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

In the Matter of	)	
	)	
AvL TECHNOLOGIES	)	
	)	File No. SES-MOD-20040225-00277
	)	E030130
Application for Earth Station Authority	)	
in the Fixed-Satellite Service	)	

PETITION TO DENY

Pursuant to Section 25.154(a) of the Commission's Rules, 47 C.F.R. § 25.154(a), SWE-DISH Satellite Communications, Inc. ("SWE-DISH"), the U.S.-subsidiary of SWE-DISH Satellite Systems AB, hereby files this Petition to Deny the modification application ("Application") of AvL Technologies ("AvL"). AvL's Application seeks to add three "non-conforming" antennas to its satellite earth station license (E030130) – a 0.75 meter dish, a 0.96 meter dish and a 1.0 meter dish – in addition to the 1.2 meter antenna currently authorized. As described below, SWE-DISH believes that AvL's Application raises substantial questions concerning compliance with the Commission's Rules regarding adjacent satellite interference and radiation hazard, and cannot be granted until additional information is provided or the Application is amended.[1]

BACKGROUND

SWE-DISH provides satellite communications products and services to the world market. SWE-DISH develops, produces, integrates, sells and supports products and services for digital

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[1] *See, e.g., Citizens Committee to Save WEFM v. FCC*, 506 F2d 246 (D.C. Cir. 1973) (grant of an application is not appropriate if substantial and material questions of fact are raised, or if the Commission is unable, on the basis of the application, pleadings, and officially noticeable matters, to make the requisite finding that the public interest would be served).

transmission of image, voice and data, with a focus on mobile satellite terminals and enabling services. In-house technological developments continually adapt and improve technology to meet customer requirements and bring new and innovative products and services to the market.

As a result, SWE-DISH is uniquely qualified to review the technical showings submitted by AvL and to raise questions about whether the Application demonstrates compliance with the Commission's Rules. SWE-DISH, moreover, is deeply interested in the Commission's action here, because it will solidify the current benchmark for demonstrations of compliance with the Commission's Rules to support grant of authority.[2]

This Application actually represents the second time that AvL has sought to license the antennas in question. AvL filed its original earth station application on June 2, 2003, which included requests for authority to use 1.2 meter, 1.0 meter, 0.96 meter and 0.75 meter antennas.[3] In response to a Petition to Deny filed by PanAmSat Corporation (PanAmSat") expressing concerns that AvL had not demonstrated that the less than 1.2 meter antennas conformed to the Commission's Rules,[4] AvL "supplemented" its application by requesting that the 0.75 meter, 0.96 meter and 1.0 meter antennas be removed from the application.[5] The Commission then granted the AvL application (for just the 1.2 meter antenna) within a day of receiving the "supplement" from AvL.

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[2] SWE-DISH, for example, has expended considerable resources developing a sophisticated less than 1.2 meter antenna system that avoids potential interference to adjacent satellites spaced 2 degrees from the satellite with which the IPT SUITCASE will be communicating. SWE-DISH further obtained independent third-party testing of the antenna to demonstrate compliance.

[3] File No. SES-LIC-20030602-00727. AvL's original application appeared on Public Notice on June 11, 2003.

[4] Petition to Deny filed by PanAmSat Corporation ("PanAmSat Petition"), File No. SES-LIC-20030602-00727 (July 10, 2003).

[5] Letter from William K. Coulter to Marlene Dortch, dated October 20, 2003.

AvL subsequently filed this Application to modify its earth station license to add the three antennas it had previously removed from the original application.[6]

The Commission has developed detailed technical parameters for satellite earth station performance standards to allow 2 degree spacing of satellites without risk of harmful interference.[7] The Commission's Rules also provide that, for satellite earth stations operating in the Ku-band, only antennas with an equivalent diameter of 1.2 meters or greater are eligible for "routine processing." Because each of the earth station antennas in AvL's Application are less than 1.2 meters in diameter, it was incumbent upon AvL to demonstrate that the proposed earth stations can operate on a non-interference basis in the 2 degree spacing environment.

Based on SWE-DISH's review of the AvL Application and other publicly available information on those proposed systems, we submit that the present record fails to demonstrate that the 0.75 meter, 0.96 meter and 1.0 meter antennas can operate on a non-interference basis in the 2 degree spacing for U.S. satellites. In addition, the Application raises questions as to whether these AvL earth stations comply with the Commission's radiation hazard limits with respect to backlobe emissions and whether the antennas can transmit in both polarizations in the manner indicated in the Application.

DISCUSSION

Given SWE-DISH's extensive experience in the design and manufacture of transportable earth stations, we are well aware that successfully overcoming the increased risk of adjacent satellite interference associated with a reduction in antenna size requires the application of high precision mechanics and sophisticated reflector design. The use of tracking and auto-acquisition

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6 File No. SES-MOD-20040225-00277, Public Notice Report No. SES-00-593, April 7, 2004.

7 *See generally* 47 C.F.R. §§ 25.209 and 25.212.

algorithms can also contribute to an increased risk of adjacent satellite interference, requiring extra care in the design and operation of such systems, since these algorithms generally require larger margins as compared to human-operated systems. If the mechanical design, together with an auto-acquisition and/or tracking system, is not properly matched with the reflector design, the result will be an increased potential for adjacent satellite interference.

The potential for radiation hazard to the earth station operator as a result of backlobe radiation is another risk associated with reductions in antenna size. For small antenna reflectors (such as the models at issue here) in a 2 degree satellite spacing environment, the earth station must keep the mainlobe narrow, because otherwise interference to adjacent satellites could be a serious problem (due to the higher power density of the mainlobe compared to potentially interfering sidelobes). Therefore, one of the critical design criteria is to make the mainlobe as narrow as possible. This is easiest to do by illuminating the dish uniformly, because then the largest part of the dish is utilized.

For single offset antennas (such as the ones AvL uses), this gives rise to a new problem, because there is not a subreflector to help shape the illumination of the main dish. In terms of backlobes, SWE-DISH is not aware of a manner in which the feedhorn can be designed in such a way that the power density goes to zero exactly at the edge of the reflector. Rather, the main reflector will be over-illuminated and the result is a backlobe with a gain in accordance with the horn gain (as if the main reflector were absent when looking over the reflector edge into the feedhorn). Because the energy density on the antenna surface originating from the feedhorn will be high (and normally above the safety limit for non-ionizing radiation), a backlobe with similar energy density would likely pose a radiation safety issue behind the antenna.

For single offset antennas, if the design is altered in order to minimize the backlobe, the result will be a wide mainlobe, which could create problems with the pointing accuracy and wind

load issues. By way of contrast, a dual-offset construction would make it possible to shape the illumination and minimize the mainlobe width without serious over-illumination or backlobe.

Pointing Accuracy Concerns

AVL's Application and accompanying materials indicate that the 0.75 and the 0.96 meter antennas will be aligned with a nominal pointing accuracy of less than or equal to 0.3 degrees with wind, and the 1.0 meter antenna with a nominal pointing accuracy of less than or equal to 0.4 degrees with wind.[8] To properly evaluate the possibility of antenna misalignment, a justification of the peaking error in the different operational modes (manual, auto-acquisition and tracking) should be detailed together with the pointing error in the operational wind speed, which has not been provided.

There is the possibility of additional misalignment occurring as a result of another aspect of the AvL design, involving the deformation of the reflecting surface and the optical path. Since the heavy feedarm is attached to the reflector and not the supporting construction itself, coupled with the fact that the antenna rotates around its boresight to adjust the polarization, the feedarm will induce a varying torque on the reflector and hence deflect the boresight in a non-constant manner. The effect of this is a displacement of the feedarm itself, thereby altering the optical path. To address this concern, AvL should be required to supplement its Application with the results of a simple test to estimate the magnitude of this effect on each system.

Once all these contributions to the misalignment have been properly identified and measured, the total system alignment capability can be evaluated. Using the AvL specifications published on their web site, our own rough estimate calculation of potential misalignment raises

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[8] See Letters dated December 9, 2003, and January 13, 2004, from SES Americom to FCC (appended to AVL Application as Attachments Affidavit1 and Affidavit2).

significant doubts about whether any of the three systems would in fact achieve the pointing accuracy indicated in the SES Americom letters.[9]

Further, as PanAmSat observed in its Petition to Deny AvL's original application:

> "AvL's showing, however, is lacking critical information. Whether AvL's proposed operations pose an interference threat to adjacent satellites is dependent on the accuracy of its new auto-acquisition system, including its 'patented Roto-Lok® drive system.' However, it is impossible for the Commission, let alone PanAmSat, to make a proper evaluation regarding alignment without additional information about this system."[10]

AvL's Application fails to provide any of the additional information specified by PanAmSat in its Petition to Deny.

Radiation Hazard Concerns

Examination of the antenna pattern of the 1.0 meter antenna[11] reveals a large backlobe with a gain peak close to 22 dBi. As this backlobe could be directed back towards the operator, it must be fully analyzed. The intensity of the backlobe indicates that it originates directly from

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[9] *See* AVL Technologies, Technical Specification PDFs (visited May 5, 2004) <http://www. avltech.com/avl_pdf/model1000SpecSheet.pdf; <http://www.avltech.com/Pages/75mvsat.pdf; <http://www.avltech.com/Pages/96avsat.pdf. For each of the three antenna systems, the Beam Deflection-Transmit is defined in units of dB for certain windload. Transforming the dB figure to angular deflection using the shape of the mainbeam peak produces a rough estimate of the misalignment due to the specified windload. The result yields a larger misalignment induced by wind alone than the maximum misalignment contemplated in the SES Americom letters, without taking account of other factors contributing to misalignment.

[10] PanAmSat Petition at 2-3. Although the PanAmSat Petition did not specifically address the 1.2 meter antenna, the questions and concerns raised by PanAmSat regarding the Roto-Lok® drive system are independent of the antenna size. Therefore, they would be equally applicable to the 1.2 meter antenna as well, since that drive system was to be utilized on all four-sized antennas covered by the original application. Indeed, it would appear from the information provided by AvL that pointing accuracy actually *diminishes* as antenna size increases. Unfortunately, it does not appear from the record that the deficiencies in information provided about the Roto-Lok® drive system raised by PanAmSat were ever considered by the FCC in granting the license for the 1.2 meter antenna in the original application, once the smaller dishes were removed. Yet AvL now appears to be relying on the prior (routine) license approval as an endorsement of the Roto-Lok® drive system for use with these smaller (non-routine) antennas.

[11] *See* AvL Application, AvL.App.PAT1000.

the feedhorn, and therefore the power density behind the reflector, in line with the backlobe, should be of the same order as the intensity on the reflector surface, exceeding the safe limits for both controlled environment (5 mW/cm^2) and uncontrolled environment (1 mW/cm^2). We further note that the results of the radiation hazard analysis calculations for all three dish sizes are absent except for the power density at the reflector surface. At a minimum, these results should be provided along with a calculation of the safe distance behind the 1.0 meter reflector.

With regard to the 0.75 meter antenna, it is impossible to properly assess the backlobe situation because the antenna radiation patterns showing the possible backlobe are missing for the transmit band. AvL should supplement its Application to provide this missing information.

The incomplete information reflected in the antenna patterns on the AvL antenna backlobe transmissions suggests that AvL has "opted for" a large backlobe in order to minimize the width of the mainlobe. These backlobe radiations may raise a safety issue for the earth station operator, particularly in the "fixed temporary" mode in which these systems are intended to operate.[12] However, the terse Radiation Hazard Studies submitted by AvL fail to address this issue sufficiently for SWE-DISH to determine whether their systems comply with Commission requirements. Until such information is submitted for these earth stations, SWE-DISH believes grant of the Application would be premature.

Ability to Transmit on Both Polarizations

From the information in the Application and the specifications on the AvL web-site, a question regarding the AvL systems and their ability to transmit on both polarizations (horizontal and vertical) is raised. The radiation patterns that have been submitted use the 32-25*Log (Theta) envelope on the elevation patterns, which is correct as long as the azimuth cut is always

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[12] The different antenna patterns submitted by AvL with its original application and the instant Application for the 1.0 meter antenna suggest that in order to address some of these potential concerns, AvL may have altered the design of the dish or the feedhorn between filings.

aligned with the satellite orbital arc and not the elevation cut. But since the AvL systems align the polarization by rotation of the antenna around the boresight, according to specifications on AvL's web site,[13] the elevation cut will be aligned with the satellite orbital arc for one of the two orthogonal polarization directions. Since the antennas are of offset construction, the mainlobe will be asymmetric in the elevation cut and therefore will have somewhat worse characteristics with respect to adjacent satellite interference compared to the symmetric azimuth cut. Therefore, the elevation cut will be the dominating cut for determining the allowable misalignment.

When the elevation cut is aligned with the orbital arc, this cut will determine the adjacent satellite interference levels rather than the azimuth and should be required to comply with the 29-25*Log(Theta) envelope. This is not addressed at all in the current Application and should be clarified. Specifically, AvL should indicate whether the operator is required to manually rotate the feed when changing between the two orthogonal transmit polarizations or, if not, why the elevation plots (when included) have not been submitted for the 29-25*Log(Theta) envelope that would justify polarization alignment by antenna boresight rotation alone.

This issue might be easily resolved by inclusion of the users guide for each system, if there is an easy and user-friendly way of changing between the two orthogonal polarizations without simultaneously turning the antenna. If not, AvL must add elevation plots with 29-25*Log(Theta) envelopes to enable a correct adjacent satellite interference analysis.

Other Relevant Information

To fully evaluate the possibility of adjacent satellite interference, it is also necessary to show the close-in plots with the mainlobe and the first sidelobes, however these plots are missing on the 0.96 meter antenna. With regard to the 0.75 meter antenna, the close-in radiation patterns

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[13] *See* footnote 9, *supra*. The polarization axis rotation for each of the three antenna systems is specified as "Rotation of Reflector/Feed System about boresight."

showing the mainlobe and the first sidelobes should be modified to show the 29-25*Log(Theta) envelope from 1.25° as required by the Commission in order to allow for an easy evaluation of the possible adjacent satellite interference levels.

The current Application appears to provide somewhat inconsistent information from the original application with regard to the pointing accuracy of its earth stations. In the original application, AvL asserted that "the proven capability of AvL's new auto-acquisition system the pointing accuracy will always be within 0.2 degrees of the center of the main beam."[14] In contrast, in the current Application AvL did not include the same "Technical Justifications." The AvL Application does not provide any support for these claims regarding adjacent satellite interference, nor does it indicate how the earth station operators (or the "automatic" system) will detect alignment errors and cease transmissions.

It is not clear what, if anything, changed with respect to the antenna system designs between the time of AvL's original filing on June 2, 2003 and the current Application filed on February 25, 2004. SWE-DISH observes that with respect to the 0.75 meter antenna, AvL submitted the identical antenna test patterns (apparently from a study conducted on April 12, 2000). For the 0.96 meter antenna, the original application included an undated eight page set of test patterns, while the current Application includes a different 20 page set of antenna patterns dated November 14 and 15, 2000. For the 1.0 meter antenna, the original application included an undated 23-page set of antenna patterns, while the current Application included a different "Antenna Test Report" (conducted by a subsidiary of TriPoint Global – a company that commented on SWE-DISH's application), dated November 13, 2003.[15] We further note that

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[14] AvL Application (SES-LIC-20030602-00727), Technical Justification.

[15] AvL does not explain why the application relies on antenna tests conducted more than three years earlier for the 0.75 meter and 0.96 meter antennas, as opposed to the tests for the 1.0 meter antenna that are much more current.

antenna data for elevation angles smaller than –5 degrees is missing for the 1.0 meter antenna (although provided in the original application filed in June 2003).

Lastly, we would also like to observe that, according to industry practice, a cut antenna is not considered as the same antenna without cuts when evaluating the antenna radiation properties. Therefore it is important that AvL confirm that the submitted radiation patterns for the 1.0 meter antenna have been measured on a cut antenna.

CONCLUSION

For the foregoing reasons, the Commission should (1) require AvL to supplement its Application to supply the additional or missing information, as discussed above, concerning pointing error, radiation hazard, capability to transmit in both polarizations and other matters; and (2) fully and completely review the sufficiency of such additional information to resolve the issues identified herein before taking action on AvL's Application.

Respectfully submitted,

SWE-DISH SATELLITE COMMUNICATIONS, INC.

By: Maury J. Mechanick

Maury J. Mechanick
WHITE & CASE, LLP
601 13th Street, N.W.
Washington, D.C. 20005
Tel: (202) 626-3635
Fax: (202) 639-9355
Email: mmechanick@whitecase.com
Its Attorney

May 7, 2004

DECLARATION

I, Håkan Karlsson, Chief Technical Officer of SWE-DISH Satellite Systems AB, the parent company of SWE-DISH Satellite Communications, Inc., hereby declare under penalty of perjury under the laws of the United States, that:

(1) I have read the foregoing "Petition to Deny" submitted by SWE-DISH Satellite Communications, Inc. concerning the application filed by AvL Technologies.

(2) The facts and technical information set forth therein are true and correct to the best of my knowledge, information and belief.

Executed this 7th day of May, 2004.

Håkan Karlsson
Chief Technical Officer
SWE-DISH Satellite Systems, AB

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing was sent by first-class mail, postage prepaid, this 7th day of May, 2004, to the following:

William Coulter
Coudert Brothers, LLP
1627 Eye Street, N.W.
Washington, D.C. 20006

Maury J. Mechanick