Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)		
	)		
	)		
Application of KVH Industries, Inc. for	)	File Nos.	SES-LIC-20060824-01502
Modification of License to Operate a	)		SES-LIC-20070504-00563
Network of Earth Stations Onboard Vessels	)		SES-LIC-20081104-01450
("ESVs") in the 14.0-14.5 GHz (Transmit)	)		
and 10.95–11.2 GHz, 11.45–11.7 GHz and	)	Call Sign	E090001
11.7-12.2 GHz (Receive) Frequency Bands	)		
	)		

APPLICATION FOR LICENSE MODIFICATION

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January 4, 2012

SUMMARY

KVH Industries, Inc. ("KVH") hereby submits this application for license modification to add authority to operate up to 500 V11 terminals, a new Ku-band ESV model that uses a 1m antenna and complies with the Commission's ESV rules and policies. Like KVH's other ESV terminals, the V11 is highly efficient and affordable, and will extend the reach of maritime broadband communications to smaller private, commercial and government vessels operating in U.S. waters and open ocean regions around the world.

Grant of the instant modification application will enhance competition in the maritime broadband services market and help maintain U.S. leadership in advanced satellite-based communications services. Accordingly, KVH respectfully requests that the Commission grant the instant application at the earliest practicable time.

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APPLICATION FOR LICENSE MODIFICATION

KVH Industries, Inc. ("KVH"), by its attorneys and pursuant to Section 25.117 of the Commission's rules, 47 C.F.R. § 25.117, hereby submits this application for license modification to operate up to 500 V11 terminals, a new Ku-band ESV model that uses a 1m antenna, to its consolidated ESV network license. The V11 terminal will provide satellite-based, broadband access for various maritime communications applications to private, commercial and government vessels operating in U.S. waters and beyond.

KVH's existing licenses authorize operation of up to 3,500 V7 ESV terminals and 1,000 V3 terminals communicating with specified satellites. KVH seeks to add 500 V11 terminals to its ESV network license. Like KVH's other ESVs, the V11 terminal operates in the 14.0-14.5 GHz band (transmit) and 10.95-11.2 GHz, 11.45-11.7 GHz and 11.7-12.2 GHz bands (receive) and**,** as demonstrated below, complies with the Commission's Ku-band ESV rules and policies, 47 C.F.R. § 25.222.

I. GRANT OF AUTHORITY TO OPERATE THE V11 TERMINAL WILL SERVE THE PUBLIC INTEREST

A. Description of the V11 Terminal

The V11 terminal employs a 1m parabolic reflector with a rear-fed sub-reflector feed assembly design. The terminal will automatically search for and acquire the designated satellite and maintain precise pointing via automatic control of the azimuth, elevation and polarization angles. The associated RF equipment is integrated into the base of the terminal and includes a three watt (3W) block upconverter.

The proposed ESV uplink return transmission (inbound from the ESV to the hub earth station) channel supports data rates of 32 kbit/s, 64 kbit/s, 128 kbit/s, 256 kbit/s and 512 kbit/s. The forward channel (outbound from the hub earth station to the ESV) will be between 3-10 Mbits/s aggregate with individual end-user rates at 0.5-2 Mbit/s. The forward channel is also spread over the 18 MHz, 27 MHz or 36 MHz channel and is overlaid onto the same transponder spectrum using a technique called PCMA.[1]

A summary of the V11 terminal's operating characteristics is set forth in Tables 1 and 2, below.

[1] Paired Carrier Multiple Access ("PCMA") is a proprietary technique developed by ViaSat for its spread spectrum ArcLight service.

Antenna diameter	1.0 m
Type of Antenna	Parabolic rear-fed
Peak Power (SSPA)	3 watts
Transmit Bandwidth	36 MHz
Transmit Gain	42.2 dBi at 14 GHz
EIRP	46.3 dBW
Transmit Data Rate	32 kbps to 512 kbps
Transmit Polarization	Horizontal or Vertical
Transmit Max RF Power Density	-32.4
Transmit Azimuth, Elevation Beamwidth	1.4° (symmetrical antenna)
Receive G/T	18 dB/K at midband
Receive Bandwidth	500 MHz
Receive Polarization	Dual Vertical and Horizontal

Table 1. V11 Terminal Operating Parameters

Azimuth	Continuous coverage over full 360º
Elevation	5 to 80º antenna elevation
Position accuracy (AZ)	Conscan 0.15º RMS; 1.0º RMS in-motion accuracy; Declared Maximum Pointing Error: 1.15º

Table 2. V11 Terminal Antenna Control Parameters

The target end users of this terminal are small and medium size vessels operated by private, commercial and government customers, including leisure vessels, fishing boats, cargo ships and United States Coast Guard and military vessels. The V11 terminal will provide high-speed connectivity for a range of maritime communications applications such as e-mail, Internet access and voice services.

B. Compliance with the Ku-band ESV Rules

The V11 terminal complies with Commission rules and policies designed to protect other users of the Ku-band from harmful interference from ESV transmit operations.

1. Off-Axis EIRP Spectral Density Limits

The V11 will operate in accordance with the off-axis EIRP spectral density limits for Ku-band ESV terminals in the Commission's rules.[2] The data rates transmitted from the terminal will vary from 32 kbits/s to 512 kbits/s. Additionally, the ESVs will transmit using CRMA spreading[3] over 18 MHz, 27 MHz and 36 MHz channel bandwidths. The co-polarized off-axis EIRP spectral density levels of the KVH ESV terminal are shown in Figures 2 through 5 below at +/-10 degrees and +/- 180 degrees off-axis angle. Note that a calculated worst case aggregate EIRP occurs when N=8 users for an 18 MHz channel bandwidth, N=12 users for a 27 MHz channel bandwidth, and N=16 users for a 36 MHz transmit channel bandwidth.

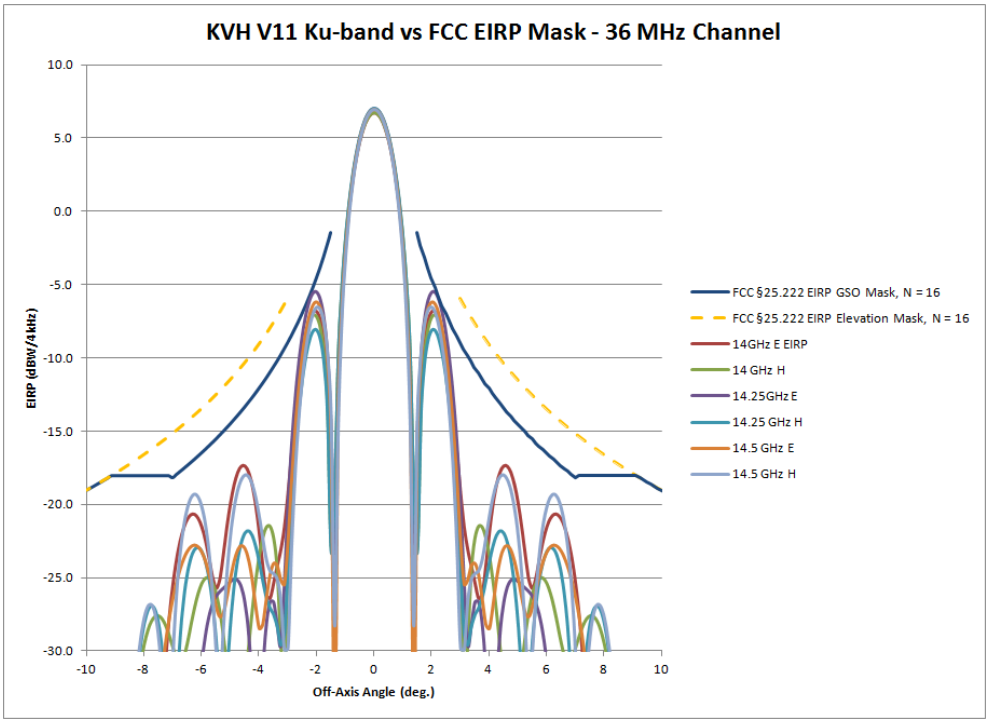

Figure 2 - V11 Off-Axis EIRP Spectral Density – 36 MHz Channel

[2] *See* 47 C.F.R. § 25.222(a)(1)(i). The V11 terminal complies with off-axis EIRP spectral density limits in both the azimuth and elevation plane.

[3] CRMA, or Code Reuse Multiple Access, is a ViaSat proprietary spread spectrum technique, similar to CDMA, used in the ArcLight satellite system.

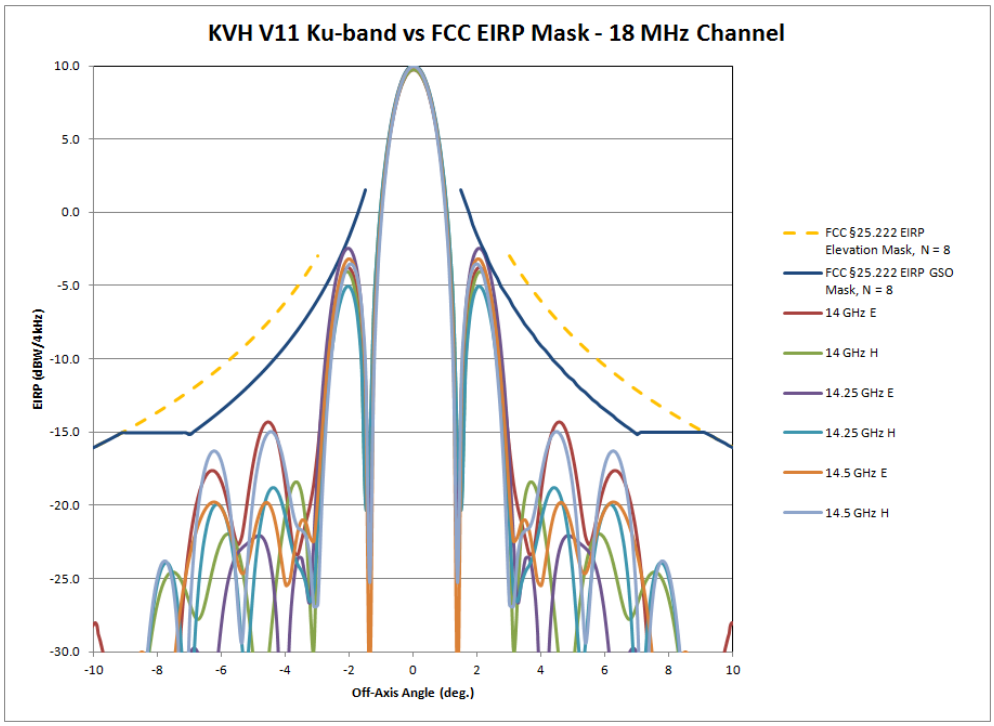

Figure 3 - V11 Off-Axis EIRP Spectral Density – 18 MHz Channel

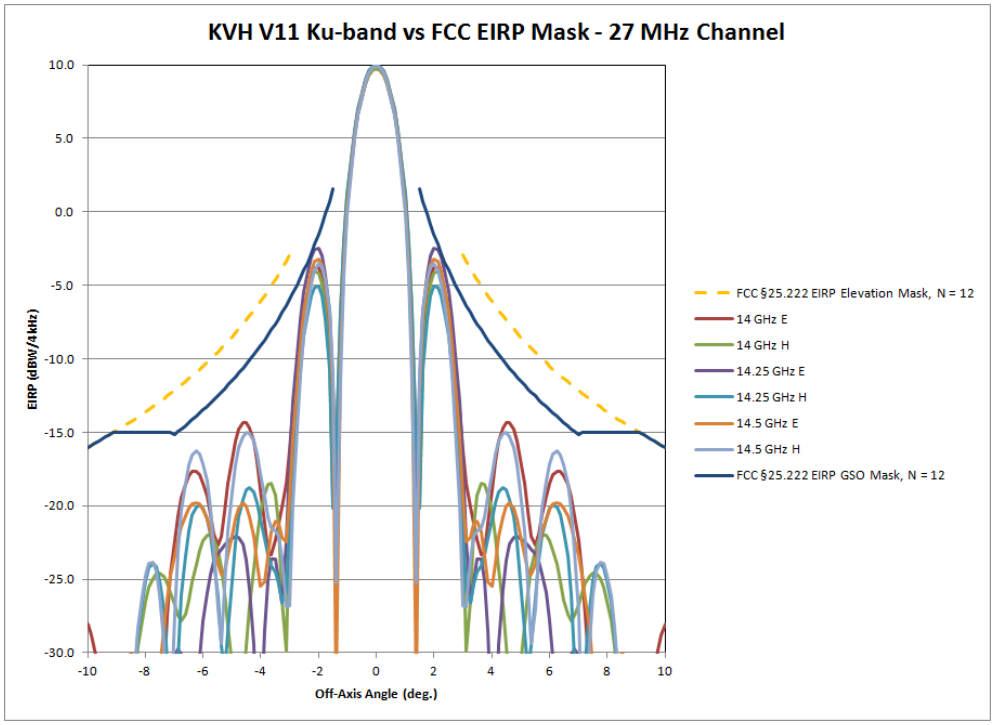

Figure 4 – 27 MHz Off-Axis EIRP Spectral Density

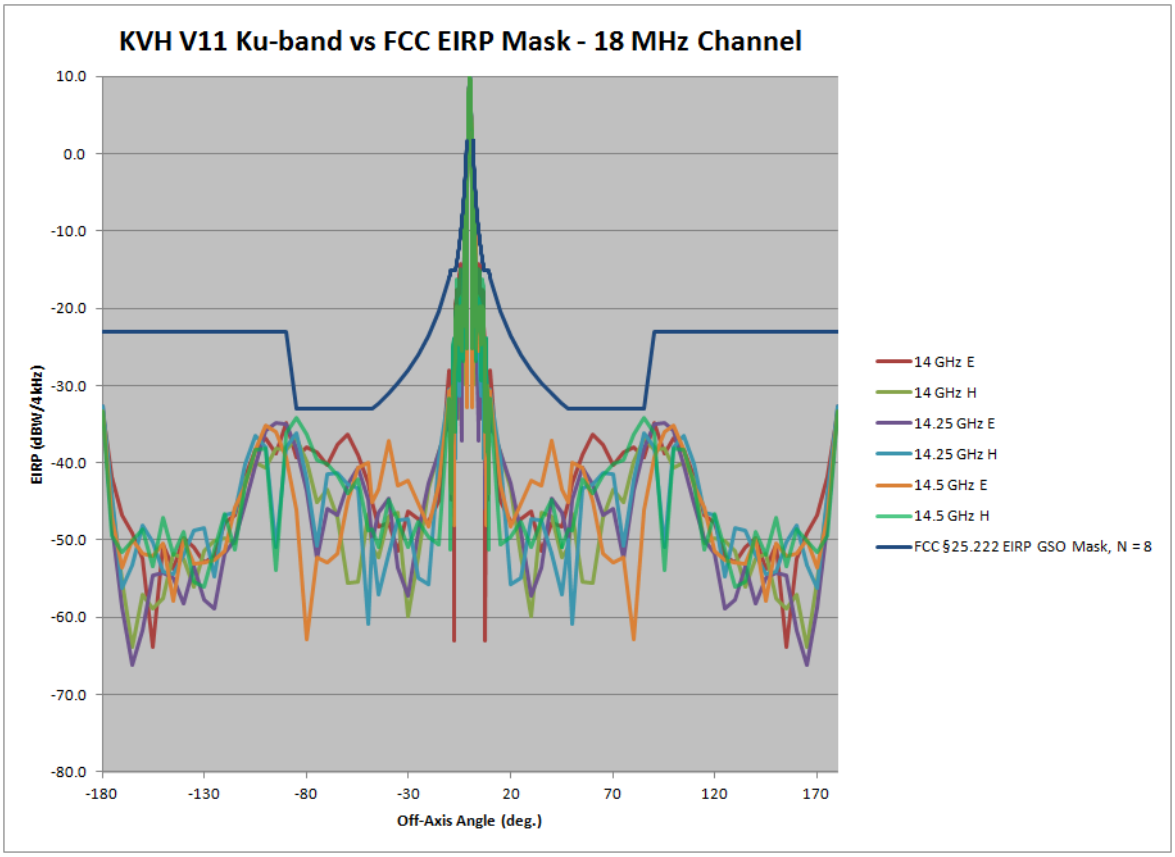

Figure 5 – 18 MHz Channel Off-Axis EIRP Spectral Density, +/- 180 deg.

In addition, pursuant to Section 25.222(a)(1)(i) and (b)(1), KVH has included in Exhibit 1 the required tables.[4] Table 1 contains the co-polarized E and H plane antenna patterns for the parabolic antenna, the E and H plane EIRP charts and the Commission's GSO and Elevation masks.

The foregoing off-axis EIRP spectral density plots, and the attached antenna gain plots and tables, demonstrate that the V11 terminal will comply with the spectral density levels set forth in Section 25.222 of the rules and the Commission's two-degree spacing policies. Because

[4] *See* Exhibit 1.

the V11 complies with the off-axis EIRP spectral density limits contained in Section 25.222(a)(1) of the rules, target satellite operator coordination letters are not required for authorization.

2. V11 Terminal Antenna Pointing Control

The V11 terminal will meet the ESV off-axis EIRP spectral density limits with a declared maximum antenna mispointing of 1.15°.[5] Upon reaching mispointing of 1.15°, the terminal will inhibit transmission within 100 milliseconds and, out of an abundance of caution, will not resume until the pointing error value is back to within 1.0°.[6]

The antenna system utilizes a conical scanning function and rate gyros to stabilize the antenna and keep it pointed properly at the desired satellite. The conscan is currently set to worst case 0.15º from boresight. The additional dynamic pointing error for the vessel accelerations during operation is expected to be approximately 1.0º. Thus the total expected mean pointing error for each vessel while under way, including both conscan and dynamic error, is 1.15º.

The ESV V11 terminal will utilize a motion stabilized tracking antenna and a direct sequence spread spectrum ("DSSS") burst modem manufactured by ViaSat to access the satellite. Each terminal will use the CRMA common spreading code and a random access method to access the satellite. CRMA is closely analogous to the more generally understood code division multiple access ("CDMA") multiple access method, but differs in that all terminals use a common spreading code rather than a number of individual codes for each transmitter. Individual bursts are distinguished by time difference of arrival. The use of this spreading

[5] *See* 47 C.F.R. § 25.222(b)(1)(iv)(A).

[6] *See* 47 C.F.R. § 25.222(b)(1)(iv)(B). Although KVH could resume transmission upon bringing pointing offset within the declared maximum pointing error of 1.15°, its system is conservatively designed to recommence transmissions when the pointing offset reaches the expected conscan plus error value of 1.0°.

technique allows the EIRP spectral density for each ESV to be significantly lower than typical TDMA systems operating in Ku-band.

If conditions cause the antenna pointing offset to exceed the declared maximum pointing error limit of 1.15°, the antenna system will send a message to the modem, and the modem will inhibit transmission until the aggregate conscan plus dynamic pointing error value is back to within 1.0°. The time lag from the time that the mispointing exceedance is detected to the time when transmissions are inhibited will be less than 100 milliseconds.

The KVH ESV network uses a spread spectrum multiple access technique whereby the individual off-axis EIRP density of each ESV terminal is well below the maximum aggregate network limit. Thus, each antenna individually will not generate harmful levels of interference – even if the antenna were pointed directly at an adjacent satellite. Random pointing errors across this ESV fleet will not cause objectionable levels of adjacent satellite interference because the antenna on each ESV will be pointing in a different direction with a different error component. There is an extremely low probability that multiple antennas will be mispointed at an adjacent satellite at the same time in such a way that results in harmful interference. Because the pointing error is random and momentary, when deliberate conscan is taken into account each ESV antenna actually has a higher likelihood of being pointed away from the geostationary satellite arc than towards an adjacent satellite.

As described in Exhibit 1, Section 5 (Pointing Accuracy), KVH has analyzed the off-axis EIRP spectral density associated with an ESV transmitting at the worst case pointing offsets and has concluded that its network will operate well below the permissible mask. In particular, Figure 6 shows the effect of a transmitting ESV operating at a pointing offset of 1.25 degrees, which is beyond the stated worst case excursion for this terminal. Note that the emissionis well

below the mask. This extremely conservative analysis firmly establishes that, like the presently authorized V7 and V3 terminals, the V11 will operate consistent with the Commission's two-degree spacing policies and will not cause harmful interference to other Ku-band operations.

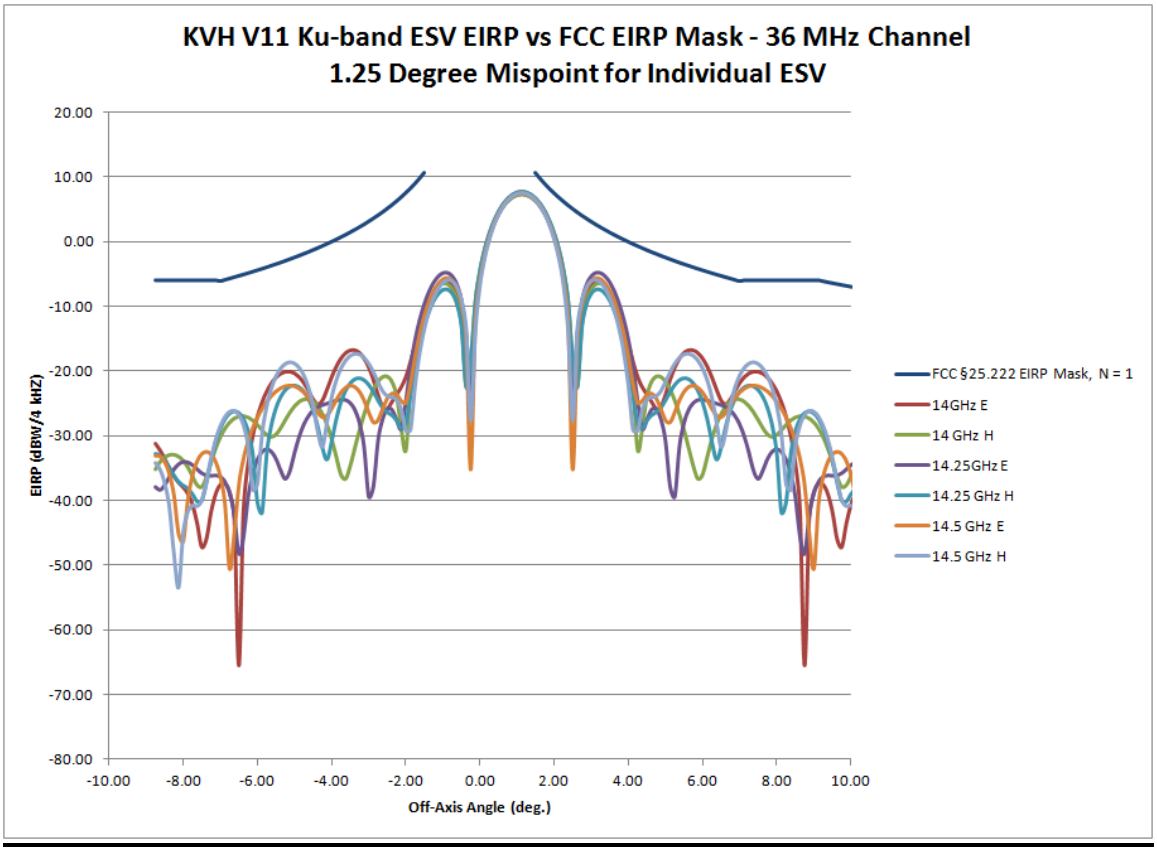

Figure 6 - Ku-Band ESV Terminal Off-axis EIRP with 1.25 degree pointing error vs §25.222 limit

3. Compliance With Additional ESV Requirements

KVH will comply with the additional requirements for ESV applicants.

Section 25.222(a)(3), (b)(4) Points of Contact and Section 25.222(a)(6) Hub Earth Station in the United States. The KVH points of contact for the proposed ESV operations, available 24 hours, 7 days a week, with authority to cease all emissions from the ESVs are:

Robert Bourget
KVH Industries, Inc.
Phone: 401.851.3830
Mobile: 401.864.8458
Email: rbourget@kvh.com

The KVH contact information for its network control station in Carlsbad, California is:

6155 El Camino Real
Carlsbad, San Diego County, CA 92009
Tel: 760-476-2583

For filing issues involving this authorization request please contact:

Carlos Nalda
Squire, Sanders & Dempsey L.L.P.
1200 19th Street, NW
Suite 300
Washington, DC 20036
Office: (202) 626-6659
Fax: (202) 626-6780
Cell: (571) 332-5626
Email: carlos.nalda@squiresanders.com

For technical issues involving this authorization request:

Kenneth G. Ryan, P.E., Skjei Telecom, Inc.
Regulatory Engineering Consultant
Office: (703) 917-4020
Fax: (703) 917-0098
Cell: (703) 919-0361
Email: ken@skjeitelecom.com

Section 25.222(a)(4) Recordkeeping. KVH will maintain, for each ESV transmitter, a time-annotated record of the ship location, transmit frequency, channel bandwidth and satellite used for at least one year. The location and time of all transmissions, at time intervals no greater than every 20 minutes while the ESV is transmitting, will be stored on a server at the hub. This information will be sent to the network control facility in Carlsbad, CA. It will be available, as required by the Commission rules, to a coordinator, fixed system operator, FSS operator, the NTIA or the Commission within 24 hours of the request.

Section 25.222(a)(5) Communications With Vessels of Foreign Registry. Records of communications with vessels of foreign registry will be downloaded to the ESV hub earth station and forwarded to the network control facility in Carlsbad, California for storage and retrieval.

Section 25.222(a)(7) Protection Claims. KVH will not claim protection from interference from any authorized terrestrial stations to which frequencies are already assigned or may be assigned in the future, in the 10.95-11.2 GHz and 11.45-11.7 GHz frequency bands.

Section 25.222(b)(3) Geographic Area of Service. KVH is seeking authorization to operate within the continental United States (CONUS), Alaska and Hawaii, as well as U.S. territories and possessions and adjacent waters within the satellite coverage zones. The service is designed as a regional service, covering the North American continent and its coastal waters, Central America, the Gulf of Mexico and the Caribbean, as well as large portions of the Atlantic and Pacific Oceans as shown in Exhibit 1, Section 3.

Section 25.222(b)(5) Radiation Hazard. KVH has included a radiation hazard analysis with this application as Exhibit 2.

4. Protection of Other Users in the 14.0-14.5 GHz Band

KVH's operation of the V11 antennas will protect other users in the 14.0-14.5 GHz band consistent with the requirements of the Commission's ESV rules.

Protection of Fixed-Satellite Service. As discussed above, KVH's terminals will operate in compliance with the ESV off-axis EIRP spectral density limits, even taking the declared pointing accuracy values into consideration. The ESV limits are consistent with those for routinely licensed VSAT earth stations and are consistent with the Commission's two-degree spacing policies.

Protection of Potential NGSO FSS Systems. KVH acknowledges that non-geostationary orbit ("NGSO") systems are also permitted to operate in the Ku-band. However,

no such systems are currently authorized. KVH will undertake adequate protection measures if such systems are authorized in the future. In any event, the V11 terminal meets the required FCC off-axis EIRP mask in directions other than the GSO arc.

Protection of Terrestrial Radio Services. KVH has examined current spectrum use in the 14.0-14.5 GHz band and has determined that there are no active FCC-licensed terrestrial services in this band in North America with which its proposed operations would potentially conflict.

Protection of the Radio Astronomy Service. KVH will comply with its prior coordination agreement with the National Science Foundation to protect radio astronomy service sites listed in Section 25.222(d) of the rules.[7]

Protection of Space Research Service. KVH recognizes the utilization of the frequency band from 14.0-14.05 GHz and the possible use of the band from 14.05-14.2 GHz allocated to the NASA TDRSS for space research conducted at White Sands, New Mexico and Blossom Point, Maryland. For purposes of this application, KVH will avoid ESV operation within 125 km of these earth stations until a coordination agreement is executed with NASA.[8]

C. Compliance With International Requirements

Although the Commission's ESV rules are consistent with the conclusions of ITU-R World Radiocommunication Conference ("WRC-03") and the intent of international ESV operational standards, including ITU-R Resolution 902, there are certain inconsistencies between U.S. and international provisions governing Ku-band ESV operations. Specifically, the U.S.

[7] Coordination Agreement with the National Science Foundation, submitted with a letter dated November 20, 2008 in IBFS File No. SES-LIC-20081104-01450.

[8] *See* 47 C.F.R. § 25.222(c).

rules do not contain antenna size and 0.2˚ pointing accuracy specifications.[9] Although the V11 terminal complies with the Commission's ESV rules, it does not strictly comply with the pointing accuracy provisions of Resolution 902. As a result, it is appropriate for the Commission to authorize V11 operations pursuant to Article 4.4 of the ITU Radio Regulations to support operations within 125 km of foreign coasts.[10]

The Commission has determined that its off-axis EIRP spectral density limits toward every point in the GSO arc will adequately protect adjacent satellites,[11] and has authorized greater maximum pointing accuracy values than contemplated in Resolution 902 in its revised ESV rules. In fact, the currently authorized V7 and V3 terminals utilize deliberate conscan (rotation around boresight to the target satellite) in excess of 0.2° to peak signal strength and

[9] In particular, the Commission permits ESV operators to specify a declared maximum pointing error, subject to compliance with the off-axis EIRP spectral density limits or alternative levels established in satellite operator coordination agreements. The relaxed pointing accuracy requirements were based on a revised definition for off-axis EIRP spectral density, which essentially includes pointing accuracy as part of the EIRP spectral density mask thereby making the maximum pointing accuracy less relevant to adjacent satellite interference. *See* ESV Order on Reconsideration, ¶ 22-27 and n.59; *see also* 47 C.F.R. § 25.222(a)(1)(ii)(B).

[10] Some administrations may view the 0.2° value as a "hard limit" on pointing accuracy, even though the Commission has adopted rules that afford more operational flexibility to Ku-band ESV operators consistent with protection of other co-frequency services. Article 4.4 provides that administrations of member states should not authorize a station in derogation of the Regulations, "except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations."

[11] In the instant application, KVH has declared a maximum antenna pointing error for the V11 terminal of 1.15° and has shown how the V11 will comply with the Commission's ESV spectral density limits to protect adjacent satellites. *See supra* Section I.B.2 and Technical Appendix.

maintain consistent pointing towards their serving satellites. The Commission included a special condition in KVH's ESV license to afford authority to operate under Article 4.4.[12]

Consistent with this precedent, and because KVH will neither cause harmful interference nor claim protection form other users in the band, the V11 can be authorized to operate pursuant to Article 4.4 with respect to pointing accuracy. Indeed, adding the V11 terminal to KVH's existing ESV license, which contains such Article 4.4 operating authority, means that no additional change to the license is necessary to permit V11 operations under Article 4.4.

The Commission also sought to protect co-frequency services – in the U.S. case, NASA TDRRS operations – from harmful interference by adopting power and power spectral density limits towards the horizon set forth in ITU-R Resolution 902 for Ku-band ESVs.[13] These limits also protect terrestrial fixed service ("FS") operations from harmful interference and formed part of the basis for the minimum distance for "prior agreement" established in Resolution 902. The V11 terminal will operate internationally no lower than 6.25° elevation and has a maximum EIRP towards the horizon of 16.2 dBW, and a maximum EIRP spectral density towards the horizon of 3.67 dBW/MHz, and thus is compliant with the values adopted by the Commission and embodied in Resolution 902.

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[12] *See* KVH Industries, Inc., Radio Station Authorization, Call Sign E090001, File No. SES-MOD-20110126-00062 at Special Condition 300 (addressing antenna size and pointing accuracy: "With respect to antenna size and pointing accuracy, licensee is authorized to operate in accordance with Article 4.4 of the ITU Radio Regulations. The operations authorized herein shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the ITU Constitution, the ITU Convention, and the ITU Radio Regulations. The operations authorized herein are otherwise consistent with ITU provisions.").

[13] *See* ESV Report and Order, ¶ 102 ("Specifically, we adopt the two limits contained in ITU Resolution 902, an EIRP towards the horizon of no greater than 16.3 dBW, and an EIRP density towards the horizon of no greater than12.5 dBW/MHz."). *See also* 47 C.F.R. § 25.204(i).

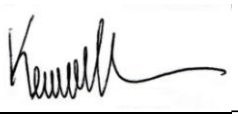
II. CONCLUSION

For the reasons set forth herein, the Commission should authorize modification of KVH's ESV network license, Call Sign E090001, to permit operation of up to 500 V11 terminals as part of KVH's ESV network to extend broadband communications to smaller vessels. The V11 terminal complies with the Commission's ESV rules and policies, and can be authorized pursuant to ITU Radio Regulation Article 4.4 to facilitate operations in international and foreign waters.

This modification would strongly serve the public interest by enhancing competition in broadband maritime services and maintaining U.S. leadership in advanced communications connectivity. Because the requested modification is consistent with the Commission's ESV rules and policies, KVH respectfully requests action on this application at the earliest practicable time.

Technical Certificate

I, Kenneth Ryan, hereby certify that I am the technically qualified person responsible for the preparation of the technical discussion contained in KVH Industries, Inc.'s Application for License Modification, that I am familiar with Part 25 of the Commission's Rules (47 C.F.R. Part 25), and that I have either prepared or reviewed the technical information submitted in this Application and found it to be complete and accurate to the best of my knowledge and belief.

By: 

Kenneth Ryan, P.E.
Skjei Telecom, Inc.

January 4, 2012