Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

Application of	)	
DIRECTV ENTERPRISES, LLC	)	Call Sign: S2430
For Modification of the DIRECTV-4S License to Extend the License Term and Secure Deorbit Authority	)	File No. _____

APPLICATION FOR MODIFICATION

DIRECTV Enterprises, LLC ("DIRECTV") hereby applies for a nine-year extension, through September 27, 2020, of the license for its DIRECTV-4S spacecraft, call sign S2430, and seeks authority to deorbit the satellite at its end of life. Grant of the requested modification will serve the public interest by enabling DIRECTV to continue to offer Direct Broadcast Satellite ("DBS") services to millions of subscribers using DIRECTV-4S, ensuring efficient use of satellite and orbital resources while promoting competition in the multichannel video programming distribution ("MVPD") market.

A completed FCC Form 312 is attached, and DIRECTV hereby incorporates by reference the technical information previously provided regarding the operations of DIRECTV-4S.[1] In addition, DIRECTV has included in the attached Technical Appendix information regarding orbital debris mitigation.

[1] *See* File Nos. SAT-LOA-20010518-00045.

MODIFICATION REQUEST

DIRECTV-4S commenced operations at the 101º W.L. orbital location on December 27, 2001,[2] and is licensed to operate in the DBS frequency bands (12.2-12.7 GHz downlink and 17.3-17.8 GHz uplink).[3] While the original order granting DIRECTV authority to operate the satellite does not specify a license expiration date, Section 25.121 of the Commission's rules in effect at the time DIRECTV-4S was launched provided that DBS satellites would have a license term of 10 years from the date the licensee certified the satellite had been successfully placed into orbit.[4] Accordingly, the license will expire on December 27, 2011. By this application, DIRECTV respectfully requests that the term be extended by approximately nine years.

Such an extension is warranted under the circumstances. DIRECTV calculates that there is sufficient fuel onboard the DIRECTV-4S spacecraft to continue providing reliable DBS service throughout the requested term extension. As a result, extending the license term of DIRECTV-4S will serve the public interest by allowing DIRECTV to continue to use the spacecraft to provide a high-quality video service offering to consumers throughout the United States, ensuring the efficient use of satellite and orbital resources while promoting competition in the MVPD market.

DIRECTV also seeks Commission authority to relocate DIRECTV-4S at the end of its useful life to a disposal orbit with a minimum perigee altitude of approximately 300 km above the geostationary arc. Because DIRECTV-4S was launched before March 18, 2002, the

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2 *See* Letter from William M. Wiltshire to Marlene H. Dortch, File No. SAT-LOA-20010518-00045 (Aug 14, 2009).

3 *See DIRECTV Enterprises, Inc.*, 16 FCC Rcd. 18530 (Int'l Bur. 2001).

4 *See* 47 C.F.R. § 25.121(a) and (d) (2001).

spacecraft is not subject to the minimum perigee requirements of Section 25.283(a).[5] Nonetheless, DIRECTV intends to comply with those requirements. DIRECTV's calculations indicate that, at the conclusion of the requested extension period, DIRECTV-4S will have sufficient fuel to reach the proposed deorbit altitude, barring a catastrophic failure of satellite components. Grant of the requested deorbit authority is consistent with Commission requirements and will facilitate placement of DIRECTV-4S in a disposal orbit at its end of life.

WAIVER REQUEST

To the extent necessary, DIRECTV seeks waiver of Sections 25.114(d)(14)(ii) and 25.283(c) of the Commission's rules in connection with the requested extension of license term for DIRECTV-4S. These rules address requirements relating to venting stored energy sources at the spacecraft's end of life.[6] DIRECTV-4S is a Boeing 601 model spacecraft and was constructed and launched before the venting requirement in Section 25.283(c) was even proposed.[7] As described in more detail in the attached Technical Appendix, the helium tanks on the spacecraft were sealed following completion of launch phase and will therefore retain residual pressure at end of life. Given the spacecraft design, it is physically impossible for DIRECTV to vent the helium tanks in order to comply with Section 25.283(c).

Granting the requested waiver of these rules would be consistent with Commission precedent and policy, as the criteria justifying a waiver are present in this case.

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5 *See* 47 C.F.R. § 25.283(d).

6 Section 25.283(c) contains the substantive venting requirement, while Section 25.114(d)(14)(ii) requires applicants to submit information that addresses "whether stored energy will be removed at the spacecraft's end of life."

7 *See Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, 17 FCC Rcd. 5586 (2002) (released March 18, 2002).

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[8]

Accordingly, the Commission has in the past waived these provisions on several occasions in extending the term of a satellite license for in-orbit spacecraft with similar limitations.[9] The Commission has even waived Section 25.283(c) in a number of cases to permit launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the space station design at a late stage of construction would pose an undue hardship.[10]

In the case of DIRECTV-4S, which was launched and operational before the venting requirements were even proposed, there is no question of bringing the satellite into compliance with the rule. Because DIRECTV-4S is already in orbit, DIRECTV can do nothing to enable full venting of residual pressure in the helium tanks. Given this reality, waiver is clearly warranted. There is no possible public interest benefit in requiring strict adherence to a rule with which the

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[8] *PanAmSat Licensee Corp.*, 17 FCC Rcd. 10483, ¶ 22 (Int'l Bur. 2002) (footnotes omitted).

[9] *See, e.g., SES Americom, Inc.*, File No. SAT-MOD-20110718-00130 , Grant Stamp Attachment at ¶ 2 (granted Oct. 13, 2011) ("We grant the requested waiver because AMC-1 was launched before Section 25.283(c) became effective and compliance would require direct retrieval of the spacecraft, which is not currently possible"); *SES Americom, Inc*., File No. SAT-MOD-20101215-00261, Grant Stamp Attachment at ¶ 4 (granted Mar. 8, 2011) (same); *XM Radio Inc.*, File No. SAT-MOD-20100722-00165, Grant Stamp Attachment at ¶ 2 (granted Oct. 14, 2010) (same).

[10] *See, e.g., DIRECTV Enterprises, LLC*, File No. SAT-LOA-20090807-00086, Grant Stamp Attachment at ¶ 4 (granted Dec. 15, 2009) (granting a partial waiver of Section 25.283(c) for DIRECTV-14, a Boeing 702 model spacecraft, on grounds that requiring modification of the satellite would present an undue hardship *EchoStar Satellite Operating Corp.*, File No. SAT-LOA-20071221-00183, Grant Stamp Attachment at ¶ 4 (granted Mar. 12, 2008) (same for AMC-14, a Lockheed Martin A2100 model spacecraft); *PanAmSat Licensee Corp.*, File Nos. SAT-MOD-20070207-00027 and SAT-AMD-20070716-00102, Grant Stamp Attachment at ¶ 7 (granted Oct. 4, 2007) (same for Intelsat 11, an Orbital Sciences Star model spacecraft).

licensee is incapable of complying, and grant in these special and limited circumstances would not undermine the policy objective of the rule.

CONCLUSION

For the foregoing reasons, DIRECTV respectfully requests that the Commission modify the license for DIRECTV-4S to extend its term through September 27, 2020 and authorize maneuvers to place the spacecraft in a disposal orbit at its end of life.

Respectfully submitted,

By: /s/

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TECHNICAL APPENDIX

This technical appendix is submitted in support of the application of DIRECTV Enterprises, LLC ("DIRECTV") for a modification of its license for the DIRECTV-4S spacecraft at the 101.2º W.L. orbital location to extend the license term and seek authority to deorbit the satellite at the end of life. DIRECTV incorporates by reference herein the technical information it has already provided with respect to DIRECTV-4S.[11] DIRECTV proposes to continue to operate the satellite as currently authorized. Below, DIRECTV provides information regarding orbital debris mitigation.

Schedule S. The proposed modification of the DIRECTV-4S license will not result in any changes to the spacecraft's operating characteristics or to the interference environment. As a result, the information requested in Schedule S duplicates information that is already on file with the Commission concerning the technical parameters of DIRECTV-4S's operation. In similar cases involving requests for extension of a satellite's license term, the International Bureau has not required the submission of a Schedule S.[12] Accordingly, DIRECTV is not filing a Schedule S with this application. DIRECTV will nevertheless prepare and submit a Schedule S if requested to do so by the staff.

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[11] *See* File No. SAT-LOA-20010518-00045.

[12] *See, e.g.*, Grant Stamp, File No. SAT-MOD-20110718-00130 (granted Oct. 13, 2011) (SES Americom request for extension of AMC-1 satellite license); Grant Stamp, File No. SAT-MOD-20090217-00024 (granted May 5, 2009) (XM Radio request for extension of XM-1 satellite license).

ORBITAL DEBRIS MITIGATION STATEMENT

This section provides the information required under Section 25.114(d)(14) of the Commission's rules.

Spacecraft Hardware Design

DIRECTV has assessed and limited the amount of debris released in a planned manner during normal operations of DIRECTV-4S. No debris is generated during normal on-station operations, and DIRECTV does not intend to release debris during the planned course of operations of the satellite. The spacecraft will remain in a stable configuration, operating outside of the station keeping volume assigned to any other spacecraft.

DIRECTV has also considered the possibility of DIRECTV-4S becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control of the spacecraft and prevent post-mission disposal. As such, DIRECTV has taken steps to address this possibility by incorporating redundancy, shielding, separation of components, and other physical characteristics into the satellite's design. For example, omni-directional antennas have been mounted on opposite sides of the spacecraft. The command receivers and decoders, telemetry encoders and transmitters, and the bus control electronics are fully redundant, physically separated, and located within a shielded area to minimize the probability of the spacecraft becoming a source of debris due to a collision.

Minimizing Accidental Explosions

DIRECTV has assessed and limited the probability of accidental explosion during and after completion of mission operations. The key areas reviewed for this purpose included

leakage of propellant and mixing of fuel and oxidizer as well as battery pressure vessels. The basic propulsion design (including component and functional redundancy, and the placement of fuel tanks inside a central cylinder which provides a high level of shielding), propulsion subsystem component construction, preflight verification through both proof testing and analysis, and quality standards were designed to ensure a very low risk of propellant leakage and fuel and oxidizer mixing that can result in subsequent explosions. During the mission, batteries and various critical areas of the propulsion subsystem are continually monitored (for both pressure and temperature) to preclude conditions that could result in the remote possibility of explosion and subsequent generation of debris.

After DIRECTV-4S reaches its final disposal orbit, all on-board sources of stored energy will be depleted or secured, all fuel line valves will be left "open," and all batteries will be left in a permanent discharge state. The solar cells will be slewed away from the sun to minimize power generation. However, at the end of DIRECTV-4S's operational life, the helium pressurant for the vessels that were used during orbit raising was permanently isolated from the propulsion system by firing a pyrotechnic valve at the beginning of on-orbit life. As a result, the residual gas (about 5%) cannot be vented at the end of life. In addition, xenon tanks have a regulator valve and cannot be vented after pressure drops below the set point of the valve. These tanks are well shielded, and the residual pressure in the tanks will be well below their maximum rating. Moreover, a leaking pressurized vessel could not cause the spacecraft to leave its storage orbit, as expulsion of pressurized gas would cause the spacecraft to tumble and the delta V (*i.e.*, the thrust) would be randomly distributed, and thus would have very little effect on the orbit apogee and perigee. In the narrative portion of this application, DIRECTV requests any necessary

waiver of Sections 25.114(d)(14)(ii) and 25.283(c) in connection with the residual gas that will remain in these tanks at the end of the satellite's useful life.

Safe Flight Profiles

DIRECTV has assessed and limited the probability of DIRECTV-4S becoming a source of debris by collisions with large debris or other operational space stations. DIRECTV has assessed the possibility of collision with satellites located at, or reasonably expected to be located at, the requested orbital location or assigned in the vicinity of that location.

Regarding avoidance of collisions with controlled objects, in general, if a geosynchronous satellite is controlled within its specified longitude and latitude stationkeeping limits, collision with another controlled object (excluding where the satellite is collocated with another object) is the direct result of that other object entering the allocated space. The instant application seeks authority for continued operation of DIRECTV-4S at the 101.2° W.L. orbital location. DIRECTV is not aware of any other FCC or non-FCC licensed spacecraft that are operational or planned to be deployed at 101.2° W.L. or to nearby orbital locations such that there would be an overlap with the requested station keeping volume of DIRECTV-4S.

During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. When de-orbit of a spacecraft is required, the initial phase is treated as a satellite move, and the same precautions are used to ensure collision avoidance.

Post-Mission Disposal

Although not subject to the requirements of Section 25.283(a) of the Commission's rules, at the end of the operational life of the satellite, DIRECTV will maneuver DIRECTV-4S into a disposal orbit with an altitude no less than that calculated using the IADC formula:

$$36{,}021 \text{ km} + (1000 \cdot C_R \cdot A/m).$$

The calculated value of $C_R A/m$ in this instance is based on the following parameters:

C_R = Solar Pressure Radiation Coefficient = 1.2

A = Total Solar Pressure Area = 90 m^2

m = Dry Mass of Satellite = 2132.5 kg

Using these values in the IADC formula results in a minimum de-orbit altitude of 36,072 km, or approximately 286 km above geosynchronous altitude. To provide adequate margin, the nominal disposal orbit will be increased above this calculated value of 36,072 km to a value of 36,086 km, resulting in a disposal orbit approximately 300 km above geosynchronous altitude. Approximately 16.4 kg of propellant will be allocated and reserved for final orbit raising maneuvers to this altitude. This value was determined through a detailed propellant budget analysis. In addition, DIRECTV has assessed fuel gauging uncertainty and this budgeted propellant provides an adequate margin of fuel reserve to ensure that the disposal orbit will be achieved despite such uncertainty.