Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	)	ET Docket No. 98-153
	)	
	)	
	)	

To: The Commission

REPLY TO OPPOSITION TO PETITION FOR RECONSIDERATION

The Satellite Industry Association ("SIA") hereby replies[1] to the Opposition filed by XtremeSpectrum, Inc. ("Xtreme") to SIA's Petition for Reconsideration.[2] In its Opposition, Xtreme asserts that SIA's Petition for Reconsideration ("Petition") should be dismissed as repetitious, calls for an I/N ratio that is not supported by its own Technical Statement, and attempts to discredit SIA's Engineering Statement. As SIA demonstrates below and in the attached Engineering Statement[3]:

(1) Xtreme's procedural contentions are without merit and, in any event, the public's interest in C-band satellite service that is not subject to harmful interference outweighs any procedural concerns;

(2) an I/N ratio of at least -10 dB is necessary to protect C-band satellite operations against harmful interference; and

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[1] This reply was originally due September 17, 2003. SIA filed an unopposed motion for extension of time to file its reply, seeking an extension until September 26, 2003. The Office of Engineering and Technology has not yet ruled on SIA's request.

[2] Opposition of XtremeSpectrum, Inc. to Petition for Reconsideration of the Satellite Industry Association (filed Sept. 4, 2003).

[3] Reply Engineering Statement of Harold Ng [hereinafter "Reply Engineering Statement"].

(3) Xtreme's criticisms of SIA's technical analysis are flawed and do not support Xtreme's conclusions.

INTRODUCTION

SIA is a national trade association representing the world's leading satellite manufacturers, service providers, and launch service companies. SIA serves as an advocate for the commercial satellite industry on regulatory and policy issues common to its members. With member companies providing a broad range of manufactured products and services throughout the world, SIA represents the unified voice of the commercial satellite industry.[4] SIA has participated in the Commission's UWB rulemaking proceeding from the outset, supporting the Commission's efforts to facilitate development of UWB technology while raising concerns about the risk of interference from UWB devices to fixed and mobile satellite systems.[5]

DISCUSSION

I. SIA's Petition for Reconsideration is not Repetitious.

Xtreme claims that SIA's petition should be dismissed as repetitious pursuant to Section 1.429(i) of the Commission's rules.[6] This rule, however, does not provide grounds for dismissing SIA's Petition.

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[4] SIA's Executive members include The Boeing Company; Globalstar, L.P.; Hughes Network Systems; ICO Global Telecommunications; Intelsat; Iridium Satellite LLC, Lockheed Martin Corp.; Loral Space & Communications Ltd.; Mobile Satellite Ventures; Northrop Grumman Corporation; PanAmSat Corporation; and SES Americom, Inc. SIA's Associate Members include Inmarsat; New Skies Satellites; and Verestar.

[5] Comments of the Satellite Industry Association (filed September 12, 2000); Petition for Reconsideration of the Satellite Industry Association (filed June 17, 2002) [hereinafter "First Petition"]; Petition for Reconsideration of the Satellite Industry Association (filed May 22, 2003) [hereinafter "Second Petition"]; SIA Reply Comments to Further Notice of Proposed Rule Making (filed Aug. 20, 2003).

[6] 47 C.F.R. §1.429(i).

By definition, SIA's Petition is not repetitious because it does not repeat the arguments raised in its initial Petition for Reconsideration. Rather, SIA addresses in the Petition an analysis of the C-band interference issue that the Commission offered for the first time in its Memorandum Opinion and Order,[7] and which did not appear in its First Report and Order.[8] SIA did not have an opportunity to respond to this analysis prior to the filing of its Petition.

Section 1.429(i), moreover, is permissive, providing only that in certain circumstances, petitions for reconsideration "*may* be dismissed . . . as repetitious."[9] The Commission has explained, however, that dismissal on procedural grounds is inappropriate if "on balance it would better serve the public interest to address those requests on their merits."[10]

The public interest considerations in this case outweigh any need for applying procedural technicalities. C-band satellite services are vital to consumers, businesses, and national security, and billions of dollars have been invested in FSS systems using the C-band. It is essential that the Commission continue to protect these services from harmful interference.

In fact, the Commission already has made a public interest determination that the interference issue should remain open. The Commission has made clear that "it intends to monitor closely the development of UWB devices and operations" and "will

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[7] *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems,* Memorandum Opinion & Order & Further Notice of Proposed Rule Making, FCC 03-33, ET Docket 98-153 (rel. Mar. 12, 2003) [hereinafter "MO&O"].
[8] *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems,* First Report & Order, FCC 02-48, ET Docket 98-153 (rel. Apr. 22, 2002).
[9] 47 C.F.R. § 1.429(i) (emphasis added).
[10] *MTS and WATS Market Structure,* 99 F.C.C.2d 708, ¶6 (1984).

continue to examine interference issues."[11] Xtreme's procedural arguments conflict with this Commission finding and should be rejected.

II. The Commission Should Adopt an I/N Ratio of -10 dB to Protect the Fixed Satellite Service.

Xtreme takes issue with SIA's position on the I/N ratio needed to protect C-band receivers from harmful interference. Xtreme supports use of the 0 dB I/N ratio that the Commission relied upon in its MO&O, rather than the -10 dB I/N ratio that SIA advocated in its Petition.[12]

Use of a 0 dB I/N ratio is contrary to the public interest, as both international standards and Xtreme's own technical analysis demonstrate. The Commission took the 0 dB I/N ratio from Appendix 7 of the ITU Radio Regulations. The I/N ratio in Appendix 7, however, is meant to govern short-term interference for the purpose of determining the required coordination distance from terrestrial fixed stations. It is not applicable to long term interference – the type of interference caused by UWB devices. As demonstrated in the attached Engineering Statement, the relevant international standards for interference protection dictate using an I/N ratio of -10 dB to -20 dB.[13]

Xtreme's own Technical Statement, moreover, supports SIA's position, not Xtreme's position. As demonstrated in the attached Engineering Statement,[14] and even before certain methodological errors that Xtreme made are taken into account, under

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[11] MO&O ¶131; *see also id.* ¶1 ("We intend to continue our review of the UWB standards to determine where additional changes warrant consideration.")

[12] Xtreme also raises a procedural objection to SIA's position on the I/N ratio, claiming that SIA had waived its right to argue for a -10 dB I/N ratio by not making the argument sooner. Contrary to Xtreme's assertions, however, SIA has consistently objected to the Commission's 0 dB I/N ratio. In its First Petition, SIA challenged the Commission's failure to require separation distances consistent with an NTIA report on which the Commission purportedly relied. First Petition at 4. That report used a -10 dB I/N ratio. SIA's criticism of the Commission's inconsistent treatment of the NTIA report, therefore, necessarily challenged the Commission's adoption of a 0 dB I/N as inadequate to protect the fixed satellite service.

[13] Reply Engineering Statement at 1-3.

[14] *Id.* at 3.

Xtreme's analysis an I/N ratio of at least -6 dB would be needed to protect C-band earth station receivers.[15]

Correcting for Xtreme's methodological errors bridges the remaining gap between Xtreme's figure and SIA's figure. Xtreme's satellite link degradation calculation was erroneous, because it failed to take international interference standards into account.[16] Once these standards are taken into account, Xtreme's analysis would yield an I/N ratio between -10 and -20 dB[17] – the same I/N ratio that the SIA supports.

In sum, SIA's Petition, the ITU's standards, and Xtreme's Technical Statement all demonstrate that an I/N of 0 dB is inadequate for protecting C-band receivers. On reconsideration, therefore, the Commission should adopt an I/N ratio of -10 dB or lower.

III. Xtreme's Criticisms of SIA's Engineering Analysis are Without Merit.

In its Opposition, Xtreme criticizes certain elements of the methodology used in SIA's previously-filed Engineering Statement. SIA refutes these criticisms below and in the attached Engineering Statement.

Peak Emissions. Xtreme apparently misunderstands SIA's Engineering Statement,[18] asserting that SIA's request to limit peak emissions would only affect low-PRF devices. SIA's analysis, however, specifically addressed high-PRF devices,[19] and its conclusions therefore apply to both low- and high-PRF devices. Accordingly, and

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[15] Technical Statement of XtremeSpectrum, Inc. at Figure 1 (filed Sept. 4, 2003); *see also id.* at 4.
[16] Reply Engineering Statement at 4.
[17] *Id.*
[18] Engineering Statement of Harold Ng (filed May 21, 2003).
[19] Reply Engineering Statement at 4.

for the reasons set forth in SIA's Petition, the Commission should take those emissions into account in its interference analysis or reduce allowable peak EIRP.[20]

Antenna Performance and Elevation Angle. As demonstrated in the attached Engineering Statement, SIA derived its antenna performance parameters from Sections 25.209(a)(2) and (c) of the Commission's rules, the standard applicable to antenna performance towards the horizontal plane.[21] Xtreme, by contrast, relied on the standards applicable to antenna performance in the geostationary-satellite orbital plane, standards that are plainly not appropriate for analyzing potential interference from earth-bound UWB devices.[22] Additional defects in Xtreme's analysis of antenna performance and elevation angle are detailed in the attached Engineering Statement.[23] Because antenna performance and elevation angle are integral elements of interference calculation, these defects render invalid Xtreme's conclusions concerning interference.

Interference Assessment Model. In its Technical Statement, Xtreme relies on the NTIA irregular terrain propagation model rather than the two-way propagation model cited by SIA. Xtreme's own analysis, however, demonstrates that the two models lead to substantially similar results, thereby vindicating SIA's reliance on the two-way model. Moreover, after correcting for Xtreme's methodological errors, as detailed above and in the attached Engineering Statement, Xtreme's NTIA analysis model should yield the same results as SIA's two-way propagation analysis model, supporting SIA's conclusion that an I/N ratio of -10 dB or less is necessary to protect the fixed satellite service.

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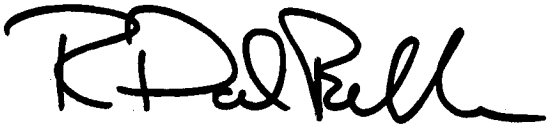
[20] Second Petition at 8-9.
[21] Reply Engineering Statement at 4-5.
[22] *Id.*
[23] *Id.* at 5.

CONCLUSION

For the reasons set forth herein and in SIA's Petition for Reconsideration, the Commission should reconsider its MO&O and modify its rules to prevent UWB devices from causing harmful interference to C-band services.

Respectfully submitted,

SATELLITE INDUSTRY ASSOCIATION



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September 26, 2003

REPLY ENGINEERING STATEMENT OF HAROLD NG
ET DOCKET NO. 98-153

I am the Director of Regulatory Engineering for PanAmSat Corporation ("PanAmSat"), an Executive Member of the Satellite Industry Association ("SIA"). I have prepared this Engineering Statement in support of the SIA's Reply to Xtreme Spectrum Inc.'s ("Xtreme") Opposition to SIA's Petition for Reconsideration in the above-referenced proceeding. This Reply Engineering Statement addresses the issue of the appropriate interference to noise ("I/N") ratio for protecting fixed satellite service receivers; identifies errors in Xtreme's interference analysis; and corrects mistakes that Xtreme made in interpreting SIA's previously-filed Engineering Statement.

Appropriate I/N Ratio for the Protection of Fixed Satellite Services

SIA has previously objected to the use of 0 dB for the I/N ratio by the Commission. In its First Petition, SIA explained:

> "the Commission did not meaningfully address the minimum separation distance specified in the NTIA Report for protecting FSS earth stations. The NTIA Report included two tables that assess the effects of UWB devices for average and peak power interactions. These tables show required separation distances for FSS interference protection that range from 630 meters to tens of kilometers."[1]

Although the NTIA Report used an I/N equal to -10 dB in its interference assessment,[2] the FCC rejected this aspect of the protection criteria used by NTIA.[3] SIA's reliance on the NTIA Report in its analysis reflected SIA's opposition to the use of a 0 dB I/N ratio.

SIA has also previously explained why an I/N ratio of 0 dB is insufficient to protect fixed satellite service from interference.[4] In view of Xtreme's contention that a 0 dB noise ratio offers sufficient protection, however, SIA reiterates and supplements its analysis as follows:

The Commission stated in its First Report and Order that its use of a 0 dB I/N ratio is based on Appendix 7 of the ITU Radio Regulations (ITU-RR).[5] The I/N ratio used in Appendix 7 of the ITU-RR, however, is designed for a different purpose, *i.e.*, for short-term interference calculation in the determination of the required coordination distance between the co-primary terrestrial fixed service and the co-primary fixed

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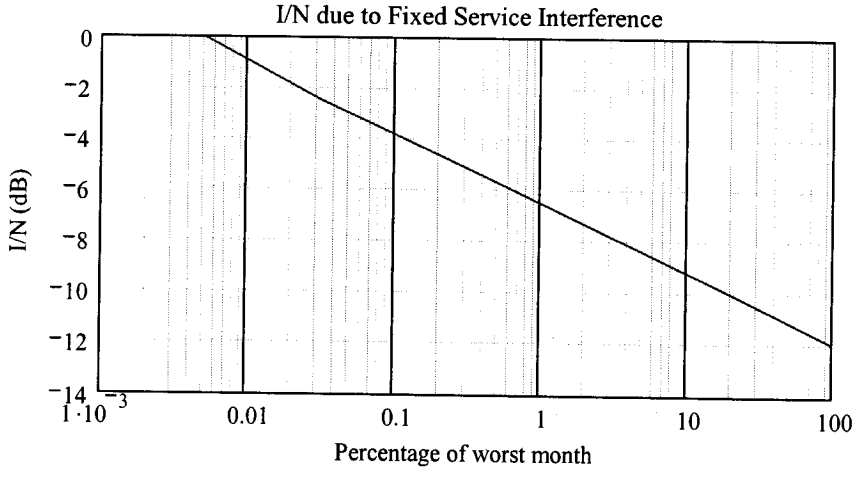
[1] Petition for Reconsideration of the Satellite Industry Association at 4 (filed June 17, 2002) (citations omitted).
[2] Table A-10, Appendix A of NTIA Special Publication 01-43.
[3] *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems,* First Report & Order, FCC 02-48, ET Docket 98-153, at ¶140 (rel. Apr. 22, 2002) [hereinafter "R&O"].
[4] *See* Engineering Statement of Harold Ng, ET Docket 90-153 (filed with Petition for Reconsideration, May 21, 2003) [hereinafter "Engineering Statement"] (detailed engineering statement including a typical satellite link budget to demonstrating the detrimental effect of having an external interference level of I/N equal to 0 dB).
[5] R&O at ¶140.

satellite receiving earth station in the C band. Exhibit 1 hereto contains a detailed explanation of the relationship between the I/N ratio and the percentage of time, and, using the Appendix 7 methodology in the 2001 edition of the Radio Regulations, shows that for 0.0017% of the time, the I/N ratio should be equal to -1.33 dB, or 0.74 times the noise level of the receiving earth station. The 0.0017% of the time figure is used to determine the required propagation loss to meet the interference level in the determination of the coordination contour.[6] Appendix 7 is used to determine the coordination distance, but is still consistent with Recommendation ITU-R S.1432, which gives the recommended apportionment of interference into a fixed satellite system. For long and medium term percentages of time, the appropriate I/N value is given by the following figure, as provided by ITU-R S.1432.



This figure demonstrates that for a co-primary terrestrial fixed service interfering into a co-primary fixed satellite service receiving earth station, the short-term interference threshold should be 0 dB for 0.005% of the time and the long-term interference threshold should be -10 dB for 20% of the time or -12 dB for 100% of the time. The graph also shows other I/N thresholds and corresponding percentages of time.

ITU-R S.1432 also recommends, for fixed-satellite system performance degradation due to interference from other services, that the clear-sky satellite system noise should be apportioned as follows:

- 20% for other FSS systems for victim systems practicing frequency re-use;
- 6% for other system having co-primary status;
- 1% for all other sources of interference,

Further, pursuant to ITU-R S.1432, the sum of all of the interference sources should not cause violation of the system performance objectives contained in other ITU-R standards.

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[6] The purpose of the coordination contour is to identify which terrestrial fixed station should coordinate with the receiving earth station. Once the site has been identified, there is a further need for detailed coordination between the two co-primary stations.

Those standards are listed in Exhibit 2.[7] Therefore, in order to meet ITU-R standards, the protection criteria for a fixed satellite service receiving earth station due to interference from Part 15 UWB devices should be limited to 1% of the clear-sky satellite system noise.[8] One percent of clear-sky satellite system noise translates into an I/N equal to -20 dB.[9]

This ITU-R international standard is consistent with the ITU-R Working Party 4A proposal as contained in the Liaison Statement to Task Group 1/8 from Working Party 4A,[10] and with the Commission's rules, as Section 25.251 provides that "the technical aspects of coordination are based on Appendix S7 of the ITU Radio Regulations and certain recommendations of the ITU."

Appendix 8 of the ITU Radio Regulations offers a further example of a sharing criteria used by the fixed satellite service for determining if coordination is required between GSO networks sharing the same frequency bands. This procedure uses a $\Delta T/T$ of 6% increase in the system noise temperature to determine if a GSO fixed satellite service network is affected by a second fixed satellite service network. A 6% increase in noise temperature is equivalent to an I/N ratio of -12 dB. This procedure is used by United States fixed satellite service networks when coordinating with foreign fixed satellite service networks, and the Commission's Part 25 rules, which ensure that fixed satellite service networks can operate with 2° spacing, are based on a similar criteria.

These international and Commission standards, in short, demonstrate an I/N ratio equal to -10 dB to -20 dB, under clear-sky conditions, is necessary to protect fixed satellite service receiving earth stations from aggregate interference from Part 15 UWB devices.

Xtreme's Analysis Supports a Lower I/N Ratio

As explained below, Xtreme's Technical Statement has significant flaws. Even before these flaws are taken into account, however, Xtreme's analysis yields an appropriate I/N ratio of –6 dB, much lower than the 0 dB I/N ratio adopted by the Commission. In its Technical Statement, Xtreme suggests that the effect of the I/N ratio should only be based on the uplink and downlink thermal noise and should exclude other noise sources in the satellite link. Based on this assumption, Xtreme produced Figure 1 in its Technical Statement. Assuming a degradation of 0.5 dB in the system link budget, Xtreme's Figure 1 indicates that an I/N equal to -6 dB should be appropriate for protection of receiving earth stations. This protection point is shown as a triangle in Figure 1 of Xtreme's Technical Statement. Xtreme's analysis appears to reflect an understanding that a typical satellite link budget cannot tolerate an I/N equal to 0 dB. This level of UWB interference would render the satellite link useless because the resultant C/(N+I) ratio is less than the demodulator signal-detection threshold. While an

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[7] *See also* Engineering Statement at 1-3.

[8] A clear-sky condition is expected at least 20% of the time.

[9] 10x Log(1%) = 10x Log(0.01) = -20.

[10] Annex 21 to Working Party 4A Chairman's Report, ITU-R Document 4A/546, April 4, 2003.

improvement over a 0 dB I/N ratio, a –6 dB I/N ratio is nevertheless insufficient to protect receiving earth stations, as demonstrated above and in SIA's previous filings.

Xtreme's Analytical Errors

I/N Ratio. In addition to disregarding noise sources other than uplink and downlink thermal noise, Xtreme's interference analysis is compromised by its miscalculation of the reference point for the satellite link degradation. Xtreme calculated the I/N degradation point as the sum of the uplink and downlink thermal noise (i.e., $C/N_{up} \oplus C/N_{down}$, where $\oplus$ denotes power sum) rather the clear-sky satellite system noise as recommended by ITU-R S.1432. This international standard stipulates that the effect of interference-calculation is relative to the clear-sky satellite system noise. Further, Xtreme does not properly apply the international standard established by ITU-R S.1432. As discussed above, the ITU recommends that, for other non co-primary service interference, the I/N should be 1% of the clear-sky satellite system noise. One percent of the clear-sky satellite system noise yields an I/N ratio of -20 dB. Consequently, after correcting for Xtreme's errors, even under Xtreme's analysis an I/N ratio between -10 and -20 dB is necessary to protect the fixed satellite service from unacceptable UWB interference.

Peak Emissions. Xtreme, in its Technical Statement, fails to recognize that the SIA Engineering Statement addresses the wide range of UWB devices, including the very high-PRF and phase-modulated UWB pulses used by Xtreme. For example, SIA's analysis covered a range of PRF, analyzed the effect of both indoor and outdoor UWB devices, and included the receiver bandwidth correction factor ($BWCF_{A/P}$) to correct for the power of the UWB signal at the victim receiver.[11] Furthermore, and contrary to Xtreme's implication, the SIA Engineering Statement specifically addresses Xtreme's very high-PRF devices in its analysis.[12] Moreover, the final table in SIA's Engineering Statement demonstrates the effect of PRF on the peak and average EIRP.[13] In short, SIA's analysis addresses the operating parameters of Xtreme's UWB devices, and its conclusions therefore are valid with respect to those devices.

Antenna Performance and Elevation Angle. The earth station antenna performance used by SIA in its Engineering Statement is derived from Commission Rules. In particular, the antenna performance in the SIA Engineering Statement is based on 47 C.F.R. §25.209(a)(2) and (c):

$32 - 25\text{Log}(\theta)$	dBi	$1^\circ \leq \theta \leq 48^\circ$
-10	dBi	$48^\circ < \theta \leq 180^\circ$

Pursuant to Section 25.209, this pattern is for antenna performance towards the horizontal plane, where the UWB devices would be located. There is no other accepted national standard for antenna performance towards the horizontal plane. The FCC and Intelsat

[11] *See* R&O Appendix E.
[12] Engineering Statement Tables A & B (PRF ≥ 50 MHz).
[13] Engineering Statement at 18.

IESS antenna performance standards cited by Xtreme, by contrast, govern antenna performance in the geostationary-satellite orbital plane. As a result, these standards are not appropriate for the development of a national rule for the protection of receiving earth stations from UWB interference

Xtreme challenges SIA's consideration of the 5° elevation case by citing both the increase in system noise temperature and earth station site selection concerns with respect to clearance angle above populated areas. The analytical model used by SIA (the PanAmSat Mathcad program) includes the effect of system temperature increase as a function of the elevation angle. Accordingly, SIA has demonstrated the exact system noise temperature impact and sharing impact in its previously submitted Engineering Statement and its January 10, 2003 *Ex Parte* filing.[14] Similarly, Tables A, B and C of the Engineering Statement show there is no blockage of the satellite downlink signal at 5° or at any other elevation angle. Consequently, SIA's conclusions with respect to 5° elevation angles are valid, and should not be disregarded.

Propagation and Interference Assessment Model. In its Technical Statement, Xtreme compared the two-way propagation model used by SIA and the NTIA Irregular Terrain Model. The comparison indicates that the two models yield similar results with a difference of less than 0.5 dB. Consequently, Xtreme's analysis confirms that the two-way propagation model is appropriate for line-of-sight propagation in UWB and earth station sharing analysis.

Similarly, Xtreme's NTIA analysis model, once Xtreme's methodological errors are corrected in the manner described above, should yield the same results as SIA's analysis. The similarities in overall approach between Xtreme and SIA confirm the validity of SIA's analysis and support SIA's conclusion that an I/N ratio of –10 dB or less is necessary to adequately protect C band earth station receivers from UWB interference.

/s/ Harold Ng
Harold Ng

September 26, 2003

[14] Letter from Richard DalBello, Executive Director, Satellite Industry Association, to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket 98-153 (filed Jan. 10, 2003).

Exhibit 1

Appendix 7 of the Radio Regulations

In Appendix 7 to the 2001 edition of the Radio Regulations (Method for the Determination of the Coordination Area around an Earth Station in Frequency Bands between 100MHz and 105 GHz) the permissible interference power into an earth station from an interfering emission is calculated. In Annex 7 and Table 8 of Appendix 8 specific parameters are given on how to calculate these levels into a digital carrier operating in the 3.7-4.2 GHz band. The following parameters are used to determine the permissible interference levels and the coordination distance between a terrestrial station and a receiving earth station.

The permissible interference Pr(p) is given as:

$P_r(p) = 10 \log (k T_e B) + N_L + 10 \log [10^{(M_s/10)} - 1] - W$

p_o (%) = 0.005
n = 3
p(%) = 0.0017
$N_L = 1$
$M_s = 2$
W = 0

From Appendix 7 the above parameters are defined as follows:

- k: Boltzmann's constant
- T_e : thermal noise temperature of the receiving system (K),
- B: reference bandwidth (Hz)
- n : number of equivalent equal level equal probability entries of interference, assumed to be uncorrelated for small percentages of time
- p_o(%): percentage of time during which the interference from all sources may exceed the threshold value
- p(%): percentage of time during which the interference from one source may exceed the permissible interference power value: since the entries of interference are not likely to occur simultaneously, $p = p_o/n$
- N_L : link noise contribution
- M_s: link performance margin (dB)
- W: a thermal noise equivalence factor (dB) for interfering emissions in the reference bandwidth; it is positive when the interfering emissions would cause more degradation than thermal noise

Based on the above the permissible interference level would be

If $10 \log (k T_e B) = N_{Rx}$,

then $P_r = N_{Rx} + N_L - 2.33$ and
$P_r(0.0017) = N_{Rx} - 1{,}33$ or
$P_r(0.0017) = 0.74\ N_{Rx}$

Therefore the interference coordination threshold can be 0.74 times the noise level but for only 0.0017 % of the time. The 0.0017% of the time is used to determine the required propagation loss to meet the permissible interference level of (P_r). For such small percentages of time the required path loss would result in substantially longer separation distances than that required for 20-30 % of the time (e.g., long-term under clear-sky).

As stated in §1.5.3 of Appendix 7 this methodology only addresses the short-term criteria and "there is therefore an implicit assumption that if the short term-criterion is satisfied, then any associated long term criteria will also be satisfied "

§1.5.3 also states that long-term interference criterion should be used for percentages of time greater than 20%. The assumed long-term interference allowance due to co-primary terrestrial fixed service and other non-primary service would be based on Rec. ITU-R S.1432. It should be noted this is the aggregate allowance and if there were multiple interferers the allowance would have to be further partitioned.

Exhibit 2

I/N Criteria for Sharing with the Fixed Satellite Service

The establishment of sharing criteria and permissible levels of interference has been studied for many years within ITU. Sharing criteria and permissible levels of interference for radiocommunication services such as the fixed satellite service and the fixed service have long been based on the impact of the interference on the performance of the affected service. The Commission, like many other administrations, has either adopted these standards in its domestic regulations or modified them to suit its specific requirements. In most cases the Commission's Rules are consistent with ITU Recommendations.

In the case of the fixed satellite service, performance objectives have been established for some time in ITU Recommendations such as:

Recommendation ITU-R S.521 Hypothetical reference digital paths (HRDP) for systems using digital transmission in the FSS

Recommendation ITU-R S.522: Allowable bit error ratios at the output of the HRDP for system in the FSS using PCM

Recommendation ITU-R S.614: Allowable error performance for a HRDP in the FSS operating below 15 GHz when forming part of an international connection in an ISDN

Recommendation ITU-R S.1062: Allowable error performance for a HRDP operating at or above the primary rate

In all of the above performance Recommendations the performance was specified for both the long-term objectives (10% to 20% of any month) and the short-term objectives (0.05% to 0.2 % or any month). In fact in Rec ITU-R S.1062 the short-term objective was for 0.2% of any month or 0.04% of any year.

Recommendations dealing with sharing between FSS networks and between FSS and other services have been based upon the above performance objectives. For example:

Recommendation ITU-R S.735: Maximum Permissible levels of interference in a GSO Network of an HRDP when forming part of the ISDN in the FSS caused by other networks of this service below 15 GHz

Recommendation ITU-R S.1323: Maximum Permissible levels of interference in a Satellite Network (GSO/FSS; NON-GSO/FSS; NON-GSO MSS Feeder links) for a HRDP in the FSS caused by other Co-Directional networks below 30 GHz.

The above Recommendations essentially provide that a maximum 6% increase in noise temperature is permitted between GSO networks. Recommendation S.1323 states that interference from a non-GSO network into a GSO network could degrade the short-term performance objective by a 10% increase in the time allowance. The FSS short-term performance objective in Rec S.1062 is based on a time allowance of 0.04 % of year and the permitted increase was .004%, i.e. 10%.

Certificate of Service

I hereby certify this 26th day of September, 2003, that I caused a copy of the foregoing "Reply to Opposition to Petition for Reconsideration" and "Reply Engineering Statement of Harold Ng" to be served by first-class mail as follows:

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/s/ Candace Gentry
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