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

In the Matter of	)	
	)	
2000 Biennial Regulatory Review --	)	
Streamlining and Other Revisions of Part 25	)	IB Docket No. 00-248
of the Commission's Rules Governing the	)	
Licensing of, and Spectrum Usage by,	)	
Satellite Network Earth Stations and Space	)	
Stations	)	

TO: The Commission

COMMENTS OF ALOHA NETWORKS, INC.

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March 10, 2003

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Aloha Networks, Inc. ("Aloha Networks") hereby files its comments in response to the *Further Notice of Proposed Rulemaking,* FCC 00-435 (September 26, 2002) (the "*Further Notice*").

I. Introduction

In its comments filed in response to the initial *Notice of Proposed Rulemaking*, 15 FCC Rcd 25128 (2000) ("*Initial Notice*"), in this proceeding, Aloha Networks demonstrated that excessive adjacent satellite interference ("ASI") is a common and growing problem. *See* Comments of Aloha Networks, Inc., Docket No. 00-248 (March 26, 2001) ("Aloha Networks Comments") at 3; Reply Comments of Aloha Networks, Inc., Docket No. 00-248 (May 7, 2001) at 2; *see also* Comments of PanAmSat, Docket No. 00-248 March 26, 2001 at 2 (ASI due to antenna pointing errors is "an all too common occurrence in the industry").

ASI is presently controlled through the mutual cooperation of satellite system operators who cooperate with each other to routinely adjust the frequencies of interfering and susceptible users to minimize or avoid ASI. However, Aloha Networks agrees with the

Commission that excessive ASI will undoubtedly increase in the future with the emergence of large consumer-oriented Internet access VSAT systems. That growth and usage will not only strain (if not exceed) the limits of mutual cooperation but also threaten the economic viability of VSAT systems. With growth in usage, VSAT systems will compete with terrestrial Internet access schemes for end users and thus place a premium on the satellite carriers' ability to eliminate excessive ASI in order to remain competitive.

Any rules adopted by the Commission now should take into account those future developments and reduce the need for rule modification in the near future. To that end, Aloha Networks recommends the following modifications to the Commission's rules:

> (1) Reduce the probability and duration of collisions in random access networks that would cause the power spectral density to exceed the –14 dBW/4kHz to either (1) .1% and 100ms or (2) 1% and 10ms respectively.
>
> (2) Encourage the use of pilot tones for installation and monitoring of antenna pointing.
>
> (3) Require professional installation requirements on those systems that
>
> > (a) exceed ASI limits for reasonable antenna pointing errors, and
> >
> > (b) do not use pilot tones for monitoring of antenna pointing and restricting terminal transmissions.

Implementation of the foregoing recommendations could increase the cost of operating VSAT systems. However, those costs will be more than offset over time by meaningful improvements in quality of service ("QOS"), capacity, availability, and increased customer satisfaction.

II. Effect of Collision Probability and Duration on Adjacent Satellite Networks

In the *Initial Notice*, the Commission expressed a concern regarding the potential for ASI when two or more earth stations in a VSAT network utilize the Aloha random access technique. To alleviate that concern, the Commission proposed revising Section 25.134(a) of its rules, 47 C.F.R. § 25.134(a), to require VSAT networks to reduce their spectral power density by 3 dB in cases where two or more terminals on the network transmit at the same time on the same frequency band . *Initial Notice* at ¶ 56. Aloha Networks and several other parties opposed that rule revision as being unnecessary and counterproductive. *See Further Notice* at ¶¶ 82-84.

In the *Further Notice*, the Commission agrees with the commenters opposing the proposed rule revision, stating that "the commenters have shown persuasively that adoption of the random access scheme requirements for Aloha systems proposed in the *Notice* would not be in the public interest." *Id.* at ¶ 85. In the *Further Notice*, the Commission tentatively concludes that a variant on the approach proposed by the Aloha Network Comments is a more workable alternative. *Id.* at ¶¶ 92-94. *See* Aloha Networks Comments at 8-10.

Aloha Networks certainly supports the Commission's proposal to adopt Aloha Networks' general approach for regulating ASI. By limiting the probability and duration of multiple simultaneous transmission events, or collisions, in multiple access networks, excessive ASI levels can be effectively restricted without regard to the method of multiple access used in a network.

However, Aloha Networks believes that the Commission's proposal is not as effective as it can or should be in minimizing or eliminating ASI. The Commission's approach unduly dilutes Aloha Networks' approach by reducing ten-fold (from .001 to .01) the maximum probability of collision allowed under subparagraph (ii) of the proposal. *See Further Notice* at ¶ 93. Aloha Networks continues to believe that a more conservative limitation is necessary to protect neighboring networks. If the Commission nonetheless adheres to a maximum probability of collision of .01, there should be a corresponding decrease in the maximum duration of any single collision.

To accomplish the foregoing balance, Aloha Networks offers the following modification to its suggested conditions for routine processing of VSAT applications proposing to use multiple access techniques:

> (i) Each earth station individually satisfies the power density limits of Section 25.134(a);
>
> (ii) The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed - 14.0 - 10 log(N) dB(W/4 kHz), where N is the smallest number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam; and
>
> (iii) The probability and maximum duration of an event with greater than N simultaneous transmitters is less than
>
> > (a) 0.1% and 100ms or
> >
> > (b) 1.0% and 10ms.

The suggested reduction of duration to 10ms for the larger 1% collision probability would lower disruptions to adjacent satellite networks below those levels typical for human response times for video streaming and other continuous use applications.

The foregoing proposal seeks to mitigate problems associated with the probability and duration of collisions on an adjacent satellite network. The following example illustrates the problem. For equivalent perfectly pointed elliptical 0.75m terminals on neighboring VSAT networks, each with transmit antenna gains of 39.2 dBi, the Commission's presently required ASI rejection of 29-25log (theta) allows a C/ASI ratio of 17.5 dB (using theta = 1.96 as outlined in Appendix B of the *Initial Notice*). The simultaneous transmission of two terminals on one network 1% of the time results in a C/ASI ratio of 14.5 dB in the neighboring system 1% of the time.

After tightening and stabilizing the antenna, professional installations of a 0.75m elliptical antenna will likely result in a pointing error of at least 0.4 degrees (or a 0.5 dB receive pointing loss);[1] for consumer installations, receive losses on the order of 1 dB are more likely. The 0.4 degree pointing error further reduces the adjacent channel C/ASI to 12.0 dB. For next generation systems – a modest turbo code rate of 0.85, a 6 dB Eb/No would provide an acceptable QOS (e.g. 10E-7 for a deterministic system). For satellite links designed to provide a faded Eb/No of 6dB, the 12dB C/ASI ratio degrades the link margin by 1.0 dB. Reliance on non-professional installations or use of less complex coding techniques could result in a much more adverse impact.

The Forward Error Correction ("FEC") Decoder can tolerate disturbances created by un-faded systems where the simultaneous transmission percentage comes in short bursts. For time durations closer to the 100ms used in Aloha Networks' original proposal, FEC would not be able to recover the data and the collision occurrence would result in the loss of a frame. This would result in loss of data in situations involving streaming video or other applications where retransmissions are not feasible. For 100ms collisions with 1% probability, the disruption of the data stream every 10 seconds is likely to create an unacceptable user experience. A 0.1 % simultaneous transmission probability that disrupts the data stream every 100 seconds is less noticeable from the consumer's perspective. Shorter duration collisions would still probably cause loss of frames but the loss would involve obviously smaller numbers at a time. A 10ms collision duration even once a second, or 1% of the time, may not even be noticeable to end users.

Additional considerations need to be taken into account with systems that have a retransmissions capacity enabled, such as the burst mode random-access portions of Internet

[1] *See* section IV below for a discussion of the Commission's proposed professional

links. In those latter situations, the intermittent interference-causing retransmission adds extra traffic on the network and causes an additional roundtrip satellite delay for the retransmitted data. That circumstance in turn creates a noticeable, but less obtrusive degradation of network performance for situations approaching the last dB of rain margin. The result is a reduction in network capacity and increased latency for the end user. As with the streaming video example, the occurrences of network disruption are more acceptable for lower probability, and shorter duration, interferences.

If the intermittent reductions in the QOS are unacceptable to the end user, the incidence of ASI reduces the link margin by 1 dB, which is a significant change in availability. That degradation is particularly troublesome because it could easily double the yearly average of downtime for consumer terminals at higher availabilities (99.7-99.8%). To gain back that 1 dB of margin, the bandwidth efficiency of the transmitter must (depending on the type of FEC used) be reduced by 10 to 25%. That reduction in turn creates a 10 to 25% increase in monthly transponder bandwidth charges for the VSAT Internet consumer.

ASI could be further reduced to negligible levels with increased coding or the application of direct sequence spreading or fast frequency hopping. For Aloha Networks' current implementation of the Spread Aloha Multiple Access ("SAMA") protocol, the power spectral density of the signal is reduced by an average of 10dB, which reduces ASI to imperceptible levels.

III. Automatic Monitoring of Terminal Antenna Alignment

In comments filed in response to the *Initial Notice*, PanAmSat expressed concern that the expected growth in the small antenna consumer market will cause considerable growth in

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installation requirements.

ASI and proposed several rule revisions to address that problem. *Further Notice* at ¶ 43. Aloha Networks shares PanAmSat's concern. Aloha Networks believes that, unless the Commission adopts corrective measures, ASI will cause noticeable degradation to neighbor satellite networks in the future. Aloha Networks therefore supports PanAmSat's proposal to monitor antenna pointing and polarization alignment automatically., and support the Commission's proposal to use pilot tones to enable this function.

A pilot tone requirement will become even more critical as smaller terminals become available. As the Satellite Industry Association ("SIA") has explained, as smaller beam width antennas are developed, transmitter power spectral density can be increased to maintain the same ASI while improving the link margin. *See Further Notice* at ¶ 113. However, the pointing errors will become more significant with those higher power, sharper beam combinations. Aloha Networks agrees that the addition of terminal antenna alignment automatic monitoring and transmission control functions would help maintain acceptable ASI levels as those newer VSAT networks age.

For some networks, automatic monitoring of received signal strength could be accomplished without the aid of pilot tones. For two-way consumer Internet VSAT systems, for instance, it should be relatively easy to implement a received signal strength monitoring function, using the downstream DVB signal. *See Further Notice* at ¶ 46. Since many of those systems require the signal to maintain synchronization for internal networking operation, they can be configured to cease transmissions when synchronization, or the lock on the downstream signal, fails. This would achieve the same goals of the pilot tone concept without requiring additional hardware to receive a separate signal.

To give an accurate indication of antenna pointing, variations in the received signal due to rain fade would have to be distinguished from variations due to antenna pointing errors.

That kind of distinction can be made through the use of a network-wide comparison of downstream signal strength to upstream signal strength for all user terminals. The comparison could be implemented as part of a required terminal maintenance component of the network management system.

However, for larger networks it would be difficult to monitor polarization alignment without a pilot tone from the satellite. In smaller networks, polarization alignment is typically performed manually by monitoring the polarization/cross-polarization ratio at the hub while mechanically aligning the remote antenna in continuous wave mode. The alignment could be automated for larger networks but only if a schedule were adopted to account for multiple concurrent installations. The use of a pilot tone at a different frequency on each polarization would not only facilitate installation in both the smaller and larger networks but could also permit periodic polarization measurements and reporting by the terminal. Although periodic adjustment may be required by the end user, the modified system would safeguard both adjacent satellite and same satellite-opposite polarization networks.

IV. Conditional Professional Installation

PanAmSat proposed that the Commission require professional installation of *all* consumer terminals. *See Further Notice* at ¶ 49. Aloha Networks believes that PanAmSat's proposal is too broad and requires refinement. All consumer terminals and networks are not the same, and, while a professional installation requirement makes sense in certain instances, in others it does not.

Professional installation can be expensive. That is an important consideration from a public interest perspective because consumers will ultimately bear the cost of such installation. The Commission should therefore impose a professional installation requirement only in those situations where the cost is reasonably likely to result in a substantial reduction in ASI. Stated another way, it should be remembered that the ultimate goal in all of the changes discussed in the *Further Notice* and these Comments are ultimately designed to reduce the aggregate probability of interference to a neighboring VSAT system, and all changes should be evaluated/on the extent to which they advance that ultimate goal.[2] From that perspective, the Commission should impose more stringent requirements on those systems with the greatest likelihood of creating interference to neighboring systems. By contrast, systems with lower power spectral densities and interference probabilities should be allowed greater tolerance in antenna pointing, installation practices and other features.

In this context, professional installation should be recognized as a stop-gap measure for those networks that transmit at or near the ASI limits and have no automatic terminal pointing monitoring capability. Although relatively expensive, professional installation cannot safeguard adjacent satellite and opposite polarization networks from antenna movement over time. That can be achieved only with automatic monitoring and user intervention or, in time, electronically-pointed antennas. Consequently, any requirement for professional installation should include a dispensation for those networks that employ automatic monitoring devices which limit ASI.

In addition to alleviating the burden it imposes on system operators and consumers, there is another benefit to requiring professional installation only for those systems most likely to cause ASI. If the Commission adopts a rule that imposes professional installation only on those systems that exceed certain ASI thresholds, it will provide an incentive for future networks to reduce their ASI or provide antenna monitoring capability to avoid costly installations. These

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2 That perspective should also govern the Commission's consideration of other requirements (such as those relating to transmitted power spectral density, probability and duration of collisions, antenna performance, and pointing accuracy) that impose costs on system operators and consumers.

thresholds that limit professional installation requirements will need to be determined from a combination of earth station antenna pointing probabilities and antenna sidelobe characteristics.

Conclusion

WHEREFORE, in view of the foregoing and the entire record herein, the Commission should (1) adopt a percentage collision rate of .1% and, if utilizing a higher percentage collision rate (such as 1%) then, in that event, the duration of the acceptable collision be reduced to 10 ms, (2) require the use of a pilot tone that could provide for automatic periodic adjustments of antenna alignment, (3) require professional installation of network systems which exceed ASI "professional installation" limits and have no antenna alignment monitoring capability.

Respectfully submitted,

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