition would be imposed on ESIMs operations. Operations with ESIMs are no different, as ESIMs are supposed to operate as a fixed earth station that can be anywhere within the satellite beam.

<sup>43</sup> Boeing FNPRM Reply Comments at 5.

<sup>44</sup> Telesat FNPRM Reply Comment at 3.

more efficient use of spectrum without imposing a burden on NGSO FSS operations in this band.<sup>45</sup> The GSO system, operating on a non-interference, non-protected basis, is expected to show, to the NGSO system satisfaction, that it is capable of protecting the NGSO's operation. The only burden on the NGSO system is to examine the GSO showing in good faith to determine its acceptability.

20. Accordingly, we will allow ESIMs to communicate with GSO FSS satellites in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands on an unprotected, non-interference basis with respect to NGSO FSS satellite systems.<sup>46</sup> Both these bands are allocated to FSS on a primary basis, but GSO FSS operations are conducted on an unprotected, non-interference basis with respect to NGSO FSS.<sup>47</sup> We find that the record supports allowing ESIMs to communicate with GSO FSS satellites in these bands, consistent with the existing status of GSO FSS vis-à-vis NGSO FSS.

### 3. General Issues

21. The Commission sought comment on any possible effects that expanding the frequencies available to ESIMs communicating with GSO FSS satellite networks may have on other services in these frequency bands or adjacent frequency bands in the United States.<sup>48</sup> National Academy of Sciences' Committee on Radio Frequencies (CORF) expresses concern about other services and adjacent bands.<sup>49</sup> In addition, Boeing proposes that consideration be given to opening the 19.4-19.6 GHz band to both GSO and NGSO FSS systems, including those operating with ESIMs.<sup>50</sup>

22. CORF expresses concerns regarding potential interference to protected passive scientific observations caused by GSO FSS downlink transmissions to ESIMs.<sup>51</sup> Specifically, CORF is concerned that the reception of GSO FSS satellite signals by ESIMs in the 10.7-10.95 GHz, 17.8-18.3 GHz, 18.8-19.3 GHz (space-to-Earth), and 19.6-19.7 GHz (space-to-Earth) bands, which, CORF asserts, could result in additional interference to Earth exploration-satellite service systems and radio astronomy service operating in adjacent frequencies. CORF advocates for more stringent out-of-band emissions limits for GSO FSS satellite signals that would be received by ESIMs using the 10.7-10.95 GHz band.<sup>52</sup> CORF also suggests that the Commission prohibit the reception of satellite signals by ESIMs in the bottom 25

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<sup>45</sup> Boeing FNPRM Comments at 6-8 (asking the Commission to be diligent in ensuring the subordinate status of GSO FSS networks vis-a-vis NGSO FSS operations); SES FNPRM Comments at 2 (stating that SES supports allowing GSO ESIM use of these frequency bands, provided that the Commission adopts its proposal to specify that GSO operations in the band segments are "on an unprotected, non-interference basis with respect to NGSO FSS satellite systems" to ensure NGSO use of these critical frequencies is not impaired). As discussed below, we reject Echostar's proposal to give equal status to ESIMs operating with GSO and NGSO space stations as this would contradict the secondary designation of GSO systems in these bands. *See infra* paras. 32-33.

<sup>46</sup> *See* Appendix B (where a reference to footnote NG527A has been added to the 18.8-19.3 GHz band in the non-Federal Table and where the text of footnote NG527A has been revised accordingly).

<sup>47</sup> 47 CFR § 2.106, NG165 (stating, "In the bands 18.8-19.3 GHz and 28.6-29.1 GHz, geostationary-satellite networks in the fixed-satellite service shall not cause harmful interference to, or claim protection from, non-geostationary-satellite systems in the fixed-satellite service.").

<sup>48</sup> *ESIMs GSO FSS FNPRM*, 32 FCC Rcd at 9354, para. 90.

<sup>49</sup> *See generally* CORF FNPRM Comments. The FWCC's concerns were previously addressed in the discussion on the individual frequency bands.

<sup>50</sup> Boeing FNPRM Reply Comments.

<sup>51</sup> *See generally* CORF FNPRM Comments.

<sup>52</sup> CORF FNPRM Comments at 8.



megahertz portion of the 10.7-10.95 GHz band in order to create a guard band to further protect scientific monitoring by Earth exploration-satellite service systems.<sup>53</sup>

23. We decline to adopt new limits on out-of-band emissions or prohibitions on GSO FSS downlink use in this proceeding. References to ESIMs communications with GSO FSS satellites as “ESIM downlinks” are inaccurate, and concerns regarding the difficulty of addressing interference from “moving targets” are misplaced, because the only transmissions in the frequency ranges discussed by CORF will be from GSO satellites, not from ESIM terminals.<sup>54</sup> Accordingly, CORF concerns are not with ESIMs, which solely receive in the frequency bands that CORF identified as being of concern, but rather with the space-to-Earth transmissions of GSO FSS satellites, which are not the subject of this rulemaking. In this respect, we note that the Commission’s rules already impose specific limits on out of band emissions in the frequency bands and services at issue here.<sup>55</sup> Possible revisions to these limits are the subject of a separate rulemaking.<sup>56</sup> In addition, as mentioned above, protection of radio astronomy service observations is also ensured through specific footnotes to the U.S. Table of Allocations.<sup>57</sup>

24. Additionally, CORF expresses concern about the use of the 18.6-18.8 GHz (space-to-Earth) band, which was not proposed as an additional frequency band for communications of ESIMs with NGSO FSS satellites.<sup>58</sup> This band is allocated for passive scientific observation use on a co-primary basis with GSO FSS in the space-to-Earth direction, with GSO FSS downlinks subject to power flux density limits designed to protect other authorized spectrum users.<sup>59</sup> Specifically, CORF states that any new use by ESIMs in these frequency bands should be mindful of the need to preserve the extensive existing scientific use of the 18.6-18.8 GHz (space-to-Earth) band.<sup>60</sup> The Commission has previously concurred with this need,<sup>61</sup> and no further action is appropriate because the 18.6-18.8 GHz band is not one of the additional frequency bands included in this proceeding.<sup>62</sup>

25. Boeing proposes to open the 19.4-19.6 GHz band to both GSO and NGSO FSS systems, including those operating with ESIMs, on a secondary basis with respect to feeder links to NGSO MSS space stations operating in these frequencies.<sup>63</sup> Boeing argues that GSO and NGSO FSS systems are already permitted to operate below 19.4 GHz and above 19.6 GHz, so the reception of these transmissions by ESIMs will not alter the spectrum sharing conditions.<sup>64</sup> We disagree. As Iridium accurately notes, the Ka-band plan and U.S. Table of Frequency Allocations prohibit any earth station—fixed, in motion, individually-licensed, or blanket-licensed—from communicating with an FSS space station in this

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<sup>53</sup> CORF FNPRM Comments at 9.

<sup>54</sup> SES FNPRM Reply Comments at 2-3.

<sup>55</sup> 47 CFR § 25.202(f).

<sup>56</sup> *Further Streamlining Part 25 Rules Governing Satellite Services*, Notice of Proposed Rulemaking, 33 FCC Rcd 11502, 11507-08, paras. 18-19 (rel. Nov. 19, 2018) (*2018 Part 25 Further Streamlining Notice*).

<sup>57</sup> 47 CFR § 2.106, US211 and US246.

<sup>58</sup> *See generally* CORF FNPRM Comments.

<sup>59</sup> 47 CFR § 2.106, US255.

<sup>60</sup> CORF FNPRM Comments at 10.

<sup>61</sup> *GSO ESIMs Report & Order and FNPRM*, 33 FCC Rcd at 9347-48, para. 63.

<sup>62</sup> We note that GSO FSS space-to-Earth operations are already subject to prior coordination with Federal users in this band pursuant to footnote US334 to the U.S. Table. 47 CFR § 2.106, US334.

<sup>63</sup> Boeing FNPRM Comments at 5-6.

<sup>64</sup> *Id.* at 6.

frequency band.<sup>65</sup> Further, Iridium points out that this proposal is beyond the scope of the current rulemaking.<sup>66</sup> We agree with Iridium, and find that this proceeding is not the appropriate forum to address Boeing's proposal.

**B. Regulatory Framework for Communications of ESIMs With NGSO Satellites (IB Docket No. 18-315)**

26. In the *ESIMs NGSO NPRM*, the Commission sought comment on allowing ESIMs to communicate with NGSO FSS satellites in the 11.7-12.2 GHz (space-to-Earth); 14.0-14.5 GHz (Earth-to-space); 18.3-18.6 GHz (space-to-Earth); 19.7-20.2 GHz (space-to-Earth); 28.35-28.6 GHz (Earth-to-space); and 29.5-30.0 GHz (Earth-to-space) bands, as well as the 18.8-19.3 GHz (space-to-Earth), and the 28.6-29.1 GHz (Earth-to-space) bands, the 10.7-11.7 GHz (space-to-Earth) bands, the 17.8-18.3 GHz (space-to-Earth) band, and the 19.3-19.4 GHz and 19.6-19.7 GHz (space-to-Earth) bands,<sup>67</sup> which encompass most of the same conventional Ku-band, extended Ku-band, and Ka-band frequencies that were allowed or proposed for communications of ESIMs with GSO FSS satellites.<sup>68</sup> Second, the Commission sought comment on extending blanket earth station licensing, which is available to ESIMs communicating with GSO FSS satellites, to ESIMs communicating with NGSO FSS satellites in frequency bands in which NGSO FSS systems have a primary status, or have been found to be able to operate on a secondary or non-conforming basis, without causing interference to primary users of the bands.<sup>69</sup> Finally, the Commission sought comment on revisions to specific rule provisions to implement these changes.<sup>70</sup>

27. As a general matter, we conclude that the public interest is served by adopting a regulatory framework for communications of ESIMs with NGSO FSS satellites that is analogous to that which exists for ESIMs communicating with GSO FSS satellites and offers a similar streamlined path to deployment. Given the growing number of NGSO FSS entities that propose to provide service to earth stations at fixed locations as well as to ESIMs,<sup>71</sup> it is important to have streamlined rules in place for NGSO ESIMs operations, both for parity among ESIM operators and regulatory certainty for potential

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<sup>65</sup> Iridium FNPRM Reply Comments at 1-2.

<sup>66</sup> *Id.* at 2-3.

<sup>67</sup> FSS operation in the 18.6-18.8 GHz band is limited to communications with GSO space stations. 47 CFR § 2.106 NG164. Transmissions to NGSO space stations in the 29.25-29.5 GHz band are limited to feeder links to MSS space stations. See 47 CFR § 2.106 NG535A. Thus, the frequency bands 18.6-18.8 GHz (space-to-Earth) and 29.25-29.5 GHz (Earth-to-space) were not included in the proposed bands for ESIMs NGSO FSS operations.

<sup>68</sup> *NGSO ESIMs NPRM*, 33 FCC Rcd at 11418-19, para. 7; *ESIMs Report and Order and Further Notice*, 32 FCC Rcd at Appendix F (proposing frequencies available for ESIMs in a revision to section 25.202(a)(10)).

<sup>69</sup> *NGSO ESIMs NPRM*, 33 FCC Rcd at 11420, para. 15.

<sup>70</sup> The Commission did not seek comment on, and we do not address here, the operations of traditional NGSO satellite constellations offering mobile-satellite service (MSS), such as those operated by Iridium LLC, Globalstar, Inc., or ORBCOMM License Corp.

<sup>71</sup> During the preceding years, licenses or grants of U.S. market access have been given to a number of NGSO FSS satellite providers. See, e.g., *O3b Limited, Request for Modification of U.S. Market Access for O3b Limited's Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile-Satellite Service*, Order and Declaratory Ruling, 33 FCC Rcd. 5508 (2018); *Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System*, Memorandum Opinion, Order and Authorization, 33 FCC Rcd 3391 (2018); *Telesat Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation*, Order and Declaratory Ruling, 32 FCC Rcd. 9663 (2017); *WorldVu Satellites Limited, Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017).

operators.<sup>72</sup> Doing so will facilitate the spread of accessible, broadband mobility services;<sup>73</sup> promote global spectrum harmonization, allow customers to take advantage of seamless connectivity;<sup>74</sup> increase investment in NGSO FSS capacity that can serve remote and rural areas and provide restoration if terrestrial networks are damaged due to natural disasters;<sup>75</sup> and ensure that antenna manufacturers are able to bring their antennas to the market quickly, enabling a faster return on their investment, and thus making the U.S. a desirable market in which to introduce innovative new equipment.<sup>76</sup> We agree with many of the public interest benefits expressed in the record of the proceeding and adopt the framework discussed in the *NGSO ESIMs NPRM*.

### 1. Ku- and Ka- Frequency Bands

28. *11.7-12.2 GHz, 14.0-14.5 GHz, 18.3-18.6 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz, and 29.5-30.0 GHz.*—The Commission sought comment on allowing, to the extent feasible, ESIMs to communicate with NGSO FSS systems in the Ku- and Ka-bands where the Commission’s rules allow ESIM communications with GSO FSS space stations. The Commission proposed to allow ESIMs to communicate with NGSO FSS systems under the existing primary FSS allocation in the following six frequency bands: 11.7-12.2 GHz (space-to-Earth); 14.0-14.5 GHz (Earth-to-space); 18.3-18.6 GHz (space-to-Earth); 19.7-20.2 GHz (space-to-Earth); 28.35-28.6 GHz (Earth-to-space); and 29.5-30.0 GHz (Earth-to-space).<sup>77</sup> There are no allocations to terrestrial services in any of these bands. Under the Commission’s rules, NGSO FSS operations cannot cause interference to, or claim protection from, GSO FSS networks.<sup>78</sup> Accordingly, the Commission sought comment on adding new paragraphs to footnote NG527A of the Table of Frequency Allocations set forth at 47 CFR § 2.106 to indicate that ESIMs can operate with NGSO FSS space stations in these six frequency bands.

29. We adopt the proposal to add a paragraph to footnote NG527A to specify that ESIMs may be authorized to communicate with NGSO FSS satellites in these six bands, with the exception of the 28.35-28.4 GHz band, under the existing primary FSS allocation. Many commenters agree that the Commission should adopt its proposal to allow ESIMs to communicate with NGSO FSS systems on a primary basis in these frequency bands.<sup>79</sup> For example, the ESIM Coalition supports adoption of the proposal to add a paragraph to footnote NG527A to indicate that ESIMs can operate with NGSO FSS satellites in these six frequency bands.<sup>80</sup> This will ensure that the part 25 rules accurately reflect the current NGSO-GSO sharing framework and extend this well accepted framework to NGSO FSS operations with ESIMs.

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<sup>72</sup> Letter from Ryan W. King, Vice President & Head of Legal, Americas, Speedcast Americas Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Sept. 25, 2019).

<sup>73</sup> ESIM Coalition NPRM Comments at 5, SES and O3b NPRM Comments at 1, 3. *See also* Letter from Mariah Dodson Shuman, Corporate Counsel, Project Kuiper, Kuiper Systems LLC to Marlene H. Dortch, Secretary, Federal Communications Commission (filed Nov. 26, 2019).

<sup>74</sup> SES and O3b NPRM Comments at 4, 5-6.

<sup>75</sup> *Id.* at 5.

<sup>76</sup> SES and O3b NPRM Comments at 5; Viasat NPRM Comments at 3.

<sup>77</sup> *ESIMs NGSO FSS NPRM*, 33 FCC Rcd at 11419, para. 9. T-Mobile asks the Commission to clarify that its proposals in this proceeding will not expand use of ESIM operations in the 3.7-4.2 GHz band. T-Mobile NPRM Comments at 1-3. We so clarify here.

<sup>78</sup> 47 CFR § 25.289.

<sup>79</sup> ESIM Coalition NPRM Comments at 2-3; Hughes NPRM Comments at 3.

<sup>80</sup> *See also* SES and O3b NPRM Comments at 7.

30. Some concerns, however, were recently raised about potential interference from out-of-band emissions of ESIMs in the 28.35-28.6 GHz band into the adjacent 27.5-28.35 GHz band used by UMFUS, generated by ESIM transmissions to NGSO FSS space stations in frequencies above 28.35 GHz.<sup>81</sup> Contrarily, others have argued that the Commission already considered and dismissed similar concerns when it authorized ESIMs to communicate with GSO satellites, and the authorization of ESIM communications with NGSOs does not raise any new concerns.<sup>82</sup> Given these differences of opinion, we are initiating a *Further Notice* to further develop the record on these issues. As such, we will not permit ESIM operations with NGSO FSS space stations in the lowest 50 megahertz of the 28.35-28.6 GHz band (28.35-28.4 GHz), subject to further consideration. However, in the interest of avoiding delay in potential ESIMs operations in the remaining 200 megahertz of the 28.35-28.6 GHz band, we will permit the filing and processing of ESIMs applications for use of spectrum between 28.4-28.6 GHz, with any grants conditioned on compliance with any future determinations made in this proceeding. Based on the current record, we do not anticipate that ESIM operations above 28.4 GHz will have a significant out-of-band emissions impact on UMFUS operation below 28.35 GHz.<sup>83</sup> Additionally, should parties have concerns about specific applications for ESIMs use, they can be addressed as part of the public comment review process for each ESIM application filed before the Commission. Before granting any of these applications, the possible need to require more stringent limits than those in section 25.202(f), even for ESIM operations with NGSO FSS space stations above 28.4 GHz, can be considered and addressed as appropriate.

31. Several commenters believe that the use of the term “primary” to describe the status of communications of ESIMs with NGSO FSS satellites in these six bands is potentially confusing because of the need of such communications to protect GSO FSS operations.<sup>84</sup> We clarify here and in the new paragraph (c) to footnote NG527A, that NGSO ESIMs operations in these bands are on an unprotected, non-interference basis only with respect to GSO FSS operations. As Intelsat correctly states, we do not propose to elevate the NGSO protection status vis-à-vis GSO operations.<sup>85</sup> Rather, communications of ESIMs with NGSO FSS satellites is an application in the FSS,<sup>86</sup> which has a primary allocation in these bands.<sup>87</sup> The rules for communications of ESIMs with both NGSO and GSO satellites maintain the existing protection status offered to GSO operations vis-à-vis NGSO operations, which is articulated in the proposed revision to footnote NG527A. In other words, NGSO ESIM operations will be provided the same protections, and have the same obligations, as NGSO FSS already possesses. This includes the

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<sup>81</sup> Letter from Daudeline Meme, Verizon and US Cellular to Marlene H. Dortch, Secretary, Federal Communications Commission (filed May 4, 2020) (Verizon May 4 Ex Parte Letter).

<sup>82</sup> Letter from Suzanne Malloy, Vice President of Regulatory Affairs for SES Americom, Inc. and O3b Limited, Kimberly M. Baum Vice President, Regulatory Affairs Hughes Network Systems, LLC, and EchoStar Satellite Services, L.L.C. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed May 6, 2020) (SES Americom, Inc. and O3b Limited, Inmarsat, Inc., Hughes Network Systems, LLC, and EchoStar Satellite Services, L.L.C. May 6 Ex Parte Letter); Letter from John P. Janka, Chief Officer, Global Government Affairs & Regulatory, Viasat, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (filed May 6, 2020) (Viasat May 6 Ex Parte Letter).

<sup>83</sup> As per section 25.202(f), ESIM emissions will be attenuated by approximately 35 dB at 28.35 GHz.

<sup>84</sup> ESIMs Coalition NPRM Comments at 2-3; Intelsat NPRM Reply Comments at 2.

<sup>85</sup> Intelsat NPRM Reply Comments at 2.

<sup>86</sup> See U.S. Table of Frequency Allocations, 47 CFR § 2.106, n. NG527A.

<sup>87</sup> *Id.*

obligation for NGSO FSS to protect GSO FSS—including GSO FSS communications to ESIMs—in these frequency bands under part 25 of the Commission’s rules.<sup>88</sup>

32. Some commenters noted that the Commission used the term “harmful interference” in some contexts and “unacceptable interference” in the NPRM.<sup>89</sup> The specific obligation on NGSO FSS operations is that they do not cause unacceptable interference to GSO FSS networks.<sup>90</sup> We believe that “unacceptable interference” is the appropriate term to use here.<sup>91</sup> To the extent that “harmful interference” was used elsewhere in the *ESIMs NGSO NPRM*, we clarify that there was no intent to alter the “unacceptable interference” obligation.

33. *18.8-19.3 GHz and 28.6-29.1 GHz.*—The Commission proposed to allow ESIMs to communicate with NGSO FSS systems on a primary basis in the 18.8-19.3 GHz (space-to-Earth), and the 28.6-29.1 GHz (Earth-to-space) bands. In these bands, there are no terrestrial allocations, and GSO FSS operations are secondary with respect to NGSO FSS. Accordingly, the Commission sought comment on adding a new paragraph (e) to footnote NG527A to indicate that ESIMs can operate both with a GSO FSS space station and with NGSO FSS systems in these two frequency bands, but that GSO FSS operations in these bands must not cause unacceptable interference to, or claim protection from, NGSO FSS networks.<sup>92</sup> We adopt this proposal.

34. Boeing and other commenters support this proposal.<sup>93</sup> Boeing asserts that the Commission already appropriately treats ESIMs as a permitted application of FSS, employing the same frequency allocation and protection rights as FSS.<sup>94</sup> Hughes, on the other hand, supports permitting NGSO ESIM operation in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands, not on a primary basis as the Commission proposes, but “with a status equal to that of any GSO operation that takes place in the frequency band.”<sup>95</sup> Hughes notes that, to date, the Commission has authorized use of these bands by GSO FSS on a secondary basis with respect to communications between NGSO systems and fixed earth stations, and that Hughes has successfully entered into coordination agreements with several NGSO system operators to utilize these frequency bands in its GSO satellite networks, with the expectation that coordination would require analysis only of networks with fixed earth stations.<sup>96</sup> According to Hughes, allowing NGSO ESIMs to operate on a primary basis would complicate the ability of GSO licensees to seek coordination agreements with NGSO systems that will allow these frequency bands to be used with maximum efficiency.<sup>97</sup> Therefore, Hughes argues the Commission should permit

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<sup>88</sup> 47 CFR § 25.289 (stating that, unless provided otherwise, “an NGSO system licensee must not cause unacceptable interference to, or claim protection from, a GSO FSS...network”).

<sup>89</sup> ESIMs Coalition NPRM Comments at 3; SES and O3b NPRM Comments at 8; Intelsat NPRM Reply Comments at 3.

<sup>90</sup> 47 CFR § 25.289.

<sup>91</sup> See 47 CFR § 25.289; *ESIMs NGSO FSS NPRM*, 33 FCC Rcd at 11425-28, App. A. (The Commission used the term “unacceptable interference” in proposed footnote NG527A).

<sup>92</sup> *ESIMs NGSO FSS NPRM*, 33 FCC Rcd at 11419, para. 10.

<sup>93</sup> See Boeing NPRM Comments at 7; ESIM Coalition at 3; SES and O3b NPRM Comments at 8.

<sup>94</sup> Boeing NPRM Comments at 7.

<sup>95</sup> Hughes NPRM Comments at 4.

<sup>96</sup> *Id.*

<sup>97</sup> *Id.* at 4-5.

all GSO operations and ESIM NGSO operations to have equal status, with each having secondary status with respect to fixed earth stations communicating with NGSO satellites in these frequency bands.<sup>98</sup>

35. We agree with Boeing that Hughes' proposal overreaches with respect to the appropriate regulatory treatment of ESIMs operating in the 18.8-19.3 GHz (space-to-Earth) and the 28.6-29.1 GHz (Earth-to-space) bands.<sup>99</sup> As Hughes acknowledges, these frequency bands constitute one of the few FSS allocations where NGSO FSS systems have priority over GSO FSS networks.<sup>100</sup> Nonetheless, Hughes urges the Commission to treat ESIMs operations with NGSO FSS systems as co-equal with GSO FSS networks in this spectrum.<sup>101</sup> As the Commission has stated, "limiting the primary designation in these frequency bands to NGSO FSS systems will give operators of these systems greater flexibility in the coordination discussions and ultimate deployment."<sup>102</sup> Further, we agree with Boeing that Hughes' private agreements with certain NGSO FSS operators are immaterial to Commission policy regarding the rights of future NGSO FSS systems.<sup>103</sup> Accordingly, we decline to lower the status of ESIMs communicating with NGSO FSS satellites below that of other earth stations communicating with NGSO FSS satellites.

36. Viasat argues that the Commission must ensure that any primary NGSO ESIM operations that may be allowed in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) band segments within the United States do not impact GSO operations outside of the United States, where GSO and NGSO systems are co-primary and are subject to ITU coordination requirements.<sup>104</sup> Similarly, Hughes requests that the Commission clarify that while GSO operations are secondary to NGSO operations in the United States in these frequency bands, the services are co-primary outside the United States.<sup>105</sup> As has been the Commission's policy in other situations involving operations outside the United States, ESIM operations in a NGSO FSS system licensed by the United States will: (i) have higher status than operations in a GSO FSS satellite network licensed by the United States anywhere in the world; (ii) have higher status than operations in a GSO FSS satellite network that holds a grant to access the U.S. market only for communications to or from the U.S. territory; and (iii) be co-primary with a GSO FSS satellite network in all other cases.<sup>106</sup>

37. In addition, CORF raises concerns regarding the Earth exploration-satellite service co-primary allocation at 18.6-18.8 GHz (space-to-Earth).<sup>107</sup> Specifically, CORF is concerned that NGSO ESIM operations in 18.3-18.6 GHz (space-to-Earth) and 18.8-19.3 GHz (space-to-Earth) may

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<sup>98</sup> See Letter from Jennifer A. Manner, Senior Vice President, Regulatory Affairs, Hughes Network Systems, to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 18-315, at 2 (Apr. 19, 2019).

<sup>99</sup> Boeing NPRM Reply Comments at 2.

<sup>100</sup> Hughes NPRM Reply Comments at 4. As Boeing notes, Hughes does not explain how its proposal for co-equal status would work. Presumably, however, Hughes' existing Ka-band GSO FSS operations would have first-in-time priority over ESIMs operating with NGSO FSS systems given the fact that ESIMs are not yet authorized in this spectrum. Boeing NPRM Reply Comments at 3.

<sup>101</sup> Hughes NPRM Comments at 4.

<sup>102</sup> See *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809, 7814-15, ¶ 14 (2017) (*NGSO FSS Report and Order*).

<sup>103</sup> Boeing NPRM Reply Comments at 3.

<sup>104</sup> Viasat NPRM Comments at 5.

<sup>105</sup> Hughes NPRM Reply Comments at 1-2.

<sup>106</sup> *NGSO FSS Report and Order*, 32 FCC Rcd at 7814-15, para. 14.

<sup>107</sup> See CORF NPRM Comments.

contaminate Earth exploration-satellite service observations, as radio interference from moving targets is even more difficult to flag and remove than interference from fixed stations.<sup>108</sup> CORF also notes that increased usage of the adjacent bands may degrade this band if out-of-band emissions are not severely curtailed.<sup>109</sup> CORF raised similar arguments against operation in these bands in the context of ESIM operation with GSO FSS satellites. As we noted in addressing their arguments there, CORF's concerns are not with ESIMs, which solely receive in the frequency bands that CORF identified as being of concern, but rather with the space-to-Earth transmissions of NGSO satellites, which are not the subject of this rulemaking.<sup>110</sup> Therefore, as before, we note that the Commission's rules already impose specific limits on out of band emissions.

38. Kymeta argues for even further streamlining than the Commission has proposed.<sup>111</sup> For example, in the case of existing licensees seeking to operate with NGSO satellite systems on a primary basis in the 28.6-29.1 GHz (Earth-to-space) band, Kymeta states that no additional technical information should be required.<sup>112</sup> Further, Kymeta requests the Commission to find that for existing licensees seeking to operate with NGSO satellite systems on a primary or secondary basis in all other authorized Ku-band and Ka-band frequencies, the only additional technical showing required would be a demonstration that the ESIM complies with the equivalent power flux density up limits referenced in section 25.289. While other commenters do not oppose Kymeta's proposals as a general matter, commenters disagree about the specific technical showing that should be required.<sup>113</sup> We note that such proposals are well beyond the current rulemaking. Moreover, any showing of the kind proposed by Kymeta would be more appropriately provided by the licensee of the NGSO FSS system since equivalent power flux density limits refer to the aggregate of all emissions within the system. We therefore decline to adopt Kymeta's proposals at this time.

39. *10.7-11.7 GHz.*—The Commission sought comment on allowing ESIMs to receive signals from NGSO FSS space stations in the 10.7-11.7 GHz (space-to-Earth) band, on an unprotected basis, with respect to transmissions from non-Federal fixed service stations. FSS and fixed service are co-primary in these frequency bands, and receive terrestrial stations are protected by existing power flux density limits on space station transmissions.<sup>114</sup> Accordingly, the Commission sought comment on revising paragraph (a) of footnote NG527A to indicate that ESIMs can operate with NGSO FSS systems on an unprotected basis with regard to non-Federal fixed service in this frequency band. Many commenters support this proposal.<sup>115</sup> Also, in this frequency band, NGSO FSS operations must not cause unacceptable interference to, or claim protection from, GSO FSS networks.<sup>116</sup> Boeing states that the downlink transmissions from NGSO FSS satellites to ESIMs will be indistinguishable from existing

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<sup>108</sup> *Id.* at 12.

<sup>109</sup> *Id.* at 13.

<sup>110</sup> *See supra* para. 22.

<sup>111</sup> Kymeta NPRM Comments at 4-5.

<sup>112</sup> *Id.* at 4.

<sup>113</sup> *See, e.g.* SES NPRM Reply Comments at 8.

<sup>114</sup> 47 CFR § 25.146(a)(1).

<sup>115</sup> Boeing NPRM Comments at 8; Hughes NPRM Comments at 5; Kepler NPRM Comments at 2; Viasat NPRM Comments at 4.

<sup>116</sup> 47 CFR § 25.289. Commenters here again raise the issue of use of the term “unacceptable interference” versus “harmful interference” in the NPRM. *See, e.g.*, SES and O3b NPRM Comments at 8. This issue is addressed at paragraph 30, *supra*.

NGSO FSS downlink transmissions.<sup>117</sup> We agree with Boeing and find that the operation of ESIMs in this band will be indistinguishable from other NGSO FSS operations. Because the mechanisms the Commission already has in place to protect GSO FSS networks from NGSO FSS will also provide protection against NGSO ESIM operations, we adopt the revisions proposed to paragraph (a) of footnote NG527A, which will allow ESIMs to operate on an unprotected basis with regard to non-Federal fixed service in this frequency band.<sup>118</sup>

40. CORF asserts that there is a significant risk of interference to radio astronomy observations from downlinks in the 10.7-11.7 GHz band.<sup>119</sup> We agree that protection of these services is important but find that existing protections are sufficient to guard against interference to radio astronomy operations. CORF suggests protection of the primary allocation of Earth exploration-satellite service in the 10.68-10.70 GHz portion of the frequency band either through use of a guard band of 25 megahertz, so that the lowest frequency of this ESIM downlink band would be 10.725 GHz, or through use of a more stringent out-of-band emission standard for ESIM downlinks to protect Earth exploration-satellite service observations in the 10.68-10.70 GHz band.<sup>120</sup> As CORF notes, however, radio astronomy service observations in the 10.6-10.7 GHz band<sup>121</sup> are already entitled to protection under the Commission's rules,<sup>122</sup> as established by footnote US74, which states that "the radio astronomy service shall be protected from unwanted emissions only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates."<sup>123</sup> Since our actions today do not change this balance that the rules strike, and since the question of modifying the current protection of radio astronomy observation is part of an ongoing Commission proceeding regarding out-of-band-emissions,<sup>124</sup> the appropriate forum to address these requests is that proceeding. Accordingly, we decline to address those requests here. CORF also asks the Commission to include a requirement for NGSO operators transmitting in the 10.7-11.7 GHz band to coordinate with radio astronomy observatories; however, as CORF acknowledges, such a requirement is already included in footnote US131.<sup>125</sup>

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<sup>117</sup> Boeing NPRM Comments at 8.

<sup>118</sup> Consistent with our decision in paragraph 8 above, we revise footnote NG527A to allow ESIMs to communicate with NGSO satellites, subject to the conditions that ESIMs may not claim protection from transmissions from non-Federal fixed service stations and that NGSO FSS systems may not cause unacceptable interference to, or claim protection from, GSO FSS networks. *See* Appendix B, NG527A.

<sup>119</sup> CORF NPRM Comments at 8.

<sup>120</sup> *Id.* at 9-10.

<sup>121</sup> As we note in fn 27, CORF mentions 10.6-11.7 GHz on page 7 of its FNPRM Comments. However, it is clear from the context that their intention was to reference the 10.6-10.7 GHz band which has a primary allocation to the Radio Astronomy Services. 47 CFR § 2.106.

<sup>122</sup> *Id.* In the 10.68 GHz-10.70 GHz portion of the frequency band, radio astronomy service has a primary allocation and is protected domestically by footnote US246, and by RR No. 5.340 worldwide. Pursuant to US246, "[n]o station shall be authorized to transmit" at 10.68-10.7 GHz, and pursuant to RR 5.340, "[a]ll emissions are prohibited" at 10.68-10.7 GHz. *See* 47 CFR § 2.106, US246. Similarly, in footnote US211, applicants for airborne or space station assignments at, among other frequency bands, 10.7-11.7 GHz, are urged to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference. 47 CFR § 2.106, US211; *see also* 47 CFR § 2.106, US131 (requiring prior coordination with specific radio astronomy service sites).

<sup>123</sup> 47 CFR § 2.106, US74.

<sup>124</sup> CORF NPRM Comments at 9-10. *See 2018 Part 25 Further Streamlining Notice*, 33 FCC Rcd at 11507-08, paras. 18-19.

<sup>125</sup> CORF NPRM Comments at 8-9; 47 CFR § 2.106, US131.



41. *17.8-18.3 GHz.*—The Commission sought comment on allowing ESIMs to receive signals from NGSO FSS systems on a secondary basis in the 17.8-18.3 GHz (space-to-Earth) band. This frequency band is allocated to the fixed service on a primary basis and, given the FSS secondary status, ESIM receive earth stations are not entitled to protection. Protection of terrestrial operations in this band will be ensured by imposing on space station transmissions the appropriate power flux density limits.<sup>126</sup> Accordingly, the Commission sought comment on adding a paragraph to footnote NG527A to indicate that ESIMs can operate on a secondary basis with regard to non-Federal fixed service in this frequency band, both with a GSO FSS space station and with NGSO FSS systems.<sup>127</sup>

42. The ESIM Coalition and other commenters support the proposal to allow ESIMs to receive signals from NGSO FSS space stations on a secondary basis in the 17.8-18.3 GHz (space-to-Earth) band, and no commenter opposed this proposal.<sup>128</sup> As the Commission explained in the *NGSO ESIMs NPRM*,<sup>129</sup> NGSO ESIMs can ensure adequate protection of terrestrial operations via compliance with the existing International Telecommunication Union power flux density limits, currently codified in the Commission's rules.<sup>130</sup> Accordingly, we adopt the proposed addition of paragraph (d) to footnote NG527A.

43. *19.3-19.4 GHz and 19.6-19.7 GHz.*—The Commission sought comment on allowing ESIMs to receive signals from NGSO FSS space stations in the 19.3-19.4 GHz and 19.6-19.7 GHz (space-to-Earth) bands, on an unprotected basis, with respect to transmissions from non-Federal fixed service stations. FSS and fixed service are co-primary in these frequency bands, and receive terrestrial stations are protected by imposing the appropriate power flux density limits on space station transmissions.<sup>131</sup> In addition, NGSO FSS operations must not cause unacceptable interference to, or claim protection from, GSO FSS networks.<sup>132</sup> Accordingly, the Commission sought comment on revising footnote NG527A to indicate that ESIMs can operate with NGSO FSS systems in these two frequency bands on an unprotected basis with regard to non-Federal fixed service. The Commission also proposed revisions to footnote NG527A to indicate that ESIMs can operate with NGSO FSS systems in these two frequency bands, provided that NGSO FSS operations not cause unacceptable interference to, or claim protection from, GSO FSS satellite networks.<sup>133</sup> Commenters support all of these proposals and raise no concerns.<sup>134</sup>

44. Accordingly, we further revise paragraph (a) of footnote NG527(A) to state that NGSO ESIM operations in the 19.3-19.4 GHz and 19.6-19.7 GHz (space-to-Earth) bands may be authorized on an unprotected basis with respect to fixed service and NGSO FSS systems operating with ESIMs may be

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<sup>126</sup> 47 CFR § 25.146(a)(1).

<sup>127</sup> In this band, NGSO FSS operations must not cause unacceptable interference to, or claim protection from, GSO FSS networks. *See* 47 CFR § 25.289.

<sup>128</sup> Boeing NPRM Comments at 10; ESIM Coalition NPRM Comments at 4; SES and O3b NPRM Comments at 8; Viasat Comments at 4.

<sup>129</sup> *ESIMs FSS NGSO NPRM*, at para. 13.

<sup>130</sup> ESIM Coalition NPRM Comments at 4; *see also* 47 CFR § 25.146(a)(1).

<sup>131</sup> 47 CFR § 25.146(a)(1).

<sup>132</sup> 47 CFR § 25.289.

<sup>133</sup> *ESIMs NGSO NPRM*, 33 FCC Rcd at 11420, para. 12.

<sup>134</sup> Boeing NPRM Comments at 8; ESIM Coalition NPRM Comments at 4; OneWeb NPRM Comments at 10; SES and O3b NPRM Comments at 8; Viasat NPRM Comments at 4.

authorized on an unprotected, non-interference basis with respect to GSO FSS satellite networks.<sup>135</sup>

## 2. Additional Frequency Bands

45. Several parties filed comments requesting that we consider including frequency bands that were not proposed in the *NGSO ESIMs NPRM*. Boeing states that the Commission should permit GSO and NGSO ESIMs in every frequency band that is allocated for use by FSS.<sup>136</sup> SES encourages the Commission to consider NGSO ESIMs matters as part of any future proceeding developing service rules for “V-band” FSS in the 37.5- 52.4 GHz range of frequencies.<sup>137</sup> Other commenters ask that the Commission authorize NGSO systems to support ESIMs in additional space-to-Earth frequency bands including 12.2-12.7 GHz, and throughout the V-band.<sup>138</sup> While some other parties join these proposals, other commenters oppose them.<sup>139</sup> For example, Iridium strongly objects to proposals to include the 19.4-19.6 GHz and the 29.1-29.5 GHz bands, arguing that these bands are beyond the scope of this proceeding.<sup>140</sup> MDS Operations argues that allowing NGSO ESIM links in the 12.2-12.7 GHz band would create insurmountable coordination challenges for incumbent licensees.<sup>141</sup> The MVDDS 5G Coalition concurs.<sup>142</sup> Specifically, they assert that ensuring that the 12.2-12.7 GHz band remains free of ESIMs communications with NGSO FSS satellites would protect in-band terrestrial services and preserve the possibility of future two-way mobile 5G services.<sup>143</sup> CTIA asserts that permitting ESIM operations in the UMFUS bands would be inconsistent with the carefully calibrated framework the Commission adopted in the *Spectrum Frontiers* proceeding,<sup>144</sup> which allows for limited siting of new earth stations under very specific rules.<sup>145</sup>

46. These additional frequency bands were not included in this proceeding, and the record is insufficient for us to consider use of these bands for ESIMs communications with NGSO FSS satellites. Moreover, allowing ESIMs to transmit in the UMFUS bands would be inconsistent with the

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<sup>135</sup> See Appendix B, NG527A.

<sup>136</sup> Boeing FNPRM Comments at 1.

<sup>137</sup> SES and O3b NPRM Comments at 9; SES and O3b NPRM Reply Comments at 6-7.

<sup>138</sup> Boeing NPRM Reply Comments at 1; Viasat NPRM Comments at 3; WorldVu NPRM Comments at i-ii, 3-7, WorldVu NPRM Reply Comments at 1-3.

<sup>139</sup> MDS Operations support the Commission’s proposal to exclude the 12 GHz MVDDS band from the bands in which ESIMs may communicate with NGSOs. MDS Operations NPRM Reply Comments at 2. MDS Operations asserts that allocation for ESIM use in the 12 GHz band would stymie investment and innovation for MVDDS use. *Id.*

<sup>140</sup> See generally Iridium NPRM Reply Comments.

<sup>141</sup> MDS NPRM Reply Comments at 3-4.

<sup>142</sup> MVDDS 5G Coalition NPRM Reply Comments at 1-4.

<sup>143</sup> *Id.* at 1.

<sup>144</sup> See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al., Report and Order and Further Notice of Proposed Rulemaking*, 31 FCC Rcd 8014 (2016); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al., Second Report and Order and Order on Reconsideration*, 32 FCC Rcd 10988 (2017); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al., Third Report and Order*, 33 FCC Rcd 5576 (2018); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al., Fifth Report and Order*, 34 FCC Rcd 2556 (2019).

<sup>145</sup> Letter from Jennifer L. Oberhausen, Director, Regulatory Affairs, CTIA to Marlene H. Dortch, Secretary, Federal Communications Commission (filed May 1, 2020) (CTIA May 1 Ex Parte Letter) at 2; Letter from Jennifer L. Oberhausen, Director, Regulatory Affairs, CTIA to Marlene H. Dortch, Secretary, Federal Communications Commission (filed May 6, 2020) (CTIA May 6 Ex Parte Letter).

Commission's decisions adopted in the *Spectrum Frontiers* proceeding. Accordingly, we decline to include these additional frequency bands in the rules adopted in this proceeding.

### 3. Blanket Licensing

47. In the *NGSO ESIMs NPRM*, the Commission proposed extending blanket licensing for communications of ESIMs with NGSO FSS systems since such licensing would be limited to frequency bands in which NGSO FSS systems have a primary status or have been found to be able to operate on a secondary or non-conforming basis without causing interference to primary users of those bands. The Commission sought comment on extending blanket licensing to ESIMs operating with NGSO FSS space stations in all the frequency bands being proposed here for ESIM NGSO operation.

48. Commenters were uniformly supportive of blanket licensing.<sup>146</sup> Commenters argue that blanket licensing would be more efficient than individually licensing ESIM terminals,<sup>147</sup> and that individual licensing is only necessary to facilitate site-by-site coordination, which is not needed for terminals in-motion, which employ technical means to operate on a shared basis with other spectrum users.<sup>148</sup> In the past, the Commission has granted blanket licenses to ESIMs communicating with GSO FSS satellites for each specific type of ESIM—Earth Stations on Vessels, Vehicle-Mounted Earth Stations, and Earth Stations Aboard Aircraft—concluding that blanket licensing would be far more effective and administratively efficient than employing an individual licensing approach for these types of earth stations.<sup>149</sup> We find that the proposed blanket licensing does not pose any increased risk of harmful interference and that the reasons that blanket licensing is appropriate for communications of these terminals with GSO FSS satellites applies equally to communications of such terminals with NGSO FSS systems. Accordingly, we conclude that blanket licensing is appropriate for communications of ESIMs with NGSO FSS satellites and adopt this proposal.<sup>150</sup>

### 4. Implementing Rule Revisions

49. In the paragraphs below, we address other changes to our rules, in addition to those discussed above in connection with the frequency bands being proposed for NGSO FSS ESIM operation. The Commission sought comment on these changes, and on any other revisions necessary to implement

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<sup>146</sup> ESIM Coalition NPRM Comments at 5; Kymeta NPRM Comments at 2-3; SES and O3b NPRM Comments at 10; WorldVu NPRM Comments at 10-11; Boeing NPRM Comments at 12-13.

<sup>147</sup> ESIM Coalition NPRM Comments at 5.

<sup>148</sup> Kymeta NPRM Comments at 2-3.

<sup>149</sup> *Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, IB Docket No. 02-10, Report and Order, 20 FCC Rcd 674, 722, para. 115 (2005); *Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum and Adopt Service Rules and Procedures to Govern the Use of Vehicle-Mounted Earth Stations in Certain Frequency Bands Allocated to the Fixed-Satellite Service*, IB Docket No. 07-101, Report and Order, 24 FCC Rcd 10414, 10464, para. 162 (2009); *Revisions to Parts 2 and 25 of the Commission's Rules to Govern the Use of Earth Stations Aboard Aircraft Communicating with Fixed-Satellite Service Geostationary-Orbit Space Stations Operating in the 10.95-11.2 GHz, 11.45-11.7 GHz, 11.7-12.2 GHz and 14.0-14.5 GHz Frequency Bands*, IB Docket No. 12-376, Report and Order, 27 FCC Rcd 16510, 16550, para. 104 (Dec. 28, 2012).

<sup>150</sup> SES and O3b ask for confirmation that when the Commission stated in the *NGSO ESIMs NPRM* that "ESIMs' communications with NGSO FSS systems would be limited to frequency bands in which NGSO FSS systems have a primary status, or have been found to be able to operate on a secondary or non-conforming basis, without causing interference to primary users of those bands," the Commission was referring to the frequency bands to be authorized for NGSO ESIMs through this proceeding. SES and O3b NPRM Comments at 10. SES and O3b state that such a confirmation would remove any concern that the Commission intends to require a separate compatibility showing for a given frequency band to be eligible for blanket licensing. To the extent such a confirmation is necessary, we so confirm here.

the ESIM NGSO FSS operations described here.<sup>151</sup>

50. *Section 25.202.* The Commission sought comment on amending the list of frequencies available to ESIMs in sections 25.202(a)(8), (a)(10), and (a)(11) to reflect changes made in this *Report and Order* to frequency bands in which ESIMs can communicate with NGSO FSS satellites.<sup>152</sup> Other than the objections to the 28.35-28.6 GHz band discussed above, there were no objections to this change, and we amend section 25.202, with the exception of 28.35-28.4 GHz, also taking into account the additional frequencies made available for ESIM operation with GSO FSS satellites, as specified in Section III.A of this *Report and Order*.

51. *Section 25.115.* The Commission sought comment on changes to extend the rules adopted for GSO FSS ESIMs to NGSO FSS ESIMs, with the appropriate conforming technical changes. Specifically, comment was sought on excluding NGSO ESIMs from rules that pertain to “two-degree spacing”<sup>153</sup> for GSO FSS space stations.<sup>154</sup> Comment was also sought on adding a new paragraph (o) to section 25.115 to codify these requirements for ESIMs that communicate with NGSO FSS space stations.<sup>155</sup> The Commission also sought comment on changing the cross-references contained in the information requirements for earth station applications set forth in section 25.115 for earth stations communicating with GSO and NGSO FSS space stations. All commenters who addressed this issue support this approach and agree that the rules should exclude NGSO ESIMs from the application of off-axis Equivalent Isotropically Radiated Power (EIRP) density requirements for two-degree spaced GSO FSS earth stations.<sup>156</sup> We adopt these conforming revisions with a small modification to take into account that section 25.115(e)(2) is limited to GSO FSS earth stations.

52. Finally, the Commission’s Ka-band Plan has a secondary designation for NGSO FSS operations in the 29.5-30.0 GHz band, as described in the *NGSO FSS Order*.<sup>157</sup> The licensing provisions in section 25.115(f) adopted in the *NGSO FSS Order*, however, inadvertently omitted the 29.5-30.0 GHz band.<sup>158</sup> In the *NGSO ESIMS NPRM*, the Commission proposed to correct this omission and proposed to extend the provisions of section 25.115(f) to the 29.5-30.0 GHz band. Commenters did not address this specific point. We adopt the revision to correct the omission consistent with the Ka-band Plan as previously adopted by the Commission.

53. *Section 25.228.* Section 25.228 contains requirements in paragraphs (a), (b), and (c), that codify the two-degree spacing requirements for ESIMs communicating with GSO FSS satellite networks, but the paragraphs are not specifically worded to apply only to such ESIMs. The Commission sought

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<sup>151</sup> *ESIMs NGSO FSS NPRM*, 33 FCC Rcd at 11422, paras. 16-21. The Commission stated that there would not be significant cost associated with the rule changes for NGSO ESIMs but invited comment to help with the costs and benefits analysis. See *ESIMs NGSO FSS NPRM*, 33 FCC Rcd at 11422, para. 23. No comments were received.

<sup>152</sup> The Commission released an Erratum on December 20, 2018 to correct the *ESIMs NGSO NPRM* which initially suggested revisions to, rather than removal of, section 25.202(a)(11). See *Erratum to the ESIMs NGSO FSS NPRM*.

<sup>153</sup> “Two-degree spacing” refers to angular separation in the GSO arc between adjacent co-frequency space stations. See *Comprehensive Review of Licensing and Operating Rules for Satellite Services*, Second Report and Order, 30 FCC Rcd 14713, 14747, para. 92 (2015).

<sup>154</sup> Sections 25.115(l)-(n) contain requirements in paragraphs (1), (2), and (3)(i) that pertain to the two-degree spacing rules for ESIMs communicating with GSO FSS space stations, which are not applicable to NGSO systems. The requirements in paragraphs (3)(ii)-(iv) of this section, however, are also appropriate for ESIMs operating in NGSO FSS systems.

<sup>155</sup> *ESIMs NGSO NPRM*, 33 FCC Rcd at 11421, para. 18.

<sup>156</sup> ESIM Coalition NPRM Comments at 5-6; Viasat NPRM Comments at 6.

<sup>157</sup> *NGSO FSS Report and Order*, 32 FCC Rcd at 7813, para. 9.

<sup>158</sup> *ESIMs NGSO NPRM*, 33 FCC Rcd at 11421, para. 21.

comment on adopting revisions to clarify that these paragraphs apply only to ESIMs communicating with GSO FSS satellite networks.<sup>159</sup>

54. Intelsat notes that the proposed changes may have been interpreted differently by different commenters,<sup>160</sup> and Kepler states that further clarification may be necessary because of the separate purposes these rules address.<sup>161</sup> Despite this disagreement, commenters are uniformly concerned that the proposed revision eliminates the NGSO ESIM self-monitoring and network monitoring and control requirements,<sup>162</sup> and many commenters argue against adding language specifying that section 25.228(a), (b), and (c) are GSO-specific. The ESIM Coalition, for example, believes ESIM terminal self-monitoring and network control and monitoring center requirements are essential to ensuring operations are conducted in accordance with applicable license provisions, consistent with the ESIM rules, and without causing interference to other satellite and earth station operations. They argue that there is no basis to treat GSO FSS and NGSO FSS ESIMs differently with respect to these important requirements.<sup>163</sup> Eutelsat concurs, stating this revision appears to suggest elimination of self-monitoring and network control and monitoring center requirements for NGSO FSS ESIMs.

55. We agree with these concerns. Therefore, we adopt modified language to ensure that GSO and NGSO FSS ESIM operators comply with the same general monitoring and control requirements, and limit applicability to GSO ESIMs only for section 25.228(a). Specifically, to confirm the applicability of sections 25.228(b) and 25.228(c) to both GSO and NGSO FSS ESIMs, we do not include the word “GSO” in the initial sentence, and include clauses specifically applicable to GSO and NGSO in the remaining text of the rule.<sup>164</sup> We agree with commenters that there should be parity between the GSO and NGSO ESIM self-monitoring and network monitoring and control requirements.<sup>165</sup> We also agree with commenters that self-monitoring and network monitoring and control requirements are necessary to ensure operations are in accordance with the Commission’s rules and licensing conditions.<sup>166</sup>

56. Relatedly, we note that the adoption of the section 25.228 rules in the *GSO ESIMs Report & Order and FNPRM* inadvertently created an inconsistency with regard to network control and monitoring centers for Earth Stations on Vessels.<sup>167</sup> Specifically, in that decision, the Commission adopted section 25.228(e)(1) which states, in part, that Earth Stations on Vessels operators must control Earth Stations on Vessels by a network control and monitoring center located in the United States, but it fails to include the option of using an equivalent facility, as section 25.228’s paragraph (c) does for ESIMs.<sup>168</sup> Because Earth Stations on Vessels are a type of ESIM, and because section 25.228(c) as adopted in the *GSO ESIM R&O* already provided that “[e]ach ESIM must be monitored and controlled by a network control and monitoring center (NCMC) or equivalent facility,” the addition of “equivalent facility” to the language in section 25.228(e)(1) simply conforms the two provisions of the rules in

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<sup>159</sup> *Id.* at para. 19.

<sup>160</sup> Intelsat NPRM Reply Comments at 3.

<sup>161</sup> Kepler NPRM Comments at 1-2, and n4.

<sup>162</sup> See ESIM Coalition at 5-6; Eutelsat at 2; SES at 9; Intelsat NPRM Reply Comments at 3.

<sup>163</sup> ESIM Coalition NPRM Comments at 5-6. See also Eutelsat NPRM Comments at 2.

<sup>164</sup> See section 25.228(b) and (c) in Appendix B.

<sup>165</sup> ESIM Coalition NPRM Comments at 5-6; Eutelsat NPRM Comments at 2; SES NPRM Reply Comments at 9; Intelsat NPRM Reply Comments at 3; WorldVu NPRM Reply Comments at 4.

<sup>166</sup> Intelsat NPRM Reply Comments at 3.

<sup>167</sup> *GSO ESIM Report & Order*, 33 FCC Rcd at Appendix B.

<sup>168</sup> See 47 CFR §§ 25.228(c) and (e).

accordance with the *GSO ESIM Report & Order*.<sup>169</sup> Therefore, we fix that inconsistency here by adding the phrase “or equivalent facility” (which appears in section 25.228(c)) to section 25.228(e)(1), to state that Earth Stations on Vessels operators must control all Earth Stations on Vessels by a network control and monitoring center or equivalent facility located in the United States.<sup>170</sup>

57. Kepler argues that further clarification may be required on how various systems should operate their ESIMs, and in particular notes that a satellite network need not be controlled in “real-time” from a network control and monitoring center, but may instead rely either on Artificial Intelligence (“AI”) or predetermined rules in order to mitigate interference as it relates to aggregate EIRP.<sup>171</sup> Kepler further asserts that while this does not preclude the requirement for a network control and monitoring center, it should be clarified that operations without bent-pipe architecture may implement alternate safety measures, and could use the satellite itself as an “equivalent facility.”<sup>172</sup> Although we agree that technology may evolve to such a point in the future, we find that such a discussion is beyond the scope of this rulemaking.

58. Paragraph (j) of section 25.228 is explicitly limited to ESIMs transmitting to GSO FSS satellites, and the Commission sought comment on revising the language of the rule to apply to Ku-band ESIMs communicating with NGSO FSS space stations as well.<sup>173</sup> Additionally, in the 14.0-14.2 GHz (Earth-to-space) band, there is a secondary allocation to the Space Research service. In order to ensure compatibility with Space Research operations, the Commission sought comment on modifying section 25.228(j) to extend to NGSO FSS systems conditions that currently apply to ESIM operation with GSO FSS space stations.<sup>174</sup> CORF asserts that since radio astronomy observatories are just as vulnerable to interference from NGSO uplinks as from GSO uplinks, the Commission should modify the text of section 25.228(j) to apply the same coordination requirement to NGSO operators.<sup>175</sup> Viasat agrees with the Commission and CORF that such a requirement would be reasonable.<sup>176</sup> We adopt the revision.

59. *Section 25.103.* Consistent with these changes, the Commission proposed to amend the definitions of Earth Stations on Vessels, Vehicle-Mounted Earth Stations, and Earth Stations Aboard Aircraft in section 25.103, which restrict communications to “geostationary-orbit FSS space stations.”<sup>177</sup> Pursuant to what was described above, Earth Stations on Vessels, Vehicle-Mounted Earth Stations, and Earth Stations Aboard Aircraft would also be permitted to operate in NGSO FSS systems. Accordingly, the Commission sought comment on removing the word “geostationary-orbit” from these definitions. No commenters objected to this change, and we adopt it herein.

60. *Additional conforming changes.* Pursuant to changes to part 25 of the Commission’s rules in another proceeding,<sup>178</sup> we take this opportunity to eliminate cross-references to section 25.223, which has been removed and reserved. Specifically, we delete the cross references in sections 25.103,

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<sup>169</sup> *GSO ESIM Report & Order*, 33 FCC Rcd 9327.

<sup>170</sup> See Appendix B (setting forth amendments adopted herein to 47 CFR § 25.228(e)) (emphasis added). Because this change is editorial and non-substantive, we find good cause to conclude that notice and comment are unnecessary for its adoption. See 5 U.S.C. § 553(b)(B).

<sup>171</sup> Kepler NPRM Comments at 2.

<sup>172</sup> See also Kepler NPRM Comments at 2.

<sup>173</sup> *ESIMs NGSO NPRM*, 33 FCC Rcd at 11421, para. 19.

<sup>174</sup> *Id.* at 11419, para. 9.

<sup>175</sup> CORF NPRM Comments at 11.

<sup>176</sup> Viasat NPRM Reply Comments at 7-8.

<sup>177</sup> *ESIMs NGSO NPRM*, 33 FCC Rcd at 11421, para. 20; 47 CFR § 25.103.

<sup>178</sup> *Spectrum Frontiers Third Report and Order*, 33 FCC Rcd 5576 (2018).

*Routine processing or licensing*, 25.115(g)(1)(vii), and 25.209(f).<sup>179</sup> Further, we add text in section 25.218(a) and (j) to incorporate the 24.75-25.25 GHz band that had been included in the now reserved section 25.138.<sup>180</sup>

61. Additionally, we take this opportunity to harmonize the language of the revisions to section 25.115(l)(3)(i)-(n)(3)(i) adopted in the *GSO ESIMs Report & Order and FNPRM* with the text of that decision.<sup>181</sup> Specifically, in the *GSO ESIMs Report & Order and FNPRM*, we stated that sections 25.115(l)(3)(i)-(n)(3)(i) would require all applicants to “provide a certification that the ESIM system is capable of detecting and automatically ceasing emissions when an individual ESIM transmitter exceeds the relevant off-axis EIRP spectral density limits specified in section 25.218, or the limits provided to the target satellite operator for operation under section 25.220.”<sup>182</sup> However, in the text of the rules, we stated that an application would need to certify that “an individual ESIM transmitter ” meets these requirements.<sup>183</sup> The revisions here conform the text of the rule to the language of the *Order* regarding “systems,” and therefore they are editorial and non-substantive changes.<sup>184</sup>

#### IV. FURTHER NOTICE OF PROPOSED RULEMAKING

62. In this *Further Notice*, we seek further comment on the Commission’s proposal to allow ESIMs to communicate with NGSO FSS space stations in the 28.35-28.6 GHz band. On May 4, 2020, Verizon and US Cellular filed an *ex parte* raising concerns regarding potential interference from out-of-band emissions of ESIMs in the 28.35-28.6 GHz band into the adjacent 27.5-28.35 GHz band used by UMFUS.<sup>185</sup> We believe this issue merits further discussion and expansion of the record. Therefore, we ask whether the current out-of-band emission limits in section 25.202(f) would be sufficient to protect UMFUS operations in the 27.5-28.35 GHz band. We also ask for comments on what level of interference generated by out-of-band emissions from ESIM operations with NGSO space stations above 28.35 GHz would be acceptable for UMFUS receivers operating immediately below 28.35 GHz, while at the same time not unduly constraining ESIM operations above 28.35 GHz. We seek comment on whether UMFUS receivers have been designed to account for the interference environment created by pre-existing operations in adjacent bands.<sup>186</sup> We also request comment on whether UMFUS operators are developing equipment characteristics that make them less susceptible to unwanted energy generated by adjacent band users, and thus more compatible with such users.

63. The out-of-band emissions limit for UMFUS licensees is -13 dBm/MHz measured either

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<sup>179</sup> Because these changes are editorial and non-substantive, we find good cause to conclude that notice and comment are unnecessary for their adoption. See 5 U.S.C. § 553(b)(B).

<sup>180</sup> In the *Spectrum Frontiers Third Report and Order*, the Commission amended section 25.138 of the Commission’s rules to include the 24.75-25.25 GHz band vis-à-vis GSO FSS earth station licensing requirements. 33 FCC Rcd 5576. Based on the timing of rules becoming effective, that section was subsequently “reserved” in the Code of Federal Regulations. See *GSO ESIM Report & Order*, 33 FCC Rcd 9327, 33 FCC Rcd at Appendix B. Therefore, bringing the adopted edits into the appropriate rule section is a simple ministerial update. As such, we find good cause to conclude that notice and comment are unnecessary for their inclusion. See 5 U.S.C. § 553(b)(B).

<sup>181</sup> *GSO ESIMs Report & Order and FNPRM*, 33 FCC Rcd at 9351, para. 75.

<sup>182</sup> *Id.* (emphasis added).

<sup>183</sup> See, e.g., 47 CFR § 25.115(l)(3)(i)

<sup>184</sup> See Appendix B, Final Rules.

<sup>185</sup> See Verizon May 4 *Ex Parte* Letter. In response to Verizon’s May 4 *Ex Parte* Letter, other parties filed *ex partes* in opposition. See SES Americom, Inc. and O3b Limited, Inmarsat, Inc., Hughes Network Systems, LLC, and EchoStar Satellite Services, L.L.C. May 6 *Ex Parte* Letter; Viasat May 6 *Ex Parte* Letter.

<sup>186</sup> Currently, ESIMs can operate with GSO space stations using the 28.35-28.6 GHz band.

as conductive or total radiated power.<sup>187</sup> We seek comment on whether ESIM operations should be required to meet this limit below 28.35 GHz. Further, given that ESIM operations require highly directive antennas, should the out-of-band emissions limit be specified as an EIRP limit?

64. We seek comment on whether typical ESIM operations meeting the out-of-band limits in section 25.202(f) produce interference above these acceptable levels.<sup>188</sup> We note that the emissions below 28.35 GHz under the part 25 rule depends on the ESIMs transmit power and channel bandwidth whereas the UMFUS limit is a set limit.

65. Next, if acceptable levels of interference are exceeded what measures should be taken to ensure out-of-band emissions are appropriately limited? We seek comment on whether a sufficiently wide guard band could serve to protect UMFUS receivers. If a guard band could serve to protect UMFUS receivers, we ask for comment on how wide this guard band should be. Further, we seek comment on whether a guard band would be applicable only in certain ESIM operational scenarios (i.e. VMES, ESAA on the ground, ESV in a port).

66. Additionally, we seek comment on whether setting a minimum elevation angle for ESIM operations with NGSO FSS space stations would be an effective way of achieving the desired balance between protecting UMFUS operations without over constraining FSS operations above 28.35 GHz. Alternatively, when transmitting to a NGSO FSS space station, should we limit the ESIM out-of-band EIRP density towards the horizon or within a certain range of elevation angles?

67. Finally, we seek comment on whether aggregation of interference, including that from clutter reflections, should be considered, or is interference likely to be determined by the strongest (closest) interfering source. Given that ESIMs and UMFUS transmitters will likely differ in terms of antenna patterns, heights, and pointing directions, how would aggregate interference from ESIMs differ from that caused by adjacent UMFUS licensees? If aggregate interference is a significant issue, what assumptions should be made in modeling aggregate interference for various use cases of ESIMs?

## V. PROCEDURAL MATTERS

68. *Ex Parte Procedures.* The proceeding this *FNPRM* initiates shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.<sup>189</sup> Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter’s written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with section 1.1206(b). In proceedings governed by section 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and

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<sup>187</sup> 47 CFR § 30.203.

<sup>188</sup> We also note that there is currently an open Commission proceeding that proposes to replace the out-of-band emissions limits in section 25.202(f) with those in Recommendation ITU-R SM.1541-6. *Further Streamlining Part 25 Rules Governing Satellite Services*, Notice of Proposed Rulemaking, 33 FCC Rcd 11502, 11507-08, paras. 18-19 (2018).

<sup>189</sup> 47 CFR §§ 1.1200 *et seq.*



memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

69. *Comment Filing Requirements.* Pursuant to sections 1.415 and 1.419 of the Commission's rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- *Electronic Filers.* Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs>.
- *Paper Filers.* Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701. U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12<sup>th</sup> Street, SW, Washington DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. See FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy, Public Notice, DA 20-304 (March 19, 2020). <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>
- *People with Disabilities:* To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an email to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice) or 202-418-0432 (TTY).

70. *Final Regulatory Flexibility Analysis.* Pursuant to the Regulatory Flexibility Act of 1980, as amended, 5 U.S.C. § 601 *et seq.* (RFA), the Commission's Final Regulatory Flexibility Analysis (FRFA) on the possible significant economic impact on small entities of the policies and rules addressed in this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315, is attached as Appendix C. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket 18-315, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).

71. *Initial Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act of 1980, as amended, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) for this Further Notice, of the possible significant economic impact on small entities of the policies and rules addressed in this document. The IRFA is set forth as Appendix E. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the

deadlines for comments on the Notice provided on or before the dates indicated on the first page of this Notice. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of the Further Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.

72. *Paperwork Reduction Act.* This document does not contain new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified information collection burden for small business concerns with fewer than 25 employees, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4).

73. *Congressional Review Act.* The Commission has determined, and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs that these rules are non-major under the Congressional Review Act, 5 U.S.C. § 804(2). The Commission will send a copy of this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket 18-315 and *Further Notice of Proposed Rulemaking* to Congress and the Government Accountability Office pursuant to 5 U.S.C. § 801(a)(1)(A).

## VI. ORDERING CLAUSES

74. IT IS ORDERED, pursuant to sections 4(i), 7(a), 303, 308(b), and 316 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157(a), 303, 308(b), 316, that this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 IS ADOPTED, the policies, rules, and requirements discussed herein ARE ADOPTED, and parts 2 and 25 of the Commission's rules ARE AMENDED as set forth in Appendix B.

75. IT IS FURTHER ORDERED that the rules and requirements adopted in the *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 WILL BECOME EFFECTIVE 30 days from the date of publication in the Federal Register.

76. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 and *Further Notice of Proposed Rulemaking*, including the Final and Initial Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

77. IT IS FURTHER ORDERED that the Commission, SHALL SEND a copy of this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 to Congress and the Government Accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

**APPENDIX A****List of Commenters****ESIM GSO FSS FNPRM (IB Docket No. 17-95)****Commenters**

The Boeing Company (Boeing)

Fixed Wireless Communications Coalition (FWCC)

Hughes Network System, LLC

Inmarsat Inc.

National Academy of Sciences' Committee on Radio Frequencies (CORF)

Panasonic Avionics Corp (Panasonic)

SES Americom, Inc., O3B Limited, and Intelsat License LLC (SES, O3b, and Intelsat)

Viasat, Inc.

**Reply Commenters**

The Boeing Company (Boeing)

Fixed Wireless Communications Coalition, Inc. (FWCC)

Iridium Satellite LLC (Iridium)

SES Americom, Inc., O3B Limited, and Intelsat License LLC (SES, O3b, and Intelsat)

Viasat, Inc.

**ESIM NGSO FSS NPRM (IB Docket No. 18-315)****Commenters**

The Boeing Company (Boeing)

Echostar Satellite Operating Corp. and Hughes Network System, LLC (Echostar)

ESIM Coalition (The Boeing Company, Kymeta Corporation, SES Americom, Inc. & O3b Limited, Panasonic Avionics Corporation, Telesat Canada, WorldVu Satellites Limited, and Kepler Communications Inc.)

Eutelsat SA

Kepler Communications Inc.

Kymeta Corp.

National Academy of Sciences' Committee on Radio Frequencies (CORF)

SES Americom, Inc. and O3B Limited (SES and O3b)

T-Mobile USA, Inc.

Viasat, Inc.

WorldVu Satellites Limited (OneWeb)

**Reply Commenters**

The Boeing Company (Boeing)

Intelsat License LLC

Iridium Communications, Inc.

MDS Operations, Inc. and RS Access, LLC (MDS Operations)

MVDDS 5G Coalition

SES Americom, Inc. and O3B Limited (SES and O3b)

Telesat Canada

Viasat, Inc.

WorldVu Satellites Limited (OneWeb)

**Ex Parte Filers**

CTIA – The Wireless Association

Kuiper Systems LLC

SES Americom, Inc. and O3b Limited, Inmarsat, Inc., Hughes Network Systems, LLC, and EchoStar Satellite Services

Speedcast Americas Inc.

Verizon and US Cellular

Viasat Inc.

**APPENDIX B****Final Rules**

The Federal Communications Commission amends title 47 of the Code of Federal Regulations, parts 2 and 25 as follows:

**PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS**

1. The authority citation for part 2 continues to read as follows:

Authority: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

- a. Pages 52 and 53 are revised.

- b. In the list of Non-Federal Government (NG) footnotes, footnote NG527A is revised.

**§ 2.106 Table of Frequency Allocations.**

The revisions and additions read as follows:

\* \* \* \* \*

15.63-15.7 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION			15.63-15.7 RADIOLOCATION 5.511E 5.511F US511E AERONAUTICAL RADIONAVIGATION US260 US211	15.63-15.7 AERONAUTICAL RADIONAVIGATION US260  US211 US511E	Aviation (87)
15.7-16.6 RADIOLOCATION 5.512 5.513			15.7-16.6 RADIOLOCATION G59	15.7-17.2 Radiolocation	Private Land Mobile (90)
16.6-17.1 RADIOLOCATION Space research (deep space) (Earth-to-space) 5.512 5.513			16.6-17.1 RADIOLOCATION G59 Space research (deep space) (Earth-to-space)		
17.1-17.2 RADIOLOCATION 5.512 5.513			17.1-17.2 RADIOLOCATION G59		
17.2-17.3 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) 5.512 5.513 5.513A			17.2-17.3 EARTH EXPLORATION- SATELLITE (active) RADIOLOCATION G59 SPACE RESEARCH (active)	17.2-17.3 Earth exploration-satellite (active) Radiolocation Space research (active)	
17.3-17.7 FIXED-SATELLITE (Earth-to- space) 5.516 (space-to-Earth) 5.516A 5.516B Radiolocation 5.514	17.3-17.7 FIXED-SATELLITE (Earth-to- space) 5.516 BROADCASTING-SATELLITE Radiolocation 5.514 5.515	17.3-17.7 FIXED-SATELLITE (Earth-to- space) 5.516 Radiolocation 5.514	17.3-17.7 Radiolocation US259 G59  US402 G117	17.3-17.7 FIXED-SATELLITE (Earth-to- space) US271 BROADCASTING-SATELLITE US402 NG163 US259	Satellite Communications (25)
17.7-18.1 FIXED FIXED-SATELLITE (space-to- Earth) 5.484A (Earth-to-space) 5.516 MOBILE	17.7-17.8 FIXED FIXED-SATELLITE (space-to- Earth) 5.517 (Earth-to-space) 5.516 BROADCASTING-SATELLITE Mobile 5.515	17.7-18.1 FIXED FIXED-SATELLITE (space-to- Earth) 5.484A (Earth-to-space) 5.516 MOBILE	17.7-17.8  US334 G117	17.7-17.8 FIXED FIXED-SATELLITE (Earth-to- space) US271 US334	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
	17.8-18.1 FIXED FIXED-SATELLITE (space-to- Earth) 5.484A (Earth-to-space) 5.516 MOBILE 5.519		17.8-18.3 FIXED-SATELLITE (space- to- Earth) US334 G117	17.8-18.3 FIXED Fixed-satellite (space-to-Earth)	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
18.1-18.4 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B (Earth-to-space) 5.520			US519 18.3-18.6	US334 US519 NG527A 18.3-18.6	

MOBILE 5.519 5.521	FIXED-SATELLITE (space- to- Earth) US334 G117	FIXED-SATELLITE (space-to- Earth) NG527A	Satellite Communications (25)
18.4-18.6 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B MOBILE	US139	US139 US334	Page 52

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B MOBILE except aeronautical mobile Space research (passive) 5.522A 5.522C	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.522B MOBILE except aeronautical mobile SPACE RESEARCH (passive) 5.522A	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B MOBILE except aeronautical mobile Space research (passive) 5.522A	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) US255 US334 G117 SPACE RESEARCH (passive)  US139 US254	18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) US255 NG164 NG527A SPACE RESEARCH (passive)  US139 US254 US334	Satellite Communications (25)
18.8-19.3 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.523A MOBILE	5.516B 5.523A		18.8-20.2 FIXED-SATELLITE (space-to-Earth) US334 G117	18.8-19.3 FIXED-SATELLITE (space-to-Earth) NG165 NG527A US139 US334	
19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.523B 5.523C 5.523D 5.523E MOBILE	5.523B 5.523C 5.523D 5.523E			19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) NG166  US334 NG527A	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Mobile-satellite (space-to-Earth)  5.524	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A MOBILE-SATELLITE (space-to-Earth)  5.524 5.525 5.526 5.527 5.528 5.529	19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A Mobile-satellite (space-to-Earth)  5.524		19.7-20.2 FIXED-SATELLITE (space-to-Earth) NG527A MOBILE-SATELLITE (space-to-Earth)  5.525 5.526 5.527 5.528 5.529 US334	Satellite Communications (25)
20.1-20.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.484B 5.516B 5.527A MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528	5.484A 5.484B 5.516B 5.527A		US139		
20.2-21.2 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth)  5.524			20.2-21.2 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-	20.2-21.2 Standard frequency and time signal-satellite (space-to-Earth)	



			Earth) G117		
21.2-21.4 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive)			21.2-21.4 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) US532		Fixed Microwave (101)
21.4-22 FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530A 5.530B 5.530D	21.4-22 FIXED MOBILE 5.530A	21.4-22 FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530A 5.530B 5.530D 5.531	21.4-22 FIXED MOBILE		

\* \* \* \* \*

**NON-FEDERAL GOVERNMENT (NG) FOOTNOTES**

\* \* \* \* \*

NG527A Earth Stations in Motion (ESIMs), as regulated under 47 CFR part 25, are an application of the fixed-satellite service (FSS) and the following provisions shall apply:

(a) In the bands 10.7-11.7 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz (space-to-Earth), ESIMs may be authorized for the reception of FSS emissions from geostationary and non-geostationary satellites, subject to the conditions that these earth stations may not claim protection from transmissions of non-Federal stations in the fixed service and that non-geostationary-satellite systems not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(b) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with geostationary satellites on a primary basis.

(c) In the bands 11.7-12.2 GHz (space-to-Earth), 14.0-14.5 GHz (Earth-to-space), 18.3-18.6 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.4-28.6 GHz (Earth-to-space), and 29.5-30.0 GHz (Earth-to-space), ESIMs may be authorized to communicate with non-geostationary satellites, subject to the condition that non-geostationary-satellite systems may not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(d) In the band 17.8-18.3 GHz (space-to-Earth), ESIMs may be authorized for the reception of FSS emissions from geostationary and non-geostationary satellites on a secondary basis, subject to the condition that non-geostationary-satellite systems not cause unacceptable interference to, or claim protection from, geostationary-satellite networks.

(e) In the bands 18.8-19.3 GHz and 28.6-29.1 GHz, ESIMs may be authorized to communicate with geostationary and non-geostationary satellites, subject to the condition that geostationary-satellite networks may not cause unacceptable interference to, or claim protection from, non-geostationary satellite systems in the fixed-satellite service.

**PART 25 – SATELLITE COMMUNICATIONS**

The Federal Communications Commission proposes to amend title 47, part 25 of the Code of Federal Regulations as follows:

3. The authority citation for part 25 continues to read as follows:

Authority: 47 U.S.C. 154, 301, 302, 303, 307, 309, 310, 319, 332, 605, and 721, unless otherwise noted.

4. In § 25.103, revise the definitions of Earth Station on Vessel, Earth Stations Aboard Aircraft, Routine processing or licensing, and Vehicle-Mounted Earth Station as shown below.

§ 25.103 Definitions.

\* \* \* \* \*

*Earth Station Aboard Aircraft (ESAA).* An earth station operating aboard an aircraft that receives from

and transmits to Fixed-Satellite Service space stations.

\* \* \* \* \*

*Earth Station on Vessel (ESV).* An earth station onboard a craft designed for traveling on water, receiving from and transmitting to Fixed-Satellite Service space stations.

\* \* \* \* \*

*Routine processing or licensing.* Expedited processing of unopposed applications for earth stations in the FSS communicating with GSO space stations that satisfy the criteria in § 25.211(d), § 25.212(c), § 25.212(d), § 25.212(e), § 25.212(f), or § 25.218, include all required information, are consistent with all Commission rules, and do not raise any policy issues. Some, but not all, routine earth station applications are eligible for an autogrant procedure under § 25.115(a)(3).

\* \* \* \* \*

*Vehicle-Mounted Earth Station (VMES).* An earth station, operating from a motorized vehicle that travels primarily on land, that receives from and transmits to Fixed-Satellite Service space stations and operates within the United States.

4. Amend section 25.115 by revising paragraphs (f) (g)(1)(vii), (l)(3)(i), (m)(3)(i), and (n)(3)(i), and adding paragraph (o) to read as follows:

§ 25.115 Applications for earth station authorizations.

\* \* \* \* \*

(f) NGSO FSS earth stations in 10.7-30.0 GHz. (1) An application for an NGSO FSS earth station license in the 10.7-30.0 GHz band must include the certification described in §25.146(a)(2).

(2) Individual or blanket license applications may be filed for operation in the 10.7-12.7 GHz, 14-14.5 GHz, 17.8-18.6 GHz, 18.8-19.4 GHz, 19.6-20.2 GHz, 28.35-29.1 GHz, or 29.5-30.0 GHz bands; however, ESIMs cannot operate in the 28.35-28.4 GHz band and blanket licensing in the 10.7-11.7 GHz, 17.8-18.3 GHz, 19.3-19.4 GHz, and 19.6-19.7 GHz bands is on an unprotected basis with respect to current and future systems operating in the fixed service.

(3) Individual license applications only may be filed for operation in the 12.75-13.15 GHz, 13.2125-13.25 GHz, 13.75-14 GHz, or 27.5-28.35 GHz bands.

\* \* \* \* \*

(g) \* \* \*

(1) \* \* \*

(vii) The relevant off-axis EIRP density envelopes in § 25.218 must be superimposed on plots submitted pursuant to paragraphs (g)(1)(i) through (vi) of this section.

\* \* \* \* \*

(l) \* \* \*

(3) \* \* \*

(i) ESIM applicants that meet the relevant off-axis EIRP density mask must certify that an ESIM system is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. ESIM applicants that do not meet the relevant off-axis EIRP density mask must provide a detailed showing that an ESIM system is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. Variable-power ESIM applicants must certify that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off axis EIRP densities of the transmitter or transmitters exceed the relevant off-axis EIRP density limits.

\* \* \* \* \*

(m) \* \* \*

(3) \* \* \*

(i) ESIM applicants that meet the relevant off-axis EIRP density mask must certify that an ESIM system is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. ESIM applicants that do not meet the relevant off-axis EIRP density mask must provide a detailed showing that an ESIM system is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. Variable-power ESIM applicants must certify that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off axis EIRP densities of the transmitter or transmitters exceed the relevant off-axis EIRP density limits.

\* \* \* \* \*

(n) \* \* \*

(3) \* \* \*

(i) ESIM applicants that meet the relevant off-axis EIRP density mask must certify that an ESIM system is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. ESIM applicants that do not meet the relevant off-axis EIRP density mask must provide a detailed showing that an ESIM system is self-monitoring and capable of automatically ceasing or reducing emissions within 100 milliseconds if the ESIM transmitter exceeds the relevant off-axis EIRP density limits. Variable-power ESIM applicants must certify that one or more transmitters are capable of automatically ceasing or reducing emissions within 100 milliseconds of receiving a command to do so from the system's network control and monitoring center, if the aggregate off axis EIRP densities of the transmitter or transmitters exceed the relevant off-axis EIRP density limits.

\* \* \* \* \*

(o) The requirements in this paragraph apply to applications for ESIMs operation with NGSO satellites in the Fixed-Satellite Service, in addition to the requirements in paragraphs (a)(1), (a)(5), and (i) of this section:

- (1) An exhibit describing the geographic area(s) in which the ESIMs will operate and the location of hub and/or gateway stations.
- (2) The point of contact information referred to in § 25.228(e)(2), (f), or (g)(1) as appropriate.
- (3) Applicants for ESIMs that will exceed the guidelines in § 1.1310 of this chapter for radio frequency radiation exposure must provide, with their environmental assessment, a plan for mitigation of radiation exposure to the extent required to meet those guidelines.

\* \* \* \* \*

5. In § 25.202, revise paragraph (a)(8) and (a)(10) to read as follows and remove and reserve paragraph (a)(11):

§ 25.202 Frequencies, frequency tolerance, and emission limits.

(a) \* \* \*

\* \* \* \* \*

(a)(8) The following frequencies are available for use by Earth Stations on Vessels (ESVs) communicating with GSO FSS space stations, subject to the provisions in § 2.106 of this chapter:  
 3700-4200 MHz (space-to-Earth)  
 5925-6425 MHz (Earth-to-space)

\* \* \*

(a)(10)

(i) The following frequencies are available for use by Earth Stations in Motion (ESIMs) communicating with GSO FSS space stations, subject to the provisions in § 2.106 of this chapter:

10.7-11.7 GHz (space-to-Earth)  
 11.7-12.2 GHz (space-to-Earth)  
 14.0-14.5 GHz (Earth-to-space)  
 17.8-18.3 GHz (space-to-Earth)  
 18.3-18.8 GHz (space-to-Earth)  
 18.8-19.3 GHz (space-to-Earth)  
 19.3-19.4 GHz (space-to-Earth)  
 19.6-19.7 GHz (space-to-Earth)  
 19.7-20.2 GHz (space-to-Earth)  
 28.35-28.6 GHz (Earth-to-space)  
 28.6-29.1 GHz (Earth-to-space)  
 29.25-30.0 GHz (Earth-to-space)

(ii) The following frequencies are available for use by Earth Stations in Motion (ESIMs) communicating with NGSO FSS space stations, subject to the provisions in § 2.106 of this chapter:

10.7-11.7 GHz (space-to-Earth)  
 11.7-12.2 GHz (space-to-Earth)  
 14.0-14.5 GHz (Earth-to-space)  
 17.8-18.3 GHz (space-to-Earth)  
 18.3-18.6 GHz (space-to-Earth)  
 18.8-19.3 GHz (space-to-Earth)  
 19.3-19.4 GHz (space-to-Earth)  
 19.6-19.7 GHz (space-to-Earth)

19.7-20.2 GHz (space-to-Earth)  
28.4-28.6 GHz (Earth-to-space)  
28.6-29.1 GHz (Earth-to-space)  
29.5-30.0 GHz (Earth-to-space)

(a)(11) [Reserved]

6. In section 25.209, revise paragraphs (f) to read as follows:

§ 25.209 Earth station antenna performance standards.

\* \* \* \* \*

(f) A GSO FSS earth station with an antenna that does not conform to the applicable standards in paragraphs (a) and (b) of this section will be authorized only if the applicant demonstrates that the antenna will not cause unacceptable interference. This demonstration must show that the transmissions of the earth station comport with the requirements in § 25.218 or the applicant must demonstrate that the operations of the earth station have been coordinated under § 25.220.

7. In section 25.218, revise paragraphs (a) and (j) introductory text to read as follows:

§ 25.218 Off-axis EIRP density envelopes for FSS earth stations transmitting in certain frequency bands.

(a) This section applies to applications for fixed and temporary-fixed FSS earth stations transmitting to geostationary space stations in the conventional C-band, extended C-band, conventional Ku-band, extended Ku-band, conventional Ka-band, or 24.75-25.25 GHz and applications for ESIMs transmitting in the conventional C-band, conventional Ku-band, or conventional Ka-band, except for applications proposing transmission of analog command signals at a band edge with bandwidths greater than 1 MHz or transmission of any other type of analog signal with bandwidths greater than 200 kHz.

(j) Applications for authority for fixed earth station operation in the conventional C-band, extended C-band, conventional Ku-band, extended Ku-band, conventional Ka-band, or 24.75-25.25 GHz that do not qualify for routine processing under relevant criteria in this section, § 25.211, or § 25.212 are subject to the requirements in § 25.220.

8. Amend section 25.228 by revising (a), (b), (c), (e)(1), and the introductory text of paragraph (j) to read as follows:

§ 25.228 Operating and coordination requirements for earth stations in motion (ESIMs).

(a) GSO FSS ESIM transmissions must comport with the applicable EIRP density limits in § 25.218, unless coordinated pursuant to the requirements in § 25.220.

(b) Each FSS ESIM must be self-monitoring and, should a condition occur that would cause the ESIMs to exceed its authorized off-axis EIRP density limits in the case of GSO FSS ESIMs or any emission limits included in the licensing conditions in the case of NGSO FSS ESIMs, the ESIM must automatically cease transmissions within 100 milliseconds, and not resume transmissions until the condition that caused the ESIM to exceed those limits is corrected.

(c) Each FSS ESIM must be monitored and controlled by a network control and monitoring center (NCCM) or equivalent facility. Each ESIM must comply with a “disable transmission” command

from the NCMC within 100 milliseconds of receiving the command. In addition, the NCMC must monitor the operation of each ESIM in its network, and transmit a “disable transmission” command to any ESIM that operates in such a way as to exceed the authorized off-axis EIRP density limit for GSO FSS ESIMs or any emission limits included in the licensing conditions in the case of NGSO FSS ESIMs. The NCMC must not allow the ESIM(s) under its control to resume transmissions until the condition that caused the ESIM(s) to exceed the authorized EIRP density limits is corrected.

\* \* \*

(e) The following requirements govern all ESV operations.

- (1) ESV operators must control all ESVs by a NCMC or equivalent facility located in the United States, except that an ESV on U.S.-registered vessels may operate under control of a NCMC location outside the United States provided the ESV operator maintains a point of contact within the United States that will have the capability and authority to cause an ESV on a U.S.-registered vessel to cease transmitting if necessary.

\* \* \*

(j) The following requirements govern all ESIMs transmitting to GSO or NGSO satellites in the Fixed-Satellite Service in the 14.0-14.5 GHz band.

\* \* \* \* \*

## APPENDIX C

### Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act (RFA),<sup>190</sup> an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Further Notice of Proposed Rulemaking in the Matter of Comprehensive Review of Licensing and Operating Rules for Satellite Services (GSO ESIMs FNPRM)<sup>191</sup> and the Notice of Proposed Rulemaking (NGSO ESIMs NPRM).<sup>192</sup> The Commission sought written public comment on the proposals in the *GSO ESIMs FNPRM and the NGSO ESIMs NPRM*, including comment on the IRFA. No comments were received on the IRFAs. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.<sup>193</sup>

#### A. Need for, and Objectives of, the Rules

This *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket 18-315 adopts changes to parts 2 of the Commission's rules, which governs frequency allocations, and 25 of the Commission's rules, which governs licensing and operation of space stations and earth stations for the provision of satellite communication services.<sup>194</sup> We revise the rules to, among other things, facilitate the deployment of Earth Stations in Motion (ESIMs) and reduce the regulatory burdens on those ESIMs by streamlining the rules governing ESIMs, eliminating redundant and unnecessary regulations, expanding the frequency bands licensed by ESIMs regulations, and consolidating regulations where possible.

This *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket 18-315 revises the Table of Frequency Allocations in part 2 of the rules and multiple sections of part 25 of the rules. Specifically, it revises the rules to:

- 1) Allow ESIMs to operate in all of the frequency bands in which earth stations at fixed locations operating in GSO FSS satellite networks can be blanket-licensed to include the ranges 10.7-10.95 GHz and 11.2-11.45 GHz (space-to-Earth) on an unprotected basis with respect to other services;
- 2) Allow ESIMs to receive signals from GSO FSS satellite space stations on a secondary basis in the 17.8-18.3 GHz band and, on a primary basis, in the 19.3-19.4 and 19.6-19.7 GHz band;
- 3) Allow ESIMs to operate in GSO FSS satellite networks in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands on an unprotected, non-interference basis with respect to NGSO FSS satellite systems;
- 4) Establish a regulatory framework for ESIMs communications with NGSO FSS systems that is analogous to that which currently exists for ESIMs communicating with GSO FSS systems.
- 5) Allow ESIMs to communicate with NGSO FSS systems in many of the same conventional Ku-band, extended Ku-band, and Ka-band frequencies for communications with GSO ESIMs, with the exception of the frequency bands 18.6-18.8 GHz and 29.25-29.5 GHz;

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<sup>190</sup> See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996) (CWAAA).

<sup>191</sup> *GSO ESIMs FNPRM*, 33 FCC Rcd at 9400-01, Appendix F.

<sup>192</sup> *NGSO ESIMs NPRM*, 33 FCC Rcd at 11429-30, Appendix B.

<sup>193</sup> See 5 U.S.C. § 604.

<sup>194</sup> 47 C.F.R. Part 25, Satellite Communications.



- 6) Extend blanket earth station licensing, which is available to ESIMs communicating with GSO FSS systems, to ESIMs communicating with NGSO FSS systems;
- 7) Revise specific provisions to implement these changes;
- 8) Update and improve definitions.

**B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA**

No party filing comments in this proceeding responded to the IRFAs, and no party filing comments in these proceedings otherwise argued that the policies and rules proposed in these proceedings would have a significant economic impact on a substantial number of small entities. The Commission has, nonetheless, considered any potential significant economic impact that the rule changes may have on the small entities which are impacted. On balance, the Commission believes that the economic impact on small entities will be positive rather than negative, and that the rule changes move to ensure the accuracy of part 2 and streamline the part 25 requirements.

**C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration**

Pursuant to the Small Business Jobs Act of 2010, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration, and to provide a detailed statement of any change made to the proposed rules as a result of those comments.<sup>195</sup> The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

**D. Description and Estimate of the Number of Small Entities to Which the Rules May Apply**

The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the rules adopted herein.<sup>196</sup> The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”<sup>197</sup> In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.<sup>198</sup> A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>199</sup> Below, we describe and estimate the number of small entity licensees that may be affected by the adopted rules.

***Satellite Telecommunications.*** This category comprises firms “primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications.”<sup>200</sup> Satellite telecommunications service providers include satellite and earth station operators. The category has a small business size standard of \$35 million or less in average

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<sup>195</sup> 5 U.S.C. § 604(a)(3).

<sup>196</sup> 5 U.S.C. § 604(a)(3).

<sup>197</sup> 5 U.S.C. § 601(6).

<sup>198</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of “small business concern” in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.” 5 U.S.C. § 601(3).

<sup>199</sup> Small Business Act, 15 U.S.C. § 632 (1996).

<sup>200</sup> U.S. Census Bureau, 2017 NAICS Definitions, “517410 Satellite Telecommunications”; <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517410&search=2017+NAICS+Search&search=2017>.

annual receipts, under SBA rules.<sup>201</sup> For this category, U.S. Census Bureau data for 2012 show that there were a total of 333 firms that operated for the entire year.<sup>202</sup> Of this total, 299 firms had annual receipts of less than \$25 million.<sup>203</sup> Consequently, we estimate that the majority of satellite telecommunications providers are small entities.

**All Other Telecommunications.** The “All Other Telecommunications” category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.<sup>204</sup> This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems.<sup>205</sup> Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.<sup>206</sup> The SBA has developed a small business size standard for All Other Telecommunications, which consists of all such firms with annual receipts of \$35 million or less.<sup>207</sup> For this category, U.S. Census Bureau data for 2012 shows that there were 1,442 firms that operated for the entire year.<sup>208</sup> Of those firms, a total of 1,400 had annual receipts less than \$25 million and 15 firms had annual receipts of \$25 million to \$49, 999,999.<sup>209</sup> Thus, the Commission estimates that the majority of “All Other Telecommunications” firms potentially affected by our action can be considered small.

We anticipate that our rule changes will have an impact on earth and space station applicants and licensees. Space station applicants and licensees, however, rarely qualify under the definition of a small entity. Generally, space stations cost hundreds of millions of dollars to construct, launch and operate. Consequently, we do not anticipate that any space station operators are small entities that would be affected by our actions.

This *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 extends the use of other frequency bands in which blanket-licensed FSS earth stations are permitted for ESIMs communicating with GSO FSS space stations. Additionally, this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 allows ESIMs to communicate with NGSO FSS space stations in the Ku- and Ka-bands. Consequently, this will reduce paperwork costs for such satellite operators who would no longer need to file separate application materials for these systems. Moreover, operators will no longer need to request waivers for operations that would be covered under specific regulations.

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<sup>201</sup> 13 CFR § 121.201, NAICS code 517410.

<sup>202</sup> U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ4, Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the United States: 2012, NAICS code 517410 [https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012\\_US/51SSSZ4//naics~517410](https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ4//naics~517410).

<sup>203</sup> *Id.*

<sup>204</sup> See U.S. Census Bureau, 2017 NAICS Definitions, NAICS Code “517919 All Other Telecommunications”, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517919&search=2017+NAICS+Search&search=2017>.

<sup>205</sup> *Id.*

<sup>206</sup> *Id.*

<sup>207</sup> See 13 CFR § 121.201, NAICS code 517919.

<sup>208</sup> U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ4, Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the United States: 2012, NAICS code 517919, [https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012\\_US/51SSSZ4//naics~517919](https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ4//naics~517919).

<sup>209</sup> *Id.*

**E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities**

The *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 adopts a number of rule changes that will affect reporting, recordkeeping and other compliance requirements for earth and space station operators. Most changes, as described below, will decrease the burden for all operators, especially firms that hold licenses to operate earth stations.

The *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 extends the use of other frequency bands in which blanket-licensed FSS earth stations are permitted for ESIMs communicating with GSO FSS space stations. The *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 also allows ESIMs to communicate with NGSO FSS space stations in the Ku- and Ka-bands. Additionally, the *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 expands routine licensing eligibility for ESIMs operations to include ESIMs communicating with NGSO FSS space stations in the Ku- and Ka-bands. This will reduce the economic and other impacts for these service providers by reducing the regulatory burden. Specifically, providers will no longer have to file applications that are outside of the standard rule provisions.

**F. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered**

The RFA requires an agency to describe any significant, specifically small business, alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): “(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rules for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.”<sup>210</sup>

The Commission is aware that some of the revisions may impact small entities. The *NGSO NPRM* and *GSO FNPRM* sought comment from all interested parties, and small entities were encouraged to bring to the Commission’s attention any specific concerns they may have with the proposals outlined in the *NPRM* and *FNPRM*. No commenters raised any specific concerns about the impact of the revisions on small entities. The revisions eliminate unnecessary requirements and expand routine processing to applications in additional frequency bands, among other changes. Together, the revisions in this *Second Report and Order* and *Report and Order* lessen the burden of compliance on small entities with more limited resources than larger entities.

The adopted changes for earth station licensing clarify requirements for routine licensing and expand applicability of routine licensing standards. Each of these changes will lessen the burden in the licensing process. Specifically, this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 adopts revisions that allow routine processing for ESIMs in such a way that applicant burden will be reduced. Thus, the revisions will ultimately lead to benefits for small earth station operators in the long-term.

**Report to Congress:** The Commission will send a copy of this *Second Report* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act.<sup>211</sup> In addition, the Commission will send a copy of this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315,

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<sup>210</sup> 5 U.S.C. § 603(c)(1)-(c)(4).

<sup>211</sup> See 5 U.S.C. § 801(a)(1)(A).

including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of this *Second Report and Order* in IB Docket No. 17-95 and *Report and Order* in IB Docket No. 18-315 and FRFA (or summaries thereof) will also be published in the Federal Register.<sup>212</sup>

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<sup>212</sup> See 5 U.S.C. § 604(b).

**APPENDIX D****Initial Regulatory Flexibility Analysis**

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>213</sup> the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in this Further Notice of Proposed Rulemaking (Further Notice). Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines specified in the *Notice* for comments. The Commission will send a copy of this Further Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).<sup>214</sup> In addition, the Further Notice and IRFA (or summaries thereof) will be published in the Federal Register.<sup>215</sup>

**A. Need for, and Objectives of, the Proposed Rules**

The Further Notice of Proposed Rulemaking proposes to further develop the record to determine the best option to deal with the potential interference from out-of-band emissions of ESIMs in the 28.35-28.6 GHz band into the adjacent 27.5-28.35 GHz band used by Upper Microwave Flexible Use Service (UMFUS), generated by ESIM transmissions to NGSO FSS space stations in frequencies above 28.35 GHz.

**B. Legal Basis**

The proposed action is authorized under Sections 1, 4(i), 301, 303, 307, 308, and 309 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 301, 303, 307, 308, and 309.

**C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules May Apply**

The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by adoption of proposed rules.<sup>216</sup> The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”<sup>217</sup> In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.<sup>218</sup> A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>219</sup> Below, we describe and estimate the number of small entity licensees that may be affected by adoption of the proposed rules.

***Satellite Telecommunications and All Other Telecommunications***

*Satellite Telecommunications.* This category comprises firms “primarily engaged in providing

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<sup>213</sup> See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 *et seq.*, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996, (SBREFA) Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996).

<sup>214</sup> See 5 U.S.C. § 603(a).

<sup>215</sup> *Id.*

<sup>216</sup> 5 U.S.C. § 604(a)(3).

<sup>217</sup> 5 U.S.C. § 601(6).

<sup>218</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of “small business concern” in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.” 5 U.S.C. § 601(3).

<sup>219</sup> Small Business Act, 15 U.S.C. § 632 (1996).

telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications.”<sup>220</sup> Satellite telecommunications service providers include satellite and earth station operators. The category has a small business size standard of \$35 million or less in average annual receipts, under SBA rules.<sup>221</sup> For this category, U.S. Census Bureau data for 2012 show that there were a total of 333 firms that operated for the entire year.<sup>222</sup> Of this total, 299 firms had annual receipts of less than \$25 million.<sup>223</sup> Consequently, we estimate that the majority of satellite telecommunications providers are small entities.

*All Other Telecommunications.* The “All Other Telecommunications” category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.<sup>224</sup> This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems.<sup>225</sup> Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.<sup>226</sup> The SBA has developed a small business size standard for “All Other Telecommunications”, which consists of all such firms with annual receipts of \$35 million or less.<sup>227</sup> For this category, U.S. Census Bureau data for 2012 show that there were 1,442 firms that operated for the entire year.<sup>228</sup> Of those firms, a total of 1,400 had annual receipts less than \$25 million and 15 firms had annual receipts of \$25 million to \$49, 999,999.<sup>229</sup> Thus, the Commission estimates that the majority of “All Other Telecommunications” firms potentially affected by our action can be considered small.

We estimate, however, that some space station applicants applying under part 25 of the Commission’s rules would qualify as small entities affected by these rule changes. If the Commission were to apply the bond requirement to amateur and experimental space station licensees, then additional small entities would be affected by the rule changes.

#### **D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities**

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<sup>220</sup> U.S. Census Bureau, *2017 NAICS Definitions*, “517410 Satellite Telecommunications”; <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517410&search=2017+NAICS+Search&search=2017>.

<sup>221</sup> 13 CFR § 121.201, NAICS code 517410.

<sup>222</sup> U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ4, *Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the United States: 2012*, NAICS Code 517410, [https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012\\_US/51SSSZ4//naics~517410](https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ4//naics~517410).

<sup>223</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard of annual receipts of \$35 million or less.

<sup>224</sup> See U.S. Census Bureau, *2017 NAICS Definitions*, “517919 All Other Telecommunications”, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517919&search=2017+NAICS+Search&search=2017>.

<sup>225</sup> *Id.*

<sup>226</sup> *Id.*

<sup>227</sup> See 13 CFR § 121.201, NAICS Code 517919.

<sup>228</sup> U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ4, *Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the United States: 2012*, NAICS Code 517919, [https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012\\_US/51SSSZ4//naics~517919](https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ4//naics~517919).

<sup>229</sup> *Id.*

The FNPRM proposes to develop the record on the level of interference generated by out-of-band emissions from ESIM operations with NGSO space stations above 28.35 GHz that would be acceptable for UMFUS receivers operating immediately below 28.35 GHz, while at the same time not unduly constraining FSS operations above 28.35 GHz. This would protect all users in the various bands and reduce paperwork costs for such satellite operators by establishing a mutually acceptable sharing environment.

**E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered**

The RFA requires an agency to describe any significant, specifically small business, alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): “(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rules for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.”<sup>230</sup>

The FNPRM seeks comment on whether setting a minimum elevation angle for ESIM operations with NGSO FSS space stations would be an effective way of achieving the desired balance between protecting UMFUS operations without over constraining FSS operations above 28.35 GHz. The FNPRM alternatively considers whether, when transmitting to a NGSO FSS space station, the Commission should limit the ESIM out-of-band e.i.r.p density towards the horizon or within a certain range of elevation angles. These changes may reduce the economic and other impacts for other service providers. However, the Commission invites comment on these options and any alternatives.

**F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rules**

None.

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<sup>230</sup> 5 U.S.C. § 603(c)(1)-(c)(4).

**STATEMENT OF  
COMMISSIONER MICHAEL O'RIELLY**

Re: *Amendment of Parts 2 and 35 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service, IB Docket No. 17-95; Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations, IB Docket No. 18-315.*

Earth stations in motion, or ESIMs, represent an exciting communications breakthrough. Depending on marketplace receptivity, they may vastly improve connectivity for Americans traveling by land, sea, or air; facilitate the advancement of autonomous cars; and enable new industrial and business applications — and do so cost-effectively. Today's efforts should help the development and deployment of these cutting-edge satellite systems.

Besides expanding the frequencies that can be used to transmit signals between ESIMs and GSO satellites, we authorize ESIMs to communicate with NGSO satellites, placing them on equal footing with GSO systems. By promoting technological neutrality, our action should promote investment and innovation in the satellite industry and throughout the broader communications sector.

While the promise of these large NGSO constellations and ESIMs seems boundless, we have virtually no record on whether their proliferation, which may be extensive, could cause harmful interference to adjacent terrestrial wireless systems in the 28 GHz band. Therefore, I am supportive of seeking further comment on whether the Commission's out of band emissions rules are adequate to ensure that NGSO ESIM communications will not interfere with wireless networks. It is unfortunate, however, that this issue was not raised in the original notice, and I look forward to its expeditious resolution.

I approve.