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November 10, 1999

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Via Hand Delivery

Magalie Roman Salas, Secretary
Federal Communications Commission
445 12th St., S.W., Room TW-B204
Washington, D.C. 20554

Re: Written *Ex Parte* Communication in ET Docket No. 98-206, RM-9147, and RM-9245

Dear Ms. Salas:

This letter is submitted in response to various *ex parte* communications submitted by the "Satellite Coalition"[1/] in the above-referenced docket, primarily one filed on July 29, 1999 (the "Satellite Coalition Filing"). As explained by the Satellite Coalition, ITU-R studies on issues in this proceeding were still ongoing at the conclusion of the comment cycle on the notice of proposed rulemaking in this docket (the "NPRM"). SkyBridge is therefore pleased that the Satellite Coalition has placed into the record of this proceeding the output from the last meeting of the Joint Task Group ("JTG") 4-9-11, which summarizes the international agreement reached on various questions contained in the NPRM. This output document, which constitutes Chapter 3 of the draft report of the CPM to WRC-2000 (the "CPM Text"), reflects the international consensus that has been reached on nearly all major technical issues

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1/ The members of the Satellite Coalition are GE American Communications, Inc. ("GE Americom"), PanAmSat Corporation ("PanAmSat"), Lockheed Martin Global Telecommunications, Echostar Corporation, and Hughes Electronics Corporation.

raised in the NPRM.[2] SkyBridge urges the Commission to adopt rules consistent with these agreements, to which the United States was party.

As the Satellite Coalition explains, however, agreement has not yet been reached on the downlink equivalent power flux-density ("$EPFD_{down}$") limits applicable to NGSO FSS systems corresponding to certain larger GSO FSS and BSS antenna sizes. With respect to GSO FSS antennas, although agreement was reached on the limits for the 60 cm and 1.2 m antenna sizes, two sets of limits are presented in the CPM Text for the 3 m and 10 m antenna sizes. As explained in the CPM Text, there was majority support for "curve A." However, there was some support for an alternative "curve B" that contained tighter EPFD limits.[3]

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[2] The JTG has comprehensively studied all aspects of the GSO/NGSO interference environment to determine the best way to facilitate sharing among NGSO systems and the various incumbent services. The operating assumption of this work has been that new, technically rigorous, equivalent power flux density ("EPFD") limits would be derived and proposed to WRC-2000, along with related provisions to address all technical concerns. In the process, the group has reached consensus on virtually every step in the derivation and refinement of EPFD limits for protection of GSO systems. In particular, the JTG has compiled an extensive database of actual and planned GSO links contributed by administrations. The JTG has also established GSO link protection criteria and related calculation methodologies to develop new limits based on the GSO link database. As discussed below, the JTG has specified tools to help the ITU and individual administrations confirm that NGSO systems meet the limits. This includes specification of the procedure that each NGSO operator must follow to assess the performance of its system, and definition of a 3-dimensional GSO earth station reference antenna pattern. In addition, the JTG has reached consensus on the approaches that will be taken to protect very large GSO earth station antennas and GSO systems in inclined orbits. The JTG has also agreed on the limits to protect the Fixed Service. Finally, the JTG has identified potential solutions for facilitating sharing between Radiolocation and Space Sciences systems and NGSO FSS systems.

The goal of the JTG has been to create a coherent package of provisions that will protect GSO and other co-primary systems, while allowing introduction of NGSO systems. As discussed below, examination of any set of candidate EPFD limits must be performed in the context of all of the related provisions.

[3] More specifically, in a show of cards, fifteen countries supported the adoption of curve A, while only two supported curve B.

(continued...)

To address these outstanding issues, the Satellite Coalition introduced into the record numerous prior contributions to the JTG 4-9-11 and WP 4A authored primarily by its members. These contributions, however, have already been presented, discussed, and assessed in the international fora. The fact that conclusions reached in these documents do not appear in the final outputs of these working groups means that there was no consensus on their merits. SkyBridge urges the Commission, therefore, to examine these documents critically, and assess them in light of the body of agreements reached by JTG 4-9-11. Notwithstanding the implications contained in the Satellite Coalition Filing, many of the issues raised in the documents were actually resolved by JTG 4-9-11, as described below.

SkyBridge is confident that an agreement can be reached on the remaining limits that satisfies the WRC-97 objective, articulated in Resolutions 130, 131, and 538, that no undue constraints be placed on any of the services involved. However such agreement will require careful attention to the actual operating requirements of GSO systems, coupled with an understanding of the manner in which the performance of NGSO systems will be assessed under the new regulatory environment proposed by the JTG.

Considerations related to the BR Software and actual NGSO performance. Several considerations must be kept in mind in assessing any proposed set of EPFD limits. Obviously, the impact of the limits on GSO links must be analyzed. However, this must be done with a full understanding of the way in which performance of NGSO systems is being assessed, particularly for compliance with the limits.

In response to concerns of the GSO community and regulators regarding the difficulty of individual assessment of the power transmitted to a GSO earth station from an NGSO system as a whole, the JTG has proposed to WRC-2000 that compliance be verified by the ITU Radiocommunication Bureau ("BR"), using software specified by the JTG. This software could not be based on parameters that could change over the life of the NGSO system, such as the number of beams illuminated and their pointing directions. The software therefore employs a number

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3/ (...continued)
With respect to GSO BSS antennas, agreement was reached on limits for the 30 cm, 45 cm, 60 cm, 90 cm, and 120 cm antenna sizes. A single set of limits is proposed in the CPM Text for each of the 180 cm, 240 cm and 300 cm antenna sizes; however, it is noted that certain administrations wished to conduct further studies on these limits before agreeing to them, with the goal of having results prior to the CPM. For purposes of simplification, a proposal was made to merge the FSS and BSS limits into one single set of limits that would be valid for both services. This proposal is still under study.

of worst-case and simplifying assumptions, including a "worst-case" beam configuration for the satellites of each system. The result does not, therefore, predict the EPFD statistics that will be produced by a system in operation, but rather computes a very conservative upper bound. As a result, the software will overestimate the amount of interference experienced by GSO systems. Undue constraints will be imposed on NGSO systems if this consideration is not appropriately taken into account.

The manner in which NGSO performance is evaluated is especially important when assessing the $EPFD_{down}$ limits for large GSO antennas. One concern with respect to these large antennas stems from the fact that their high gain makes them more susceptible to interference from NGSO systems during certain (brief) geometrical alignments of the NGSO and GSO satellites and receive antennas. If the interference were high enough, sync loss could occur. However, JTG studies have shown that the worst-case interference from an NGSO system into large earth stations is quite localized.[4/] The conservative upper bound computed by the BR software hides this important phenomenon. Tightening the EPFD limits to ensure protection of an unlikely placement of a large and sensitive GSO earth station under the worst-case assumptions employed in the validation software would act as an undue constraint on NGSO systems.

Nevertheless, in view of this concern, as expressed in several of the papers submitted by the Satellite Coalition, NGSO system proponents made important compromises at the last meeting of the JTG, which are reflected in the CPM Text. These agreements were made to reassure GSO operators that the EPFD limits proposed by NGSO proponents, applied in combination with the BR software, will not adversely affect operating GSO links to large antennas, and to provide them recourse in the event that they do.

First, "operational limits" were introduced to protect large antennas (gain greater than 59 dBi). These limits are in addition to the "validation limits" that the ITU BR will use for compliance verification. Put simply, the operational limits are tighter limits, which apply to a NGSO system in operation, and not to the

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4/ For any given NGSO system, the statistics of interference are not uniform over the earth. Maximum levels of EPFD for each system, caused by certain "worst-case" geometrical configurations of satellites and beams, are confined to finite areas on earth. As the size of the GSO earth station antenna increases, the size of the "worst-case" areas becomes quite small. As a result, the chance of a larger GSO earth station being located at a "worst-case" location for any NGSO system <u>and</u> pointed in the "worst-case" direction for such system, becomes remote. Studies have shown that the worst-case EPFD seen by virtually all larger antennas will be several dB's below the worst-case generated by the NGSO system.

conservative upper bound calculated by the BR software. These limits represent a risk to NGSO operators, because no demonstration of harmful interference caused by these lower interference values is required from the GSO operator. The GSO link could have ample margin to cope with the interference, yet still request the NGSO operator to lower its power to the tighter operational limits. Agreement to such limits is based on the fact that, due to the localization of worst-case interference, as well as due to the worst-case assumptions used in the BR software, the actual EPFD to operational GSO earth stations will virtually always be below the validation EPFD limits.

Second, some GSO proponents expressed concerns about the ability of the limits proposed by NGSO proponents to protect GSO antennas at higher latitudes, where larger antennas are often used to compensate for the low elevation angle inherent in such links and the reduced power transmitted towards those regions (this is particularly the case for BSS applications in Alaska, for example). In response to these concerns, NGSO operators again agreed to additional tighter EPFD limits, applicable at the higher latitudes.

As explained in the CPM Text, there are numerous penalties to NGSO systems in tightening the limits that apply world-wide, across the entire GSO arc.[5/] Care must therefore be taken to avoid adopting unduly restrictive limits. In view of the above considerations, including the addition of operational and high-latitude limits, the majority view of the JTG was that the "curve B" $EPFD_{down}$ limits referenced in the CPM Text would be unduly tight, i.e., these limits would unduly constrain NGSO system designers without any demonstrable benefit for GSO system designers. On the other hand, when these considerations are appropriately taken into account, it was the majority view that the "curve A" limits would adequately protect GSO systems.

Considerations related to the shape of the EPFD mask. The JTG recognized that the shape of the EPFD mask is of vital importance in accommodating NGSO systems. In brief, a variety of masks can be shown to comply with the GSO protection criteria, but only those whose shape mirrors or encompasses the statistics of interference produced by NGSO systems avoid undue constraints on NGSO systems. The curve A masks, especially for the 3 m antenna, more closely match the shape of the NGSO interference characteristics than the curve B masks. As pointed out by the Chairman of the JTG, due to its shape, the curve B mask for the 3 m antenna would permit only a small number of low power NGSO satellites, and thus preclude the operation of most proposed systems.

5/ Studies of the constraints placed on NGSO systems by a tightening of the limits have shown that a small change in the EPFD mask can result in a significant adverse impact on the NGSO system capacity. See CPM Text, Section 3.1.2.3.2(c).

Considerations related to the GSO links assessed. Finally, the types of links considered in the analysis must be taken into account. Links were submitted to the JTG by administrations in response to ITU-R Circular Letters CR/92 and CR/116. Curve A adequately protects virtually all of the links submitted in response to the first circular letter. Subsequent studies elucidated the characteristics that make links most sensitive, with the result that, in response to the second circular letter, a high number of links clearly designed to emphasize these sensitive characteristics were submitted by two parties (see attached graphs). Some of these links are so sensitive that a decrease of 0.3 dB in satellite EIRP would break the link, despite the fact that the typical daily variation of EIRP from a GSO satellite is about 0.6 dB in the flat gain portion of the service area and more near the edge of the service area. On the other hand, an increase in EIRP of as little as 0.1 dB is enough to cause many of the links to satisfy the JTG protection criteria in the presence of NGSO EPFD levels corresponding to curve A.[6/]

It is clear that many of these later-submitted links were designed to defeat the particular protection criteria and calculation methodologies agreed to within the JTG, which allows the GSO designer to specify its desired level of availability. By specifying a very high level of availability for a link exhibiting very little margin, it is easy to push the protection criteria and methodologies to compute a very low level of permissible NGSO interference - so low that it falls within the same order as the protection requirements of Radioastronomy receivers. However, for the reasons noted above, the kinds of links required to achieve this result are exceedingly unlikely to be implemented in practice. And if they were, they would not achieve their specified level of availability when all sources of interference and outage are taken into account, even in the absence of any NGSO system.[7/]

6/ For example, 50% of the Intelsat links that do not pass the GSO protection criteria with curve A *will* pass with only a 0.1-0.5 dB EIRP increase in satellite power.

7/ Several U.S. GSO operators have submitted links to the JTG. The links submitted by GE Americom are *all* protected by curve A. Loral also submitted links, and has agreed that curve A would provide adequate protection. On the other hand, SkyBridge has repeatedly requested from PanAmSat the parameters for real operating links for a whole transponder so that the effect of NGSO interference can be assessed accurately. PanAmSat has responded that this information is proprietary. At the same time, PanAmSat has stated that their operational links will suffer interference greater than the protection criteria agreed upon by the JTG. However, it is not possible to verify this assertion without the parameters of the operational links.

NGSO operators have agreed to protection criteria that rely on the good faith of GSO operators. In contrast to the fixed interference allowances that govern GSO/GSO coordinations, the interference allowance from NGSO systems depends on the desired availability specified by the GSO operator. The Commission cannot allow the good faith efforts of NGSO operators to ensure the legitimate protection of GSO systems to be turned against them.

Conclusion. In sum, it is clear that an appropriate balance between the needs of GSO operators and the requirements of NGSO systems is achievable. However, agreement on the final outstanding issues in this proceeding will require that the GSO needs be based on the reasonable operational requirements of such systems, in order not to unduly constrain NGSO systems. It will also require a thorough understanding of NGSO performance capabilities, and how these will be assessed using the BR software.[8/]

Curve B, when applied in combination with the BR software, does not achieve the necessary balance. Curve A, when considered as part of the "package" of inter-related provisions crafted by the JTG, strikes the appropriate balance, both adequately protecting GSO systems, and taking into accounts the needs of NGSO systems. The Commission should follow the majority view of the JTG and adopt limits based on curve A and the BR software.

Respectfully submitted,

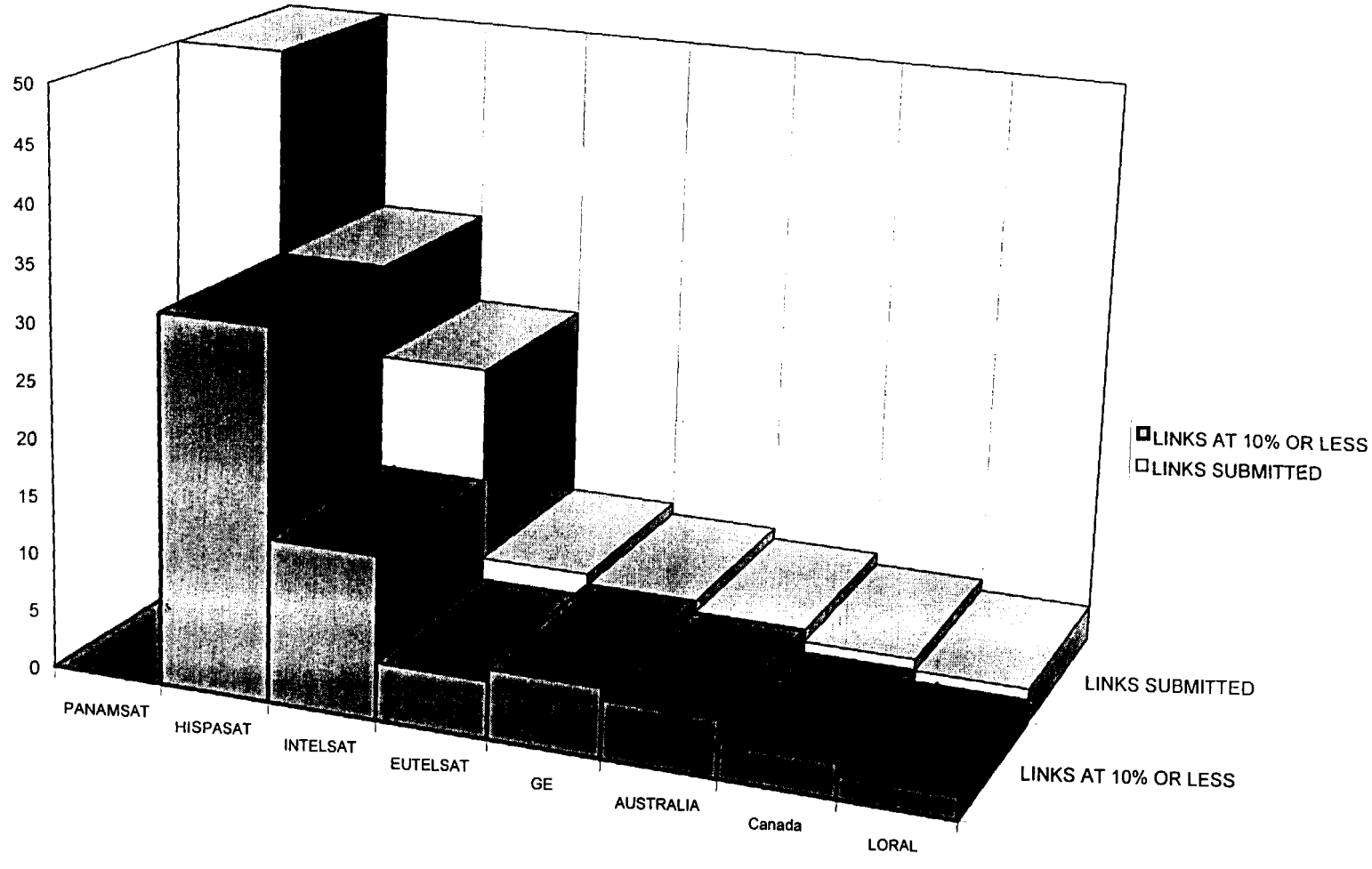
Jeffrey H. Olson
Diane C. Gaylor
Attorneys for SkyBridge LLC

Attachments

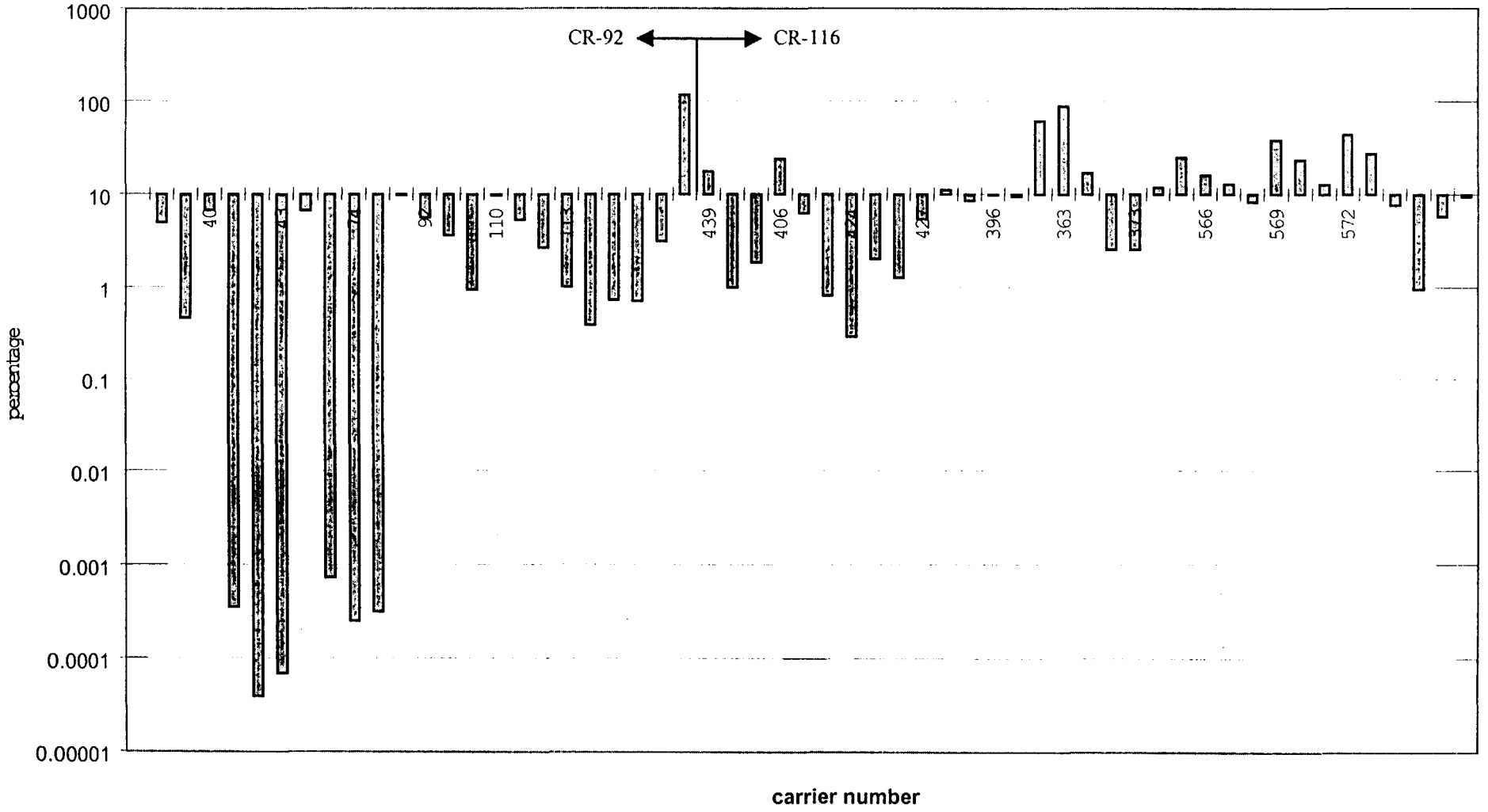
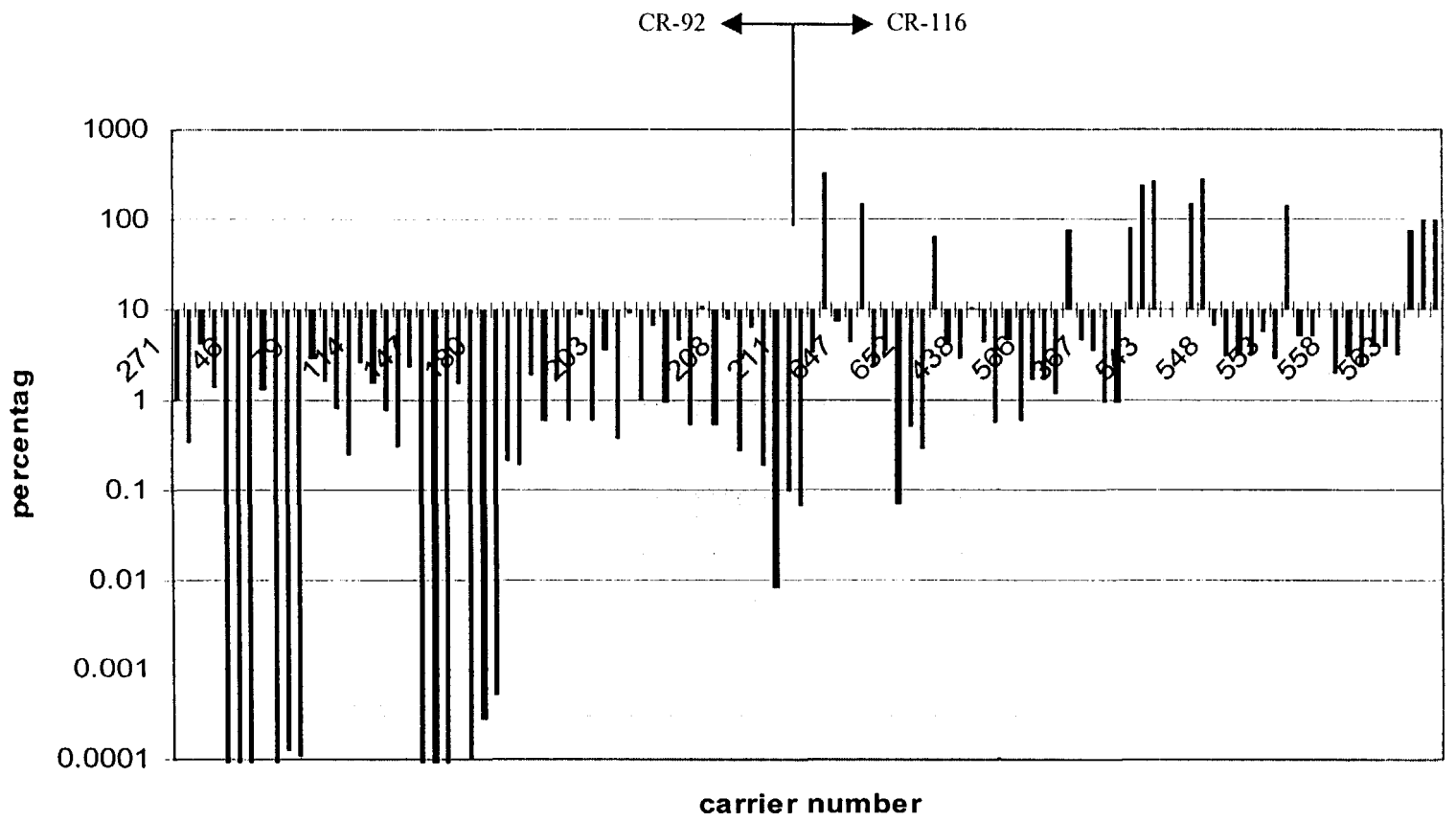
cc: Dale Hatfield	Don Abelson	Ari Fitzgerald	Mark Schneider
Julius Knapp	Thomas Tycz	Peter Tenhula	Bryan Tramont
Thomas Derenge	Harry Ng	Adam Krinsky	

8/ At present, discussions are ongoing in an attempt to reach consensus on the remaining EPFD masks. The objective is to maintain a dialogue between NGSO operators and the minority of GSO operators that have raised concerns regarding curve A, in order to reach agreement prior to WRC-00, and ideally at the next JWP 10-11S and WP 4A meetings.

Comparison of the Number of Links Submitted in Response to CR 116 with the Number of Such Links Protected by the 3m and 10m "Curve A" Masks



Impact of the aggregate "curve A" mask on the CR-92 and CR-116 60 cm links



Impact of the aggregate "curve A" mask on the CR-92 and CR-116 1.2 m links