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

In the Matter of		
Application of Harris CapRock Communications, Inc. to Modify its Earth Station Onboard Vessel ("ESV") License for Ka-band Operations	)))))	Call Sign: E060157 File No:

Application for Modification of ESV License

By this application, Harris CapRock Communications, Inc. ("Harris CapRock") seeks Commission authority to modify its existing earth stations onboard vessel ("ESV") license, Call Sign E060157. Specifically, Harris CapRock seeks to operate its previously licensed 2.4m multi-band ESV terminals (Model ST5000-2.4) with O3b Limited's ("O3b") Ka-band non-geostationary satellite orbit ("NGSO") fixed-satellite service ("FSS") system in the 27.6-28.4 GHz (Earth-to-space), 28.6-29.1 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth) and 18.8-19.3 GHz (space-to-Earth) frequency bands. Additionally, Harris CapRock seeks to operate the ST5000-2.4 with geostationary satellite orbit ("GSO") satellites on the Commission's Ka-band Permitted Space Station List ("Ka-band Permitted List") in the 28.35-28.6 GHz (Earth-to-space), 29.25-30.0 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth) and 19.7-20.2 GHz (space-to-Earth) frequency bands.

The ST5000-2.4 terminal will operate on U.S. registered and non-U.S. registered maritime vessels and enhance Harris CapRock's authorized ESV network, which provides a wide array of essential satellite communications services to vessels in motion, stationary oil drilling platforms and mobile rigs.

I. BACKGROUND

Harris CapRock has developed the ST5000-2.4 terminal, an innovative maritime earth station terminal designed to communicate in C-band, Ku-band and Ka-band FSS frequencies. Harris CapRock has been granted long-term commercial authority to operate

the ST5000-2.4 terminal in C-band and Ku-band frequencies[1] and, because a previously pending modification application effectively precluded the filing of this modification application until recently, the Commission granted Harris CapRock interim 60-day and 180-day special temporary authority ("STA") to operate the ST5000-2.4 terminal in Ka-band frequencies with O3b's NGSO system.[2] This application serves as Harris CapRock's request for long-term commercial authority to operate the ST5000-2.4 terminal in the Ka-band with O3b's NGSO FSS system and Ka-band Permitted List satellites.

Consistent with Section 25.117 of the Commission's Rules, Harris CapRock provides the attached Technical Appendix and FCC Form 312 and Schedule B for relevant information relating to the technical parameters, antenna performance information, radiation hazard analysis and general antenna specifications for the ST5000-2.4 terminal. Harris CapRock requests a waiver of certain FCC rules necessary to facilitate ST5000-2.4 Ka-band operations in the maritime context as proposed herein. Furthermore, Harris CapRock's operations of the ST5000-2.4 terminal will be consistent with the terms and conditions imposed on ESV terminal operations with the O3b system and Ka-band Permitted List satellites.

A. O3b's NGSO FSS System

In 2015, the Commission granted O3b's Petition for Declaratory Ruling seeking market access to serve the United States.[3] In that application, O3b submitted a Schedule S describing the technical characteristics of its satellite system. Harris CapRock will operate the ST5000-2.4 terminals consistent with the technical parameters outlined in the O3b Schedule S.

The Commission also granted Ka-band ESV operating authority to O3b for maritime operations nearly identical to those proposed herein. In May 2014, the

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[1] *See* Harris CapRock, File Nos. SES-MOD-20150915-00599 & SES-AMD-20151205-00907 (Call Sign E060157) (granted on Feb. 25, 2016).

[2] *See* Harris CapRock, File No. SES-STA-20160224-00170 (Call Sign E060157) ("*60-Day STA*"); File No. SES-STA-20160224-00171 (Call Sign E060157) ("*180-Day STA*").

[3] *See* O3b Limited, File No. SAT-LOI-20141029-00118, Call Sign S2935 (granted Jan. 22, 2015).

Commission granted O3b a blanket ESV license and a related waiver to operate one hundred ESV terminals on U.S. and non-U.S.-registered vessels in NGSO primary Ka-band spectrum, 28.6-29.1 GHz (Earth-to-space) and 18.8-19.3 GHz (space-to-Earth).[4] In September 2014, the Commission granted authority to O3b to operate ESV terminals on three non-U.S.-registered vessels in GSO primary Ka-band spectrum, 28.35-28.4 GHz (Earth-to-space) and 18.3-18.6 GHz (space-to-Earth).[5] In May 2015, the Commission granted O3b maritime operating authority to operate terminals on six non-U.S.-registered maritime vessels in the local multipoint distribution service ("LMDS") primary uplink band, 27.6-28.35 GHz (Earth-to-space),[6] and the fixed service ("FS") primary downlink

[4] *See* O3b Limited, File No. SES-LIC-20130528-00455 (Call Sign E130098); Letter from Jose Albuquerque, Chief, Satellite Division and Mark Settle, Chief, Policy and Rules Division, to Joslyn Read, O3b Limited, DA 14-637 (rel. May 13, 2014).

[5] *See* File No. SES-MSC-20140318-00150, Letter from Jose Albuquerque, Chief, Satellite Division and Mark Settle, Chief, Policy and Rules Division, to Suzanne Malloy, O3b Limited, DA 14-1369 (rel. September 22, 2014).

[6] As discussed in more detail in Section II.A.b, the Commission recently adopted rules that require FSS earth stations to operate on a secondary basis to the newly created Upper Microwave Flexible Use Service ("UMFUS") in the 27.5-28.35 GHz band. The Commission extended UMFUS mobile rights and protections to all existing LMDS licensees and now requires that FSS earth stations provide certain interference protection to existing and future UMFUS licensees. However, O3b's gateway earth station operations were grandfathered by the Commission to allow its existing FSS gateways in the 27.5-28.35 GHz band that were authorized prior to the adoption date of the *Spectrum Frontiers Order* to operate under the terms of their existing authorizations without having to adhere to new UMFUS protection conditions. Importantly, in several of the cited O3b licensing decisions, the Commission treated O3b's stationary earth station operations at various port locations (*i.e.*, immobile maritime operations) similar to "gateway-type" sites for purposes of recognizing coordination with co-frequency terrestrial operations. *See In the Matter of Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands, et al.*, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89, ¶¶ 41, 46 and 59 (2016) ("*Spectrum Frontiers Order*"). As discussed herein, Harris CapRock's previously coordinated and authorized port operations should be accorded similar treatment.

band, 17.8-18.3 GHz (space-to-Earth).[7] Most recently, in January 2016, the Commission granted O3b a waiver to operate on up to thirty foreign-flagged vessels in the in the 27.6 28.4 GHz,[8] 17.8-18.6 GHz and 18.8-19.3 GHz bands.[9]

The foregoing constitutes extensive precedent for Commission licensing of Ka-band maritime terminals to communicate with O3b's NGSO FSS system. The proposed operations of the ST5000-2.4 terminal are virtually identical to those authorized in the Commission decisions noted above, and thus can be authorized on the same basis as the prior grants to O3b. Grant of the requested STA will enhance competition and enable more efficient provision of critical communications services to government users and commercial customers in the maritime, oil and gas, and other industries.

Harris CapRock notes that O3b has previously completed all necessary coordination with U.S. government satellite networks operating in the Ka-band, including GSO and NGSO networks. O3b has also completed coordination with the U.S. government under footnote US334 of the United States Table of Frequency Allocations ("Table of Allocations"). Harris CapRock's proposed operations will be in accordance with all existing and future coordination agreements between O3b and other authorized Ka-band spectrum users. Finally, Harris CapRock will operate pursuant to the terms of O3b's U.S. market access grant and, to the extent relevant, will fully satisfy any conditions of the grant to communicate with O3b's NGSO system.[10]

B. <u>Ka-band Permitted Space Station List</u>

In 2010, the Commission established the Ka-band Permitted Space Station List and the procedure to allow "routine" Ka-band earth station licensees to add "Permitted List" as

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[7] *See* SES-MSC-20150206-00066, Letter from Jose Albuquerque, Chief, Satellite Division and Mark Settle, Chief, Policy and Rules Division, to Suzanne Malloy, O3b Limited, DA 15-601 (rel. May 20, 2015).

[8] *See supra* n. 6.

[9] *See* File No. SES-MSC-20151021-00760, Letter from Jose Albuquerque, Chief, Satellite Division and Mark Settle, Chief, Policy and Rules Division, to Suzanne Malloy, O3b Limited, DA 16-99 (rel. January 29, 2016).

[10] *See* O3b Limited, File No.SAT-LOI-20141029-00118 (Call Sign S2935) (granted Jan. 22, 2015).

an authorized point of communication under its license.[11] The Commission has determined that permitting Ka-band earth stations that meet the technical standards of Section 25.138 of the Commission's Rules, 47 C.F.R. § 25.138, would not result in harmful interference to other Ka-band operations and can communicate with U.S. and non-U.S. licensed satellites on the Ka-band Permitted List.[12] As further discussed below and demonstrated in the Technical Appendix, the ST5000-2.4 terminal meets the requirements of Section 25.138 of the Commission's Rules.[13]

II. SPECTRUM USE

The Table of Allocations and the Commission's Ka-band Plan ("Ka-band Plan") identify various spectrum allocations for NGSO and GSO FSS operations but no rules have been adopted for mobile earth stations or ESV operations in these bands. In the absence of such rules, Harris CapRock intends to operate the ST5000-2.4 terminal on a non-conforming (unprotected and non-interference) basis at all times when the terminals are in motion. When the ESVs are stationary, Harris CapRock will operate the ST5000-2.4 in accordance with the Commission's Rules, Table of Allocations and Ka-band Plan or, to the extent necessary, seek a limited waiver of the Commission's Rules to operate the terminal on a non-conforming basis. Because the Commission has not adopted technical rules governing Ka-band ESV maritime operations, Harris CapRock will comply with the Commission's general rules and policies governing Ku-band ESV operations, to the extent

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[11] *See In the Matter of 2006 Biennial Regulatory Review – Revision of Part 25, Establishment of a Permitted List Procedure for Ka-band Space Stations*, IB Docket No. 06-154 (Rel. January 25, 2010).

[12] *Id.*

[13] Harris CapRock acknowledges the relaxation to portions of the relevant EIRP spectral density mask in Section 25.138 and that the ST5000-2.4 terminal was designed to comply with the prior, more stringent version of the mask. *See Comprehensive Review of Licensing and Operating Rules for Satellite Services*, Second Report and Order, IB Docket. 12-167 (Dec. 17, 2015) ("*Part 25 Second Report & Order*") and current 47 C.F.R. §25.138. Because the antenna performance data included herein demonstrates compliance with the more restrictive version of the Section 25.138 mask, granting requested Permitted List authority is appropriate.

applicable.[14]

Harris CapRock seeks to communicate with O3b's Ka-band NGSO FSS system in the following bands: 27.6-28.4 GHz (Earth-to-space), 28.6-29.1 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth) and 18.8-19.3 GHz (space-to-Earth). Harris CapRock seeks to communicate with GSO satellites on the Commission's Ka-band Permitted List in the following bands: 27.6-29.1 GHz (Earth-to-space), 29.25-30.0 (Earth-to-space), 17.8-19.3 GHz (space-to-Earth) and 19.7-20.2 GHz (space-to-Earth). Issues associated with Ka-band maritime terminal operations in these band segments are discussed below.

A. NGSO FSS Operations

a. Uplink Frequencies and Ka-band Designation

i. Primary NGSO FSS Uplink

The Table of Allocations and Ka-band Plan provide that the 28.6-29.1 GHz (Earth-to-space) band may be used by NGSO FSS systems on a primary basis and by GSO FSS systems on a secondary basis.[15] Accordingly, when the ESVs are stationary, Harris CapRock will operate the ESVs on a primary basis in the 28.6-29.1 GHz band. When the ESVs are in motion, however, Harris CapRock intends to operate the ST5000-2.4 terminal on a non-conforming (unprotected and non-interference) basis.

As discussed in Section III, below, Harris CapRock respectfully requests a waiver of the Table of Allocations, 47 C.F.R. §2.106, and Ka-band Plan to the extent necessary to permit its non-conforming use of the 28.6-29.1 GHz band.[16] Harris CapRock demonstrates that it can operate the ST5000-2.4 terminal without causing harmful interference to

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[14] *See* 47 C.F.R. 25.222; Technical Appendix, IV & V (Tracking Report).

[15] *See In the Matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, 11 FCC Rcd. 19005, ¶¶ 57-58 and 78 (1996) ("*Ka-band Plan R&O"). See also In the Matter of Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use*, 15 FCC Rcd 13430, ¶¶ 28 and 34 (2000) ("*Redesignation of Ka-band Plan R&O*").

[16] *See* United States Table of Frequency Allocations, 47 C.F.R. §2.106.

authorized spectrum users and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will not claim protection from conforming uses of the 28.6-29.1 GHz band while the ESVs are in motion.

ii. Secondary NGSO FSS Uplink

The Commission's Table of Allocations and Ka-band Plan provide that LMDS systems operate on a primary basis and FSS systems on a secondary basis in the 27.5-28.35 GHz (Earth-to-space) band.[17] The Commission also recently adopted rules that make FSS secondary to the newly created Upper Microwave Flexible Use Service ("UMFUS") in the 27.5-28.35 GHz band.[18] Finally, GSO FSS systems operate on a primary basis and NGSO FSS systems operate on a secondary basis in the 28.35-28.4 GHz (Earth-to-space) band.[19]

In the recent *Spectrum Frontiers Order*, the Commission adopted grandfathering provisions that allow certain FSS earth stations in the 27.5-28.35 GHz band to operate without having to demonstrate compliance with UMFUS interference protection conditions.[20] Certain ST5000-2.4 terminal operations would fall under the grandfathering provision and thus, when the ESVs are stationary, Harris CapRock may operate the ST5000-2.4 terminal on a secondary basis to existing LMDS in the 27.6-28.35 GHz band without meeting additional UMFUS protection conditions and to GSO FSS systems in the 28.35-28.4 GHz band. When the terminal is in motion, however, Harris CapRock will operate the ST5000-2.4 on a non-conforming (unprotected and non-interference) basis.

First, Harris CapRock notes that its proposed operations in the 27.6-28.35 GHz band are consistent with the Commission's view on the type of FSS operations that would not cause harmful interference to primary LMDS stations in the band. The Commission has previously stated that FSS operations in this band are limited to "gateway-type"

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[17] *See Ka-band Plan R&O* ¶¶ 59-62; *see also Redesignation of Ka-band R&O* ¶ 28.

[18] *See Spectrum Frontiers Order* ¶ 50.

[19] *See Ka-band Plan R&O* ¶ 42; *see also Redesignation of Ka-band Plan R&O* ¶ 28.

[20] *See Spectrum Frontiers Order* ¶ 54 and Appendix A, Final Rules, 47 C.F.R. § 25.136 (Earth Stations in the 27.5-28.35 GHz and 37.5-40.0 GHz bands).

operations.[21] The Commission's main concern is ubiquitous terminals that could interfere with LMDS operations.[22] Although the rules limit operations in some bands to gateway earth stations only, the 27.5-28.35 GHz band is not among them and there is no requirement that earth stations actually serve as gateways.

Harris CapRock's proposed stationary ESV operations at a small number of port and offshore locations will be limited in scope and consistent with the Commission's views on high data-rate, gateway-type operations. The Commission has previously recognized that Ka-band maritime earth station operations are consistent with its view of "gateway-type" operations.[23] Accordingly, Harris CapRock can be permitted to operate on a secondary basis to LMDS in the 27.6-28.35 GHz band.

As a secondary user, Harris CapRock's proposed NGSO FSS operations in the 27.6-28.35 GHz band must not cause interference to primary LMDS stations. The attached Comsearch coordination reports demonstrate that Harris CapRock may operate the ST5000-2.4 terminal without causing harmful interference to LMDS licensees. Harris CapRock has completed coordination of its proposed Ka-band ESV operations in the 27.6-28.35 GHz band with existing terrestrial licenses in the port areas where equipped vessels will be docked.[24] No objections were received from incumbent licensees. Furthermore,

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[21] The Commission's references to "gateway-type" service in the 27.5-28.35 GHz band are not intended as a requirement that all earth stations in the band serve as gateway earth stations. Rather, the mention of "gateway-type" service in the 27.5-28.35 GHz band serves as an example of what the Commission's envisions as the type of service that FSS operators would be able to provide on a secondary basis without causing interference to primary LMDS stations in the band.

[22] *In the Matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5- 29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services, Third Report and Order*, 12 FCC Rcd 22310, 22327, ¶ 42 (1997).

[23] *See* O3b Limited, File No. SES-MSC-20150206-00066.

[24] Frequency coordination reports have been completed for port locations in Fort Lauderdale, Florida, Miami, Florida, Port Canaveral, Florida and San Juan, Puerto Rico. *See* Technical Appendix, VII.

Harris CapRock agrees not to cause harmful interference to future primary LMDS operations in the band and will accommodate any future LMDS licensees to the extent necessary to avoid harmful interference.

In the 27.5-28.35 GHz band, the Commission recently created a UMFUS framework to allow for the expansion of mobile operations and automatically extended UMFUS rights and protections to existing LMDS licensees.[25] Under the new rules, FSS earth stations must now demonstrate to the Commission that they comply with minimum UMFUS interference protection criteria.[26] However, the also Commission adopted grandfathering provisions that allow for (i) existing FSS earth stations authorized as of the adoption date of the *Spectrum Frontiers Order* and (ii) FSS earth station applications filed prior to the adoption date of the *Spectrum Frontiers Order*, to operate pursuant to the terms of their existing authority without having to provide UMFUS interference protection to existing or future licensees.[27]

As the Commission is aware, the ST5000-2.4 terminal has already been authorized for the identical operations proposed herein on April 5, 2016, prior to the adoption date of the *Spectrum Frontiers Order*, and Harris CapRock will operate the terminal consistent with that authority.[28] Harris CapRock seeks to continue limited in-port operations in Fort Lauderdale, Florida, Miami, Florida, Port Canaveral, Florida and San Juan, Puerto Rico for which it has demonstrated compatibility with LMDS operations. These operations are consistent with the Commission's view of "gateway-type"

[25] *See Spectrum Frontiers Order* ¶ 41.

[26] *Id.* ¶ 54.

[27] *Id.* ¶ 59 and Appendix A, Final Rules, 47 C.F.R. § 25.136 (Earth Stations in the 27.5-28.35 GHz and 37.5-40.0 GHz bands)

[28] *See* Harris CapRock Communications, Inc., File No. SES-STA-20160224-00171 (Call Sign E060157) ("*180-Day STA*").

operations [29] and should be grandfathered consistent with Commission policies. [30] Accordingly, Harris CapRock meets the Commission's grandfathering criteria and may operate at the ports identified above in the 27.6-28.35 GHz band without ensuring additional interference UMFUS protection.

As discussed in Section III, below, Harris CapRock respectfully requests a waiver of the Table of Allocations, 47 C.F.R. §2.106, and Ka-band Plan to the extent necessary to permit its non-conforming use of the 27.6-28.4 GHz band.[31] Harris CapRock demonstrates that it can operate the ST5000-2.4 terminal without causing harmful interference to authorized spectrum users and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will not claim protection from conforming uses of the 27.6-28.4 GHz band while the ESVs are in motion.

b. Downlink Frequencies and Ka-band Designation

i. Primary NGSO FSS Downlink

The Table of Allocations and the Commission's Ka-band Plan provide that the 18.8-19.3 GHz (space-to-Earth) band may be used by NGSO FSS operations on a primary basis.[32] Accordingly, when the ESVs are stationary, Harris CapRock will operate the ESVs on a primary basis in the 18.8-19.3 GHz band. Because the Commission has not adopted

[29] *Spectrum Frontiers Order* ¶ 46 (reiterating that FSS operations in the band are limited to "gateway-type" services). As discussed, the Commission has previously treated O3b's stationary earth station operations at various port locations (*i.e.*, immobile maritime operations) similar to "gateway-type" sites for purposes of recognizing coordination with co-frequency terrestrial operations.

[30] In the event Harris CapRock seeks to operate the ST5000-2.4 terminal in new locations, it will demonstrate compliance with UMFUS interference criteria consistent with the Commission's newly adopted rules for the 27.5-28.35 GHz band.

[31] *See* United States Table of Frequency Allocations, 47 C.F.R. §2.106.

[32] *See Ka-band Plan R&O* ¶¶ 59-62; *see also Redesignation of Ka-band R&O* ¶ 28. Note that low power point-to-multipoint terrestrial fixed systems may continue to be licensed and operate on a co-primary basis with NGSO/FSS in the 18.82-18.87 GHz and 19.16-19.21 GHz bands.

rules governing Ka-band terminal operations onboard maritime vessels, Harris CapRock intends to operate the ESVs on a non-conforming basis when the vessels are in motion.

As discussed in Section III, below, Harris CapRock respectfully requests a waiver of the Table of Allocations, 47 C.F.R. §2.106, and Ka-band Plan to the extent necessary to permit its non-conforming use of the 18.8-19.3 GHz band.[33] Harris CapRock demonstrates that it can operate the ST5000-2.4 terminal without causing harmful interference to authorized spectrum users and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will not claim protection from conforming uses of the 18.8-19.3 GHz band while the ESVs are in motion.

ii. Downlink with No NGSO FSS Allocation

The Table of Allocations and the Commission's Ka-band Plan provide that the 17.8-18.3 GHz band may be used by FS systems on a primary basis and NGSO FSS systems are non-conforming.[34] Similarly, the Table of Allocations and Ka-band Plan provide that in the 18.3-18.6 GHz band, FSS services are limited to GSO FSS operations.[35] Accordingly, Harris CapRock will operate its ESVs on a non-conforming basis while stationary or in motion in the 17.8-18.6 GHz band.

As discussed in Section III, below, Harris CapRock respectfully requests a waiver of the Table of Allocations, 47 C.F.R. §2.106, and Ka-band Plan to the extent necessary to permit its non-conforming use of the 17.8-18.6 GHz band.[36] Harris CapRock demonstrates that it can operate the ST5000-2.4 terminal without causing harmful interference to authorized spectrum users and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will not claim protection from conforming uses of the 17.8-18.6 GHz band while the ESVs are in motion.

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[33] *See* United States Table of Frequency Allocations, 47 C.F.R. §2.106.

[34] *See Redesignation of Ka-band Plan R&O* ¶¶ 28 and 34.

[35] *Id.*; *see* United States Table of Frequency Allocations, footnote NG164.

[36] *See* United States Table of Frequency Allocations, 47 C.F.R. §2.106.

B. GSO FSS Operations

a. Uplink Frequencies & Ka-band Designation

i. Primary GSO FSS Uplink

The Commission's Rules and Ka-band Plan provide that in the 28.35-28.6 GHz (Earth-to-space) band and 29.25-30.0 GHz (Earth-to-space) band, GSO FSS systems operate on a primary basis and NGSO FSS systems on a secondary basis.[37] Accordingly, when the ESVs are stationary, Harris CapRock will operate the ESVs on a primary basis in the 28.35-28.6 GHz and 29.25-30.0 GHz bands. When the ESVs are in motion, however, Harris CapRock intends to operate the ST5000-2.4 terminal on a non-conforming (unprotected and non-interference) basis.

As discussed in Section III, below, Harris CapRock respectfully requests a waiver of the Table of Allocations, 47 C.F.R. §2.106, and Ka-band Plan to the extent necessary to permit its non-conforming use of the 28.35-28.6 GHz and 29.25-30.0 GHz bands.[38] Harris CapRock demonstrates that it can operate the ST5000-2.4 terminal without causing harmful interference to authorized spectrum users and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will not claim protection from conforming uses of the 28.35-28.6 GHz and 29.25-30.0 GHz bands while the ESVs are in motion.

b. Downlink Frequencies & Ka-band Designation

i. Primary GSO FSS Downlink

The Table of Allocations and the Commission's Ka-band Plan provide that the 18.3-18.8 GHz (space-to-Earth) band and 19.7-20.2 GHz band (space-to-Earth) may be used by GSO FSS operations on a primary basis.[39] Accordingly, when the ESVs are stationary, Harris CapRock will operate the ESVs on a primary basis in the 18.3-18.8 GHz and 19.7-20.2 GHz bands. Because the Commission has not adopted rules governing Ka-

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[37] *Ka-band Plan R&O* ¶ 42*; see also Redesignation of Ka-band Plan R&O* ¶ 28.

[38] *See* United States Table of Frequency Allocations, 47 C.F.R. §2.106.

[39] *See Ka-band Plan R&O* ¶¶ 59-62; *see also Redesignation of Ka-band R&O* ¶ 28. Note that terrestrial FS operations are co-primary in the 18.3-18.58 GHz portion of the band.

band terminal operations onboard maritime vessels, Harris CapRock intends to operate the ESVs on a non-conforming basis when the vessels are in motion.

As discussed in Section III, below, Harris CapRock respectfully requests a waiver of the Table of Allocations, 47 C.F.R. §2.106, and Ka-band Plan to the extent necessary to permit its non-conforming use of the 18.3-18.8 GHz and 19.7-20.2 GHz bands.[40] Harris CapRock demonstrates that it can operate the ST5000-2.4 terminal without causing harmful interference to authorized spectrum users and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will not claim protection from conforming uses of the 18.3-18.8 GHz and 19.7-20.2 GHz bands while the ESVs are in motion.

III. WAIVER REQUESTS

Harris CapRock is seeking a waiver of the U.S. Table of Frequency Allocations, 47 C.F.R. § 2.106, and the Commission's Ka-band plan to the extent necessary to permit non-conforming operation of the ST5000-2.4 terminal. In considering requests for non-conforming uses, the Commission has indicated it would grant such waivers when there is little potential for interference into any service authorized under the Table of Allocations and when the non-conforming operator accepts any interference from authorized services.[41] In the following sections, Harris CapRock demonstrates it can operate the ST5000-2.4 terminal on a non-conforming basis consistent with Commission policies and precedent.

A. 28.6-29.1 GHz NGSO Uplink Band

When the ESVs are in motion, Harris CapRock proposes to operate the ST5000-2.4 terminal on a non-conforming basis in the 28.6-29.1 GHz band. Harris CapRock will not claim protection from conforming uses of the spectrum while the ESVs are in motion and agrees to accept any harmful interference from other services. In addition, Harris CapRock will immediately terminate its ESV operations upon notification that such

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[40] *See* United States Table of Frequency Allocations, 47 C.F.R. §2.106.

[41] *See* Letter from Jose Albuquerque, Chief, Satellite Division and Mark Settle, Chief, Policy and Rules Division, to Suzanne Malloy, O3b Limited, DA 14-1369 (rel. September 22, 2014); *Contactmeo Communications, LLC*, Order and Authorization, 21 FCC Rcd 4035, 4044 (IB 2006); *ViaSat AMSS Order*, File No. SES-MFS-20090624-00789; see *also* 47 C.F.R. § 1.3.

operations are not permitted under the terms of a coordination agreement with, or are causing harmful interference to, any lawfully operating radio system in the 28.6-29.1 GHz band in conformance with the Table of Allocations. Harris CapRock's operations will be in accordance with any coordination agreement that has been or will be reached between O3b and other lawfully operating spectrum users.

There is little to no potential for interference to existing secondary GSO FSS systems in these bands.[42] While there are no rules for mobile maritime operations in the Ka-band, Harris CapRock will operate the proposed terminals within the off-axis EIRP limits specified in Section 25.138 of the Commission's Rules and will otherwise comply with the Commission's two-degree spacing policy.[43] As discussed in the attached Technical Appendix, the ST5000-2.4 terminal is designed to meet the FCC's requirements for Ku-band ESV operations, including: (i) pointing accuracy of 0.2° or better; (ii) automatic cessation of emissions within 100 ms if pointing offset exceeds 0.5°; and (iii) transmissions will not resume until pointing accuracy is within 0.2°.[44] Harris CapRock has also designed a system to record a vessel's location, transmit frequency, channel bandwidth and satellite used, which can be made available to a FSS operator within 24 hours of a request.

Article 22 of the ITU Radio Regulations sets forth standards for interference protection of GSO satellite networks from NGSO satellite systems. As previously demonstrated by O3b, operations of the subject Ka-band NGSO system comply with the relevant EPFD uplink limits in the 28.6-29.1 GHz band.[45] Harris CapRock will operate the ST5000-2.4 consistent with the EPFD limits of O3b's system to provide the required

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[42] There is no potential for interference into other NGSO FSS systems because O3b's system is currently the only authorized NGSO FSS system in the United States.

[43] *See* 47 C.F.R. § 25.138; Technical Appendix, Section III.

[44] *See* Technical Appendix, IV. & V.

[45] *See* O3b Limited, File No. *See* File No. SES-LIC-20130528-00455, Technical Appendix, A.7; *contactMEO Communications, LLC*, 21 FCC Rcd 4035, 4043-4044 (IB 2006) (where the Commission held that compliance with the ITU's EPFD limits provides a sufficient basis for an NGSO FSS system to operate on a non-interference basis in a band in which GSO FSS systems are primary).

level of protection from GSO FSS systems operating in the 28.6-29.1 GHz band.

B. 27.6-28.4 GHz NGSO Uplink Band

When the ESVs are in motion, Harris CapRock proposes to operate the ST5000-2.4 terminal on a non-conforming basis in the 27.6-28.4 GHz band. Harris CapRock will not claim protection from conforming uses of the spectrum while the ESVs are in motion and agrees to accept any harmful interference from other services while operating on a non-conforming, unprotected basis. In addition, Harris CapRock will immediately terminate its ESV operations upon notification that such operations are not permitted under the terms of a coordination agreement with, or are causing harmful interference to, any lawfully operating radio system in the 27.6-28.4 GHz band in conformance with the Table of Allocations. Harris CapRock's operations will be in accordance with any coordination agreement that has been or will be reached between O3b and other lawfully operating spectrum users.

There is little to no potential for interference to existing LMDS or GSO FSS operations from Harris CapRock's proposed ESV operations in the 27.6-28.4 GHz band. Not only has Harris CapRock coordinated the relevant port areas, but while the ESVs are in motion the subject vessels will be sufficient distance from the U.S. coastline to prevent harmful interference to potentially affected terrestrial licensees. In addition, operations of the ST5000-2.4 will be consistent with the EPFD uplink limits in the 27.6-28.4 GHz band to protect authorized spectrum users pursuant to Article 22 of the ITU Radio Regulations.[46] Furthermore, Harris CapRock will operate the proposed terminals within the off-axis EIRP limits specified in Section 25.138 of the Commission's Rules and observe the Commission's Ku-band ESV requirements for pointing accuracy, recording and automatic cessation. Thus, while the ESVs are in motion, Harris CapRock can operate on a non-conforming basis without causing harmful interference to authorized GSO FSS or LMDS operations in the 27.6-28.4 GHz band.

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[46] *See* O3b Limited, File No. SES-MSC-20150206-00066, Technical Appendix A.7; *contactMEO Communications, LLC*, 21 FCC Rcd 4035, 4043-4044 (IB 2006) (where the Commission held that compliance with the ITU's EPFD limits provides a sufficient basis for an NGSO FSS system to operate on a non-interference basis in a band in which GSO FSS systems are primary).

C. 18.8-19.3 GHz NGSO Downlink Band

When the ESVs are in motion, Harris CapRock proposes to operate the ST5000-2.4 terminal on a non-conforming basis in the 18.8-19.3 GHz band. Harris CapRock will not claim protection from conforming uses of the spectrum while the ESVs are in motion and agrees to accept any harmful interference from other services while operating on an unprotected, non-conforming basis. In addition, Harris CapRock will immediately terminate its ESV operations upon notification that such operations are not permitted under the terms of a coordination agreement with, or are causing harmful interference to, any lawfully operating radio system in the 18.8-19.3 GHz band in conformance with the Table of Allocations. Harris CapRock's operations will also be in accordance with any coordination agreement that has been or will be reached between O3b and other lawfully operating spectrum users.

Because there are currently no Ka-band NGSO FSS systems authorized in the United States other than O3b, Harris CapRock's proposed operations will not cause harmful interference to other NGSO FSS systems. Furthermore, as previously demonstrated by O3b, operations of the subject Ka-band NGSO system comply with the relevant Power Flux Density ("PFD") downlink limits for the 18.8-19.3 GHz band designed to protect terrestrial FS services.[47] Harris CapRock's proposed ESV operations are consistent with the PFD limits of O3b's system and will provide the required level of protection from terrestrial FS systems operating in the 18.8-19.3 GHz band when the ESVs are in motion. The ESVs also will operate within the off-axis EIRP limits specified in Section 25.138 of the Commission's Rules and observe the Commission's Ku-band ESV requirements for pointing accuracy, recording and automatic cessation to ensure no harmful interference to authorized FS operations.

D. 17.8-18.6 GHz NGSO Downlink Band

When the ESVs are stationary or in motion, Harris CapRock proposes to operate the ST5000-2.4 terminal on a non-conforming basis in the 17.8-18.6 GHz band. Harris

[47] *See* O3b Limited, File No. SES-LIC-20130528-00455, Technical Appendix, A.5-A.7. Fixed Service stations in the United States operating in the 18.8-19.3 GHz band are no longer co-primary with FSS users in this band. *See* 47 C.F.R. § 101.85(b)(2).

CapRock will not claim protection from conforming uses of the spectrum while the ESVs are in motion and agrees to accept any harmful interference from other services while operating on an unprotected, non-conforming basis. In addition, Harris CapRock will immediately terminate its ESV operations upon notification that such operations are not permitted under the terms of a coordination agreement with, or are causing harmful interference to, any lawfully operating radio system in the 17.8-18.6 GHz band in conformance with the Table of Allocations. Harris CapRock's operations will be in accordance with any coordination agreement that has been or will be reached between O3b and other lawfully operating spectrum users.

There is no potential for the proposed operations to cause interference to other spectrum users because they are receive operations and would be the victim of interference from terrestrial transmit operations. As previously demonstrated by O3b, operations of its Ka-band NGSO system comply with the relevant PFD downlink limits for the 17.8-18.6 GHz band designed to protect terrestrial FS services.[48] Operations of the O3b system also comply with EPFD downlink limits in the 18.3-18.6 GHz band,[49] therefore providing the required level of protection from GSO FSS systems operating in the band. Furthermore, the ESVs will operate within the off-axis EIRP limits specified in Section 25.138 and observe the Commission's Ku-band ESV pointing accuracy, recording and automatic cessation requirements to ensure that there is no harmful interference to GSO FSS systems in this band.

E. 28.35-28.6 GHz and 29.25-30.0 GHz GSO Uplink Bands

When the ESVs are in motion, Harris CapRock proposes to operate the ST5000-2.4 terminal on a non-conforming basis in the 28.35-28.6 GHz and 29.25-30.0 GHz bands. Harris CapRock will not claim protection from conforming uses of the spectrum while the ESVs are in motion and agrees to accept any harmful interference from other services. In addition, Harris CapRock will immediately terminate its ESV operations upon notification that such operations are not permitted under the terms of a coordination agreement with,

[48] *See* O3b Limited, File No. SES-MSC-20150206-00066, Technical Appendix A.5

[49] *Id.* A.7

or are causing harmful interference to, any lawfully operating radio system in the in the 28.35-28.6 GHz and 29.25-30.0 GHz bands in conformance with the Table of Allocations. Harris CapRock's operations will be in accordance with any coordination agreement that has been or will be reached between Ka-band Permitted List satellite operators and other lawfully operating spectrum users.

As discussed, Harris CapRock will operate the proposed terminals within the off-axis EIRP limits specified in Section 25.138 of the Commission's Rules and observe the Commission's Ku-band ESV requirements for pointing accuracy, recording and automatic cessation. Harris CapRock's proposed ESV operations are also consistent with the PFD limits of Ka-band Permitted List satellite operators pursuant to Section 25.138(a)(6) of the Commission's Rules and will provide the required level of protection to other GSO FSS systems operating in the bands while the ESVs are in motion. Because there are no other Ka-band NGSO FSS systems authorized in the United States, Harris CapRock's proposed operations will not cause harmful interference to other NGSO FSS systems. Therefore, Harris CapRock can operate its ESV terminals while in motion on a non-conforming basis in the 28.35-28.6 GHz and 29.25-30.0 GHz bands without causing harmful interference to existing authorized spectrum users.

F. 18.3-18.8 GHz and 19.7-20.2 GHz GSO Downlink Bands

When the ESVs are in motion, Harris CapRock proposes to operate the ST5000-2.4 terminal on a non-conforming basis in the 18.3-18.8 GHz and 19.7-20.2 GHz bands. Harris CapRock will not claim protection from conforming uses of the spectrum while the ESVs are in motion and agrees to accept any harmful interference from other services. In addition, Harris CapRock will immediately terminate its ESV operations upon notification that such operations are not permitted under the terms of a coordination agreement with, or are causing harmful interference to, any lawfully operating radio system in the in the 18.3-18.8 GHz and 19.7-20.2 GHz bands in conformance with the Table of Allocations. Harris CapRock's operations will be in accordance with any coordination agreement that has been or will be reached between Ka-band Permitted List satellite operators and other lawfully operating spectrum users.

There is no potential for the proposed operations to cause interference to other spectrum users because they are receive operations and would be the victim of interference

from transmit operations. Furthermore, Harris CapRock's operations of the ST5000-2.4 terminal will be consistent with the PFD downlink limits previously demonstrated by Ka-band Permitted List satellite operators, pursuant to Section 25.138(a)(6) of the Commission's Rules, and will provide the required level of protection to GSO FSS and terrestrial FS systems when the ESVs are in motion. Furthermore, the ESVs will operate within the off-axis EIRP limits specified in Section 25.138 of the Commission's Rules and observe the Commission's Ku-band ESV requirements for pointing accuracy, recording and automatic cessation to ensure no harmful interference to authorized operations.

G. Waiver Precedent

There is strong Commission precedent for granting the waivers requested herein. The Commission has granted virtually identical waivers to O3b for its non-conforming use of the Ka-band for maritime operations.[50] Harris CapRock's proposed ESV operations are fundamentally the same as O3b's authorized operations. The Commission also has granted similar waivers to enable Ka-band aeronautical operations in the absence of rules governing Ka-band earth stations aboard aircraft ("ESAAs").[51]

Harris CapRock has demonstrated that it can operate the ST5000-2.4 terminal in the maritime context on a non-conforming basis in each band without causing harmful interference to authorized users and agrees to accept any harmful interference from other authorized systems. Accordingly, grant of the requested waivers is consistent with Commission precedent and will not undermine other uses of the subject bands.

IV. PUBLIC INTEREST

Grant of the requested ESV operating authority will strongly serve the public interest. As described in the application materials, the new ST5000-2.4 terminal will comply with the Commission's rules and policies governing Ka-band earth station operations and will otherwise operate on an unprotected and non-interference basis. Authorizing the new ST5000-2.4 terminal for Ka-band operations will facilitate the

[50] *See* File No. SES-LIC-20130528-00455 (Call Sign E130098); File No. SES-MSC-20140318-00150; File No. SES-MSC-20150206-00066; File No. SES-MSC-20151021-00760; Section I.A.

[51] *See* ViaSat Authorization, File No. SES-LIC-20120427-00404, Call Sign E120075.

utilization of Ka-band spectrum for more regularized commercial operations and improve Harris CapRock's commercial ESV network by permitting NGSO and Ka-band Permitted List communications.

In addition, adding the ST5000-2.4 to Harris CapRock's license for Ka-band operations will allow Harris CapRock to provide more robust broadband satellite communications services to a wide array of users, including vessels in motion, marine barges and remote oil platforms that may be unable to obtain communications services through alternative facilities. Users will be able to utilize high-speed Internet access, corporate VPN, e-mail, voice and other services, including emergency communications to support employees in remote locations, throughout international and U.S. waterways. Moreover, the ST5000-2.4 multi-band terminal will facilitate operational flexibility and service optimization based on spectrum availability and customer needs.

V. CONCLUSION

In view of the foregoing, Harris CapRock respectfully requests that the Commission grant its application to modify its existing ESV license (Call Sign E060157) by adding authority to operate the ST5000-2.4 ESV terminal in the Ka-band on U.S. and non-U.S. registered vessels while communicating with O3b's NGSO FSS system in the 27.6-28.4 GHz (Earth-to-space), 28.6-29.1 GHz (Earth-to-space), 17.8-18.6 GHz (space-to-Earth) and 18.8-19.3 GHz (space-to-Earth) frequency bands and Ka-band Permitted List satellites in the 28.35-28.6 GHz (Earth-to-space), 29.25-30.0 GHz (Earth-to-space), 18.3-18.8 GHz (space-to-Earth) and 19.7-20.2 GHz (space-to-Earth) frequency bands.