

**Before the  
Federal Communications Commission  
Washington, DC 20554**

|   |   |          |
|---|---|----------|
| In the Matter of                        | ) |          |
|   | ) |          |
| Astra Space Platform Services LLC       | ) |          |
|   | ) |          |
| Application for Authority to Launch and | ) | File No. |
| Operate a Non-Geostationary Orbit       | ) |          |
| Satellite System in the V-Band          | ) |          |

**APPLICATION FOR APPROVAL FOR ORBITAL DEPLOYMENT AND OPERATING  
AUTHORITY FOR THE ASTRA CONSTELLATION**

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November 4, 2021

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Astra Space Platform Services LLC (“Astra SPS”), an indirect wholly owned subsidiary of Astra Space, Inc. (“Astra Space”), in accordance with Section 25.137 of the Federal Communication Commission’s Rules, hereby requests authority to launch and operate a non-geostationary orbit (“NGSO”) satellite system using V-band frequencies (the “Astra Constellation”). This application is submitted in response to the Commission’s August 4, 2021 Public Notice initiating a new processing round for additional NGSO FSS applications and petitions for market access in this band.<sup>1</sup>

Consistent with the information required by the Commission’s rules, Astra SPS has also provided a completed Form 312, accompanying Schedule S, and Technical Attachment, which includes an Orbital Debris Mitigation Assessment. Astra SPS specifically seeks to include 37.5 - 39.5 GHz (space-to-Earth), 39.5 - 40.0 GHz (space-to-Earth), 40.0 - 42.0 GHz (space-to-Earth), and 47.2 - 50.2 GHz (Earth-to-space) and 50.4 - 51.4 GHz (Earth-to-space) to connect its space

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<sup>1</sup> See FCC Public Notice, “Cut-Off Established for Additional NGSO-Like Satellite Systems in the 37.5-40.0 GHz, 40.0-42.0 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz Bands,” Report No. SPB-288, DA 21-941 (released Aug. 4, 2021).

stations with end-user terminals in the U.S. and around the world, as well as with individually licensed gateway earth stations. These Fixed Satellite Services (“FSS”) and Mobile Satellite Services (“MSS”) bands are collectively referred to hereafter as the “V-band.” Grant of this application will allow Astra SPS to leverage the launch services of its affiliates to deploy the Astra Constellation and bring new opportunities for reliable, high-speed communications services to select enterprise, government, and institutional users and partners around the globe.

## **I. INTRODUCTION**

### **A. ASTRA SPACE PLATFORM SERVICES LLC. BACKGROUND**

Astra SPS is a Delaware limited liability company based in Alameda, California. Its parent, Astra Space f/k/a Holicity, Inc. (hereinafter, together with Astra SPS, “Astra”),<sup>2</sup> trades on the NASDAQ global select market under the ticker symbol: ASTR. Astra Space, when it was known as Holicity, Inc., was established as a special purpose acquisition company and it acquired Astra SPS’s indirect parent, Astra Space Operations, Inc. (“Astra SO”) effective June 30, 2021. Astra SPS is a new entity formed for the purpose of running Astra’s satellite services.

Astra’s mission is to “Improve Life on Earth from Space” by creating a healthier and more connected planet. Astra was founded in 2016 by space veterans Chris Kemp, former Chief Technology Officer at the National Aeronautics and Space Administration (“NASA”) and now Astra Chairman and Chief Executive Officer, and Dr. Adam London, who developed miniature rocket technology with NASA and DARPA sponsorship and now serves as Astra’s Chief Technology Officer. Within four years of its inception, Astra conducted its first flight to space in December 2020 from Kodiak, Alaska, making it the fastest company to reach space. Today,

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<sup>2</sup> Astra SPS’s direct parent is Astra Space Platform Holdings, LLC, a Delaware limited liability company (“Astra SPH”). Astra SPH’s direct parent is Astra Space Operations, Inc., a Delaware corporation (“Astra SO”). Astra Space is the sole stockholder of Astra SO.

Astra has more than fifty launches under contract with commercial companies and government agencies to deliver satellites to low-earth orbit (“LEO”).

With this FCC application, Astra will provide connectivity to a satellite constellation platform that will power a new generation of space-based services aligned with its stated mission to improve life on Earth from space. The Astra Constellation will provide global secure, high-bandwidth connectivity to enable communications services, environmental and natural resource applications, and national security missions. Given the financing secured through its recent public offering, vertically integrated launch capability, and space systems design and operations experience, Astra is well-positioned to develop this project and to introduce new space-based services, including communications solutions, while maintaining a safe space environment, utilizing spectrum efficiently and without causing harmful radiofrequency interference.

## **B. THE ASTRA CONSTELLATION**

The Astra Constellation as proposed would ultimately consist of as many as 13,620 operational LEO satellites, supported by a global network of gateway earth stations utilizing the identified V-band frequency bands for feeder links for space-to-earth transmit and receive. Commercial and government customers and partners will also utilize V-band for certain applications, particularly for select user links located in geographic areas that are less susceptible to rain and atmospheric fade. To support end-users located in other geographic areas, Astra may also explore the use of additional frequencies not referenced in this processing round and not a part of this application. Importantly, the Astra Constellation is being designed to gain maximum efficiencies from its use of the frequency bands permitted, while ensuring the ability to co-exist with other operators without harmful radiofrequency interference. Astra remains committed to collaborative operation of its constellation, both for radio frequencies and physical space

operations, and will seek to coordinate and collaborate to the greatest degree possible. The key space and ground components of the system are outlined below and in the accompanying Technical Attachment and Schedule S.

## 1. SPACE SEGMENT

The Space Segment portion of Astra's Constellation will be deployed in three phases and be distributed at equatorial, mid-inclination and sun-synchronous (SSO) altitudes, with an estimated operational lifetime of ten years. The Initial Deployment Phase of the Astra Constellation will feature a single equatorial plane comprised of 40 satellites operating at 700 km altitude, permitting certain early services to be offered in targeted locations. A second phase of 2,296 additional satellites distributed in a set of 56 mid-inclination planes at 700 km and 14 SSO planes at 690 km will permit global broadband services to customers located in all latitudes. A third phase will densify the constellation and enhance service capabilities globally with as many as 11,284 further satellites at two mid-inclination altitudes (390 km and 400 km) and one sun-synchronous plane at 380 km. Table 1 provides a summary of the three phases.

**Table 1. Astra Constellation Phases**

| Phase | Shell           | Altitude (km) | Inclination (deg.) | Number of Planes | Satellites per Plane | Satellites per Shell | Total Satellites in Phase |
|-------|-----------------|---------------|--------------------|------------------|----------------------|----------------------|---------------------------|
| 1.0   | Equatorial      | 700           | 0                  | 1                | 40                   | 40                   | 40                        |
| 2.0   | Sun-synch.      | 690           | 98                 | 14               | 36                   | 504                  | 2,296                     |
|       | 55° inclination | 700           | 55                 | 56               | 32                   | 1,792                |                           |
| 3.0   | Sun-synch.      | 380           | 97                 | 20               | 112                  | 2,240                | 11,284                    |
|       | 30° inclination | 390           | 30                 | 51               | 96                   | 4,896                |                           |
|       | 55° inclination | 400           | 55                 | 61               | 68                   | 4,148                |                           |

Astra intends to manufacture the spacecraft in-house, drawing upon engineering, design, and production expertise gained from Astra's ongoing development of small launch vehicles. The spacecraft will be equipped with on-board propulsion to undertake orbit-raising and end-of-life de-orbit maneuvers, as well as to carry out collision avoidance maneuvers as necessary. Astra plans to employ its own launch vehicles to deploy the Astra Constellation, capturing the benefits of vertical integration to build efficiencies and compress the time required for constellation services roll-out.

## **2. GROUND SEGMENT**

The Astra Constellation will efficiently and securely connect to end user terminals located at the site of commercial and government customers, and the Astra Constellation will route through gateway earth stations co-located with key access points to the Internet. Gateway and customer service links will utilize V-band frequencies. For customers located where weather disruption might degrade the quality of services delivered at higher frequencies Astra may also explore the use of additional frequencies not referenced in this processing round and not a part of this application. Satellite operations will be supported by tracking, telemetry, and control (“TT&C”) earth stations, with a primary satellite control facility located in the United States and with additional capability sited outside of the country. Astra will submit separate applications to the Commission for individual licenses for any U.S.-based gateway or TT&C, and for a blanket license for the associated end-user terminals, pursuant to Sections 25.115 and 25.136 of the commission’s Rules.<sup>3</sup>

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<sup>3</sup> See 47 C.F.R. §§ 25.115 and 25.136.

## **II. THE PUBLIC INTEREST WILL BE SERVED BY AUTHORIZING THE ASTRA CONSTELLATION**

Approval to operate the Astra Constellation would serve the public interest by adding innovative space-based connectivity for the U.S. marketplace and internationally. The ongoing COVID-19 pandemic has reinforced for every country the critical need for secure, high-speed Internet connectivity for its citizens, its government, its economy, and its society to thrive. The Commission has stepped in to spur new technologies and new deployments to bridge the connectivity gap that persists for many consumers, businesses and government activities across the United States. Last year, Acting FCC Chairwoman Jessica Rosenworcel, then a Commissioner, told Congress that the number of Americans without access high-speed broadband service was “as high as 42 million or even 162 million,” and that “as many as 16.9 million children fall into the Homework Gap.”<sup>4</sup>

Globally, the International Telecommunications Union (“ITU”) reports that Internet traffic increased by 30 percent during the 2019-2020 period, revealing notable shifts in traffic patterns as the world adapted to work from home and studying remotely as the pandemic took hold.<sup>5</sup> However, access to the powerful tool of connectivity continues to be uneven. The same ITU report reflected progress, with more than 90 percent of the urban population and more than 70 percent of the rural population in the world now being covered by mobile networks. Yet nearly half of the world’s population do not yet have access to the Internet, with 12 percent of the unconnected living in remote and rural locations that are well-suited for satellite solutions

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<sup>4</sup> Statement of Jessica Rosenworcel, Commissioner, Federal Communications Commission, before the Subcommittee on Communications & Technology, Committee on Energy and the Environment, U.S. House of Representatives, September 17, 2020.

<sup>5</sup> ITU Development Sector Report, Raul Katz and Juan Jung, “The Economic Impact of Broadband and Digitalization during the COVID Pandemic, Econometric Modelling,” at 3 (June 2021).

such as the Astra Constellation. Further, commercial and government operations increasingly demand secure and reliable broadband connectivity at remote sites, in the air, and at sea, supporting critical economic activity and national security.

Clearly, despite modest increases in the availability of service, connectivity gaps persist across the U.S. and globally, and the ITU has predicted that would cost nearly \$430 billion to close.<sup>6</sup> Astra believes its constellation will bring a far more affordable approach to rapidly deploy globally-available connectivity and adapt to ongoing innovations with its space-based connectivity platform. The Commission has long championed the introduction of new competitive service providers as a means not only to add to broadband service options for consumers, enterprise and government needs, but also to drive to ever-more affordable offerings and encourage technology innovation and investment.

Further, as the impacts of climate change continue to intensify, the Astra Constellation will add to the important benefits that space-based platforms can lend to reduced carbon footprints, including empowering significant efficiencies across diverse industries, and expanding connectivity to reduce paper and offsetting the need for travel. The information, communications, & technology (“ICT”) sector is a powerful tool to enable other sectors to achieve significant emissions reductions. The seminal report on ICT and climate change predicted that ICT could help other industries and consumers to avoid creating as much as 7.8 gigatons of CO<sub>2</sub>e emissions, representing 15 percent of predicted total global emissions – or five times ICT’s own footprint.<sup>7</sup> Authorizing the Astra Constellation will add valuable connectivity

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<sup>6</sup> ITU Development Sector Report, “Connecting Humanity: Assessing investment needs of connecting humanity to the Internet by 2030,” at 4 (2020).

<sup>7</sup> The Climate Group Report, on behalf of the Global E-Sustainability Initiative, “Smart 2020: Enabling the Low-Carbon Economy in the Information Age,” June 2008.

options for remote and rural locations, improving both service options and affordability for prospective customers and partners, ranging from enterprise sites, terrestrial communications networks and national security applications, while creating opportunities to align other space-based environmental technologies on the space-based infrastructure of the Constellation.

The Astra Constellation will apply leading-edge space technologies to improve life on Earth. From a spectrum perspective, the Astra Constellation is being designed to optimize the efficient use of the assigned radio frequencies in its service delivery, while retaining sufficient flexibility to ensure coordination of spectrum with other authorized users. In keeping with the Commissions' rules, Astra will undertake good-faith coordination with other NGSO users of the frequency bands and will exchange necessary technical parameters to avoid harmful interference and maximize spectral efficiencies across operators. Astra views operator-to-operator coordination as a superior means to utilize spectrum to the regulatory approach of band segmentation.

While we recognize that the ITU has not yet adopted complete technical standards governing NGSO use of the V-band frequencies, and there are few existing spacecraft in any orbit that are utilizing the bands, it is essential to the orderly development of these frequencies that even early space systems plan for the technological capability to co-exist with other space-based and terrestrial users without creating harmful interference. The Technical Attachment and Schedule S associated with this application reflect Astra's commitment to efficient and fair use of spectrum, and the principles of equitable co-frequency sharing.

### **III. ADDITIONAL LEGAL AND TECHNICAL INFORMATION**

#### **A. Legal**

##### **1. ITU Filings and Cost Recovery (Section 25.111)**

Astra is aware that Commission applicants are responsible for payment of any and all fees charged by the ITU and accepts responsibility to pay any ITU cost recovery fees associated with this application. Invoices for such fees may be sent to the contact noted in the FCC Form 312.

##### **2. Spectrum Access Eligibility (Section 25.159)**

Astra has not filed with the Commission any other applications for NGSO-like satellite systems in the frequency bands involved in this application or processing round, nor any NGSO-like system that has been licensed but not yet built in the subject bands. Accordingly, this application is fully compliant with the Commission's Rule placing limits on the number of pending applications and unbuilt satellite systems an applicant may have.

##### **3. System Deployment Milestones (Section 25.164)**

Astra agrees to comply with the Commission's milestone rules for NGSO deployment.

##### **4. Posting of Surety Bond (Section 25.165)**

Astra acknowledges that it will be required to post a performance surety bond pursuant to Section 25.165 of the Commission's Rules upon grant of this application.

##### **5. Reporting Requirements (Sections 25.171 *et. seq.*)**

Astra will comply with all FCC reporting requirements that apply to it or may ultimately be adopted with respect to the specific services it plans to provide.

## **B. Technical**

### **1. Orbital Debris Mitigation (Sections 25.114(d) and 25.283)**

Astra is building its constellation with the ability to meet or exceed all U.S. and international requirements for space safety and employing industry best practices for safe space operations. The Technical Attachment contains specific details on the technologies and operational techniques employed by Astra to meet the Commission's rules and industry best practices on safe space operations and orbital debris mitigation.

Astra is committed to joining with the broader space community to reduce space debris and views collaboration and the development of sustainable space safety policies as an important part of the company's mission to improve life on Earth from space. Further details on deployment and post-mission disposal, as well as on-orbit operations, are contained in the Technical Attachment.

### **2. Sharing of Ephemeris Data (Section 25.146(e))**

Astra remains committed to collaborative operation of its constellation and will optimize the efficient use of the assigned radio frequencies in its services delivery, while retaining sufficient flexibility to ensure coordination of spectrum with other authorized users. In accordance with Section 25.273(c), Astra will maintain a complete and accurate set of technical details of current and planned radiofrequency transmissions for their satellites and will provide any necessary technical information to other space station licenses in order to identify and promptly resolve any potential causes of radiofrequency interference between systems.

Astra recognizes that the ITU has not yet adopted complete international technical standards governing NGSO use of the V-band frequencies, and there are few existing spacecraft in any orbit that are utilizing the bands, Astra views it as essential to the orderly development of

these frequencies that even early space systems plan for the technological capability to co-exist with other space-based and terrestrial users without creating harmful interference. Astra encourages the Commission’s ongoing development of sensible rules to ensure the equitable and efficient use of V-band and will design and operate its constellation to fully comply with U.S. and international requirements as they are adopted.

#### **IV. REQUESTS FOR WAIVER OF FCC RULES**

The Commission’s Rules and precedents provide that the FCC has discretion to waive its rules where “good cause” is shown<sup>8</sup> and “special circumstances warrant a deviation from the general rule and such deviation will serve the public interest.”<sup>9</sup> The Commission may take into account considerations of hardship, equity, or more effective implementation of overall policy on an individual basis.<sup>10</sup> Grant of the discrete waiver requests described below, to the extent required, will serve the public interest by promoting the delivery of new, innovative satellite connectivity services without undermining the essential purpose of any of the identified Commission Rules.

##### **A. Provisional Request for Waiver of Section 25.112(a)(1)**

Section 25.112(a) of the Commission’s rules states that applications will be deemed “unacceptable for filing and will be returned to the applicant” if, among other potential defects, they lack “completeness of answers to questions [or] informational showings.”<sup>11</sup> The Commission’s rules further provide, however, that an application that is determined to be

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<sup>8</sup> See 47 C.F.R. § 1.3.

<sup>9</sup> See, e.g., *Northeast Cellular Telephone Co., L.P. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990) and *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972).

<sup>10</sup> See *WAIT Radio* at 1159; *Northeast Cellular* at 1166.

<sup>11</sup> 47 C.F.R. § 25.112(a)(1).

defective under this rule in some manner may nonetheless be accepted and processed if accompanied by an appropriate waiver request.<sup>12</sup> Astra seeks such a waiver to the extent required.

Strict application of the completeness standard may pose an undue hardship on applicants where a space station application is especially complex—*e.g.*, where it involves large numbers of non-geostationary satellites operating in multiple planes across several frequency band segments that are subject to distinct, yet still evolving requirements. Accordingly, Astra requests that, in the event that the Commission finds any discrepancies in this application, as filed, it nonetheless provide Astra an opportunity to correct such ambiguities via supplement rather than subjecting any portion of the application to exclusion from the current V-band processing round.

There is good cause for grant of the requested waiver in that it would avoid potential imposition of an unduly harsh result (particularly given that this application is being filed as part of a processing round). Indeed, the Commission has stated in reference to the completeness standard that applications must simply be “complete in substance, providing all the information required in the application form,”<sup>13</sup> a policy which is intended to deter the filing of purely frivolous or “sham” applications.<sup>14</sup> It has indicated that the primary purpose of the rule is to ensure that the application “appropriately allows for public comment on the merits of the application.”<sup>15</sup> Here, Astra has advanced a substantial, innovative proposal, which it is in the

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<sup>12</sup> See 47 C.F.R. § 25.112(b)(1).

<sup>13</sup> *DIRECTV Enterprises, LLC Application for Authorization to Launch and Operate DIRECTV RB-2*, 24 FCC Rcd 9393, 9396 (¶ 7) (IB 2009) (“DIRECTV RB-2”). See also *Amendment of the Commission’s Space Station Licensing Rules and Policies*, 17 FCC Rcd 3847, 3875 (¶ 84) (2002) (“Space Station Licensing”).

<sup>14</sup> *Space Station Licensing*, 17 FCC Rcd at 3878 (¶ 93).

<sup>15</sup> *DIRECTV RB-2*, 24 FCC Rcd at 9403 (¶ 23).

public interest to consider on its merits, rather than subjecting it to any disqualification from consideration based on any minor errors of omission.

In any case, to the extent that any portion of the application may be deemed unacceptable for filing, Astra asks that the Commission limit adverse action it takes based upon such a determination to the specific frequency band segment sought, and requests a partial waiver of Section 25.112(a) to the extent necessary to permit this treatment. In such circumstance, the Commission could continue to consider the remainder of the application without prejudice.

#### **B. Request for Limited Waiver of Section 25.114(c)(vi) and Schedule S**

Section 25.114(c)(4)(vi) of the FCC's Rules specifies that for systems that will include shapeable beams that are also steerable, the antenna gain contours to be included in Schedule S should “include the contours that would result from moving the beam peak around the limit of the effective beam peak area and the 0 dB relative antenna gain isoline”<sup>16</sup> in addition to specifying the contours, as defined in the rule “for the transmitting beam configuration that results in the highest EIRP density … and for the receiving beam configuration with the smallest gain-to-temperature ratio and the highest required saturation power flux density.”<sup>17</sup>

In the case of the Astra Constellation, the satellite beams will be both steerable and shapeable, but it is only providing at this time beam contours at the nadir, and not at the edge of the full coverage area as required under the rule. The Technical Annex states that additional information regarding the full scope of the antenna arrays will be provided as a supplemental filing once Critical Design Review of the satellites is complete because there are not final specifications currently with which to produce a full set of meaningful beam contour graphs.

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<sup>16</sup> 47 C.F.R. § 25.114(c)(4)(vi)(C).

<sup>17</sup> *Id.*

Accordingly, to the extent required, Astra requests a waiver of Section 25.114(c)(4)(vi) of the FCC's Rules and Schedule S in order to allow the initial acceptance of the beam contours as prepared with updated, final contours to be provided at a later date. The requested waiver is reasonable under these unique circumstances and will serve the public interest by allowing a full and appropriate review of the application without undermining the purpose of the Commission's Rules.

## **V. CONCLUSION**

For the reasons discussed above, grant of authority to launch and operate the Astra Constellation will serve the public interest. Astra respectfully requests that the Commission grant such operating authority, including approval for orbital deployment and station licenses.

Respectfully Submitted,

ASTRA SPACE PLATFORM SERVICES LLC