III. THE COMMISSION SHOULD MODIFY ITS SERVICE RULES FOR NGSO FSS SYSTEMS TO MAKE THEM CONSISTENT WITH THE TECHNICAL DECISIONS FINALIZED AT WRC-2000, UPON WHICH THEY ARE BASED.

A. Certain Changes To The EPFD Limits In The Commission's Rules Are Needed For Compatibility With The WRC-2000 Agreements.

SkyBridge supports the Commission's co-primary allocation to NGSO FSS systems,[63] as well as the equivalent power flux-density ("EPFD") limits adopted by the Commission for protection of GSO FSS and GSO BSS earth stations. However, there are several inconsistencies between the Commission's expression of those limits and the WRC-2000 text. Some of these deviations lead to critical changes in meaning, with corresponding impact to the regulated services. SkyBridge summarizes the most important of these below, and in Exhibit A proposes changes to the Commission's rules to rectify these inconsistencies.

- The "Operational Limits" and "Additional Operational Limits" are meant to apply at any "operational earth station" and not, as stated in the Commission's rules, "at any point on the earth's surface."[64] As discussed further in the next section, this

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[63] In particular, SkyBridge supports adoption of new footnotes S5.441, S5.484A, and S5.487A to the U.S. Table, which are based on the WRC-2000 Final Acts. However, one point should be noted. Although it was agreed at WRC-2000 that new NGSO FSS systems would not claim protection from GSO FSS and BSS networks that are operating in accordance with all relevant ITU rules, it was also agreed that the NGSO FSS allocations would be unquestionably co-primary. In the context of the Radio Regulations, this was emphasized by adding text to each of the new Radio Regulations footnotes S5.441, S5484A, and S5.487A specifying that "No.S5.43A does not apply," as reflected in the Commission's incorporation of these footnotes in the Report & Order, but not in Section 25.146(e). The relevant provision of S5.43A was newly adopted at WRC-2000, and does not appear in the Commission's rules. However, the Commission's rules do contain, in Section 2.104(g), a rule based on an earlier version of S5.43A. Therefore, should the Commission ever amend Section 2.104(g) (or any other rule) to contain the new provisions of S5.43A, Section 25.146(e) would need to be amended accordingly.

[64] 47 C.F.R. § 25.208(i),(j).

distinction was a critical aspect of the compromise that led to the adoption of those limits, and should be made clear in the rules.[65]

- WRC-2000 adopted a special Operational Limit to protect BSS earth stations of 240 cm diameter located in Region 2 west of 140° W, north of 60° N, pointing at GSO BSS satellites at certain orbital locations with elevation greater than 5°. Although the geographic area in which this Operational Limit applies generally covers Alaska, it is not coincident with Alaska. However, in its rules, the Commission replaced the WRC-2000 text "Region 2 west 140° W, north of 60° N" with the word "Alaska." This does not accurately reflect the interference scenarios debated at WRC-2000, which were based on operation of earth stations located at certain latitudes, or the nature of the agreement reached. It would impose additional burdens on NGSO FSS systems that are not warranted by the concern addressed by this operational limit. It is therefore necessary to retain the WRC-2000 language.[66]

- In several of the EPFD tables, the Commission left out text stating that "[f]or each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the EPFD levels and logarithmic for the time percentages, with straight lines joining the data points." As this text constitutes an important part of the definition of certain of the limits, SkyBridge proposes in Exhibit A that it be inserted in the appropriate tables, consistent with the WRC-2000 agreements.

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[65] On a related point, the Commission added a note to the tables for the Operational Limits and Additional Operation Limits stating that these limits relate to the EPFD "which would be obtained under free-space propagation conditions." 47 C.F.R. § 25.208(i),(j). However, such a statement is not relevant for operational limits, which, by definition, apply in operation, and should not be linked to any propagation model.

[66] In addition, this limit was adopted in view of certain restrictive power limits on BSS operations in that geographic area to protect terrestrial operations in adjacent countries. However, those limits on BSS operations were relaxed at WRC-2000, and therefore, as the Commission explained in the Report & Order, at ¶ 182, the special Operational Limit on NGSO FSS operations is to be phased out after 15 years. However, the 15-year transition period does not appear in the Commission's rules, and should be added. (For consistency with the Radio Regulations, the 15-year would commence from the conclusion of the WRC on June 2, 2000. However, the Commission states that it will commence the 15-year transition from the effective date of the rules in the Report & Order, and this is acceptable to SkyBridge.)

- The Report & Order refers to the Additional Operational Limits as "masks,"[67] and seems to imply that these limits are "continuous curves of $EPFD_{down}$."[68] However, while the "Validation Limits" are defined for *all* percentages of time, and have therefore been referred to as "masks," the Additional Operational Limits are defined for only *certain specified* percentages of time (as well as for only certain specified antenna sizes). The WRC-2000 agreement intentionally did not provide for interpolation between these points, and the Commission should clarify that it is implying no such meaning by describing the Additional Operational Limits as "masks."

B. The Commission's Rules For Assessing Compliance With The EPFD Limits Are In Several Significant Respects Inconsistent With The Regulatory Regime Finalized At WRC-2000.

As noted above, the Commission generally followed the WRC-2000 agreement on the EPFD limits themselves. However, with respect to procedures for determining compliance with these limits, the Commission departed from those agreements in several significant respects. While SkyBridge understands the motivation for some of the modifications, several of the Commission's changes or additions are inconsistent with either the purpose and intention of the limits, or the technical decisions finalized at WRC-2000, which represent the product of three years of detailed study and intense negotiation. As demonstrated below, the re-opening of issues by the Commission has resulted in rules that are very difficult to interpret, and that will therefore be very difficult to apply. SkyBridge proposes various changes to the Commission's rules that should address the Commission's concerns regarding compliance with the limits, but that are compatible with the WRC-2000 regime.

67/ R&O, ¶¶ 74 & 80

68/ R&O, ¶ 80, n.183.

1. The Commission's Rules For A Software Demonstration of Compliance With The "Validation Limits" Must Be Consistent With The Software Specification Employed.

SkyBridge generally agrees with the Commission's requirements for demonstrating compliance with the so-called "Validation" limits. However, the Commission has added some requirements that would lead to significant changes in the software specification approved by the ITU-R, with the result that the rules are difficult to interpret and unnecessarily burdensome to implement.

(a) The Commission should encourage use of the generic software tool developed within the ITU.

First, the new rules require the applicant to provide to the Commission software for computing validation EPFD levels "developed in accordance with the specification stipulated in ITU-R Recommendation BO.1503," and to provide both the source code and the executable file for the program.[69] SkyBridge supports such a requirement in the case of an applicant that elects to use its own software based on BO.1503, but would urge the Commission to encourage use of the actual computer program to be approved by the ITU-R for determining compliance with the Validation Limits, assuming such program is available at the time.[70]

This would reduce the burden for licensees, the Commission and other interested parties. In addition, it would eliminate the need for the licensee to provide the source code and executable file for the software, and the consequential review of the software by the Commission and interested parties. It would also eliminate the need for cross-validation of the software, and

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[69] R&O, ¶ 90; 47 C.F.R. § § 25.146(a)(1)(iii) and 25.146(a)(2)(iii).

[70] Two software tools based on BO.1503 have already been submitted to the ITU-BR to be validated. This validation process is expected to be completed in mid-2001, resulting in a BR-approved software.

permit NGSO FSS licensee to benefit from all the efforts that have been put toward development of an internationally-approved software. Finally, it would permit the Commission to be "confident that the NGSO FSS system information [it sends] to the ITU-BR is accurate and that the validation test used domestically is the same as that used by the ITU-BR and other Administrations."[71] In Exhibit A, SkyBridge proposes a slight modification to Sections 25.146(a)(1)(iii) and 25.146(a)(2)(iii) that would ease the regulatory burden in cases where the licensee chooses this simpler option.

(b) The Commission's required showing should be consistent with the ITU software specification.

In addition, the Commission's rules require each applicant to provide, for $EPFD_{down}$, results for the worst three test points in the U.S. and the worst three test points on each continent, as well as for the center of each beam footprint.[72] For $EPFD_{up}$, the Commission requires results for every longitudinal location on the GSO arc at 2° spacing where visible to the U.S. and at 3° spacing elsewhere.[73] For the following reasons, however, these requirements are very difficult to interpret, and reopen delicate debates that were concluded in the ITU-R in preparation for WRC-2000.

First, there exists no definition for the "worst three test points" in terms of EPFD statistics, which are represented by *curves* specifying maximum power levels for any given percentage of time. As the result of lengthy technical discussions, the ITU-R study groups reached agreement on a definition of the "worst-case" configuration (in terms of GSO location

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[71] R&O, ¶ 89.

[72] R&O, ¶ 90; 47 C.F.R. § 25.146(a)(1)(v).

[73] 47 C.F.R. § 25.146(a)(2)(v). Note that no explanation for this rule is provided in the Report & Order.

and pointing direction) at which the compliance test should be performed, and a procedure for finding that configuration for a given system is included in ITU-R Recommendation BO.1503.

It is not at all clear how that algorithm could be extended to specify the next two "worst-case" points, nor the "worst-case" over a particular region of the world, or at particular points along the GSO arc. In addition, it is not clear how the rule requiring the $EPFD_{down}$ for the center of each beam footprint could be applied to NGSO FSS systems that do not employ "sticky beams," because for such systems the location of the footprint sweeps over the surface of the earth as the satellite moves. And even for systems using sticky beams, the cell layout may change over time. Moreover, in the absence of an agreed definition or procedure, it is unclear which GSO satellite would be used as a reference for such computations. With respect to $EPFD_{up,}$ it is also unclear which GSO satellite pointing direction would be used for each arc location under the Commission's rules. Each of these uncertainties would have to be eliminated in order to avoid diverging interpretations that the Commission's rules would reopen.

Most importantly, it is not clear what purpose is served by the extra information requested by the Commission. The additional results are not needed to ensure compliance with the Validation Limits. So long as the $EPFD_{down}$ and $EPFD_{up}$ are shown to meet the Validation Limits with the agreed validation software, it follows *by definition* that the limits will be met worldwide. Moreover, both the software and the inputs provided by the NGSO FSS operators will be publicly available. If a GSO operator believes that the results for additional data points would be useful, it will be able to perform such simulations itself.

Finally, even if the information required by the Commission served a useful purpose, providing the information would be extremely burdensome for NGSO FSS licensees. The run-times for each simulation can be very long, on the order of 24 hours per data point with

the software being validated within the ITU-R. SkyBridge therefore urges the Commission to adhere to the international agreement, and require that $EPFD_{down}$ and $EPFD_{up}$ results be provided only for the test point defined by and determined using Recommendation ITU-R BO.1503. In Exhibit A, SkyBridge proposes modifications to Sections 25.146(a)(1)(v) and 25.146(a)(2)(v) that would achieve this goal.

2. The Commission's Rules For Ensuring Compliance With The Operational-Type Limits Must Be Consistent With The Definition Of Those Limits.

(a) The Commission must ensure that its rules respect the differences between the "validation" limits and the two kinds of "operational" limits.

In addition to the "validation" limits, WRC-2000 adopted two kinds of "operational" limits that apply to NGSO FSS systems. As the Commission is well aware, these limits represented a delicate compromise. Within the ITU, NGSO and GSO operators both recognized that the interference levels computed by the validation software discussed above overestimate the actual interference that can be expected into any actual GSO earth station, due to the worst-case inputs that must be provided by the operator and the conservative assumptions employed by the software. For this reason, tightening these limits posed significant burdens on NGSO operators, without any demonstration by GSO operators of an actual need for the vast majority of their links. On the other hand, it was also agreed that NGSO operators must make some commitment to lower interference levels predicted by the studies, upon which the GSO operators are clearly relying for some of their links.

In view of the difficulty of developing simulation software that is both useful as a regulatory tool *and* accurately computes the actual interference into GSO FSS earth stations,[74] the compromise ultimately reached was to adopt further limits that would bound the actual levels of interference generated by an NGSO FSS system *in operation* into any *operational* GSO earth station. As a result, GSO operators are protected in two ways: first by a demonstration via a generic software program prior to commencement of service that the power levels generated by an NGSO FSS system will not exceed the bounds determined necessary for protecting GSO systems (taking into account the conservative assumptions of that software); and second by a guarantee that, while in operation, NGSO FSS systems will take all necessary steps to meet tighter limits, if operation of those systems are generating a power level in excess of these tighter operational limits into any operational GSO receiver specified in the rules.

It is very important to understand a critical difference between the "validation" and "operational" limits. The validation limits can never be exceeded anywhere on earth at any time, and place a hard constraint on NGSO FSS system design and operation. The operational-type limits, on the other hand, may be exceeded *by definition*, so long as they are not exceeded into any operational GSO earth station.[75]

These limits may pose additional constraints on NGSO operators, but the studies showed that the chances are extremely small that an NGSO system that meets the validation

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[74] For example, as discussed in numerous SkyBridge pleadings in this docket, the actual interference levels to a GSO earth station will change with time. Changes in the beam switching algorithms and power levels will be required on a frequent basis in order to serve new customers and to permit sharing with new co-frequency NGSO FSS systems.

[75] This gives NGSO FSS operators an important measure of flexibility, because the worst-case EPFD levels are extremely localized and of short duration. See, e.g., Comments of SkyBridge, ET Docket No. 98-206, March 2, 1999 ("SkyBridge NPRM Comments"), at 36-37.

limits would violate the operational limits into an actual operating GSO earth station. Therefore NGSO operators accepted the risk that they may occasionally need to constrain their operations to meet the operational limits, because such need is expected to arise very rarely, if at all. For the same reason, GSO operators were willing to accept an operational rather than a validation limit for these tighter bounds.

In the Report & Order, the Commission has departed from the WRC-2000 result and imposed requirements that NGSO FSS licensees demonstrate, via computer simulations, compliance with the Operational Limits and Additional Operational Limits prior to the commencement of service. Indeed, the Commission's rules for assessing compliance with the two kinds of operational limits are nearly identical to the rules for the Validation Limits, despite critical and fundamental differences between these classes of limits. This is at odds with the delicate WRC-2000 compromise. SkyBridge therefore urges the Commission to recognize the differences between the Validation Limits and the two kinds of operational limits, and regulate them accordingly, consistent with the intent of WRC-2000.

(b) The Commission should eliminate its requirement for a pre-operation showing of compliance with the "Operational Limits."

The "Operational Limits" bound the *maximum* $EPFD_{down}$ (as opposed to the $EPFD_{down}$ statistics) that an operational NGSO FSS system may transmit into operational GSO FSS earth stations of varying sizes. As discussed above, these limits apply to each NGSO system in operation, and not to the conservative upper bound calculated by the software used to check compliance with the Validation Limits. Moreover, these limits apply only with respect to operational GSO earth stations. The NGSO operator is not bound to these limits where no GSO earth station exists to protect. It was therefore intended that compliance with the Operational

Limits would *not* be assessed using software; rather, measurement techniques would be developed that would permit assessment of the actual interference levels into any operational GSO earth station once an NGSO FSS system was in operation. If a measurement showed a violation, the NGSO FSS operator would have to take steps to reduce its power levels at that particular location. Such measurement techniques, and accompanying regulatory procedures, have been under development.[76]

Because (1) the Operational Limits can, by definition, be exceeded (except into an operational GSO earth station), (2) operational power levels from an NGSO FSS system change over the life of an NGSO FSS system with changes in traffic patterns, and (3) there is no definite database of GSO earth stations in operation, including their pointing directions, it is not possible to demonstrate compliance with these limits via computer simulations prior to commencement of

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[76] Two ITU-R Recommendations are being developed that will help administrations enforce the Operational Limits. The first provides methods for using ephemeris data to pinpoint and identify NGSO satellites. See Working Party 4A, Draft New Recommendation ITU-R S.[Doc 4/15(rev.1)], "Procedure for the Identification of Non-GSO Satellites Causing Interference into an Operating GSO Earth Station," Nov. 9, 2000, currently pending approval. See also note 79 infra. The second provides options for measuring, with good accuracy, the $EPFD_{down}$ levels generated into a GSO earth station when an NGSO satellite passes in-line with the GSO network. See Preliminary Draft New Recommendation, WP 4A Chairman's Report, ITU-R Doc. 4A/93, Section 4.10, "Methodologies for Measuring EPFD↓ Interference Levels From a Non-GSO Space Station to Verify Compliance with Operational EPFD↓ Limits," November 2000. These recommendations were tested on-site in July 2000, in the presence of Commission personnel, and their effectiveness has been proven. The chairman of Working Party 4A, who attended these tests, concluded that "[t]he exercise provided practical confirmation that it is possible to measure short duration, infrequently occurring peaks of interference from an NGSO constellation to an earth station in a GSO network, if the levels of those peaks are of similar order to the *operational* limit. Furthermore, this was done without interruption to the affected carrier, using a spectrum analyser such as may be found in many operational earth stations." Chairman Working Party 4A, "Report of $EPFD_{down}$ Measurement Exercise, 17-21 July 2000," ITU-R Document 4A/9, August 31, 2000, at 6.

operation without changing the scope of the limits.[77] Indeed, the three highest $EPFD_{down}$ levels obtained even with a detailed simulation of a representative mode of operation and traffic distribution would likely show instances in which the Operational Limits are exceeded, as was foreseen by the ITU-R. The Commission must therefore rely on the measurement techniques developed by the ITU-R, and put licensees on notice that they must be prepared fully to demonstrate compliance to the Commission in the course of any investigation into an alleged violation of the Operational Limits.[78] It is important to note that it is not critical that these ITU Recommendations be adopted prior to their use; they provide alternative methods for measuring

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[77] The ITU working groups concluded that, under such a scenario, any attempt to compute the worst-case operational power levels leads inexorably to the kind of analysis employed by the validation software, i.e., envelope calculations, which produces a conservative upper bound of the possible interference from a system, and not the actual interference that would be produced in operation. This reality was precisely the reason that separate "validation" and "operational" classes of limits were developed within the ITU, and the reason why no compliance assessment method for use *prior* to operation has been defined. If the Commission forces the Operational Limits to be assessed in essentially the same manner as the validation limits, an unintended and unreasonable burden will be placed on NGSO FSS applicants, and the integrity of the WRC-2000 compromises will be at stake.

[78] This is the general course taken by the Commission even in cases where hard limits exist; the reasons specified by the Commission for requiring pre-operational showings in this case (see R&O, ¶ 96) generally apply in other cases where the Commission has declined to require such showings. For example, the Commission's limits on PFD for the protection of FS systems, and frequency tolerance and emission limitations, applicable to all FSS operations, are simply a condition of each license, and are not subject to measurement or other validation except in the context of a dispute. See 47 C.F.R. § 25.202, 25.208. Similarly, the GSO FSS antenna performance standards of Section 25.209 are governed by a compliance certification requirement. See 47 C.F.R. § 25.132. In such cases, the Commission relies on each operator to honor the commitments contained in their applications to abide by such rules, knowing full well that failure to do so could lead to sanctions, including, in extreme cases to loss of license.

power levels, and do not dictate how the measurements should be conducted in any given scenario.[79]

(c) The Commission should modify its rules requiring a pre-operation showing of compliance with the "Additional Operational Limits."

The "Additional Operational Limits" apply to 3 and 10 meter GSO earth stations, and are specified as points of $EPFD_{down}$ at specific percentages of time. Unlike with the Operational Limits, the administration proposing the NGSO system is required to commit in the Appendix S4 filing for the system that, when in service, the interference from that system into any operational GSO antenna of diameter 3 m and 10 m will meet the Additional Operational Limits.[80]

The means for assessing compliance with the Additional Operational Limits poses a difficult question, which the ITU-R study groups have been working to address. As with the

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[79] The Commission has required all Ku-band NGSO FSS licensees to maintain a web site listing the satellite ephemeris for each satellite in its constellation, updated every 3 days, using NORAD format. SkyBridge agrees with the Commission that accurate ephemeris data for each constellation should be publicly available, and SkyBridge will establish a web site as required by the Commission rules. However, it should be noted that the information required by the Commission is already available on the NORAD web site, and a variety of commercial software packages for computing orbital propagations are adapted to automatically link to and download data from that site. As noted above, use of the NORAD data to accurately pinpoint NGSO satellites has been demonstrated using Globalstar satellites. See supra note 76. Updates to the NORAD site can occur up to every 10 days, which is a more appropriate time frame than the 3 days specified in the Report & Order, given the stability of the NGSO satellites at issue here. Requiring data to be updated every 3 days would not increase the accuracy that could be obtained, and SkyBridge urges the Commission to relax its requirement to require updates no more than every 10 days. Moreover, the Commission could add an explicit requirement that "the NGSO satellite operator should provide assistance to the GSO FSS operator to obtain the most current ephemeris data, if necessary to identify the source of interference," in accordance with ITU-R Draft New Recommendation ITU-R S.[DOC.4/15(rev.1)].

[80] APS4/Item A.15.

Operational Limits, simulation as a regulatory tool is difficult because the limits can be exceeded (except into an operational 3 or 10 m GSO earth station), and because the $EPFD_{down}$ statistics bounded by the limits change with time, over the life of the system. Therefore, just as in the case of the Operational Limits, the rules adopted in the Report & Order for assessing compliance with the Additional Operational Limits change significantly the character of the limits adopted by WRC-2000.

On the other hand, unlike the Operational Limits, these statistics may be difficult to measure. Therefore, the ITU-R working groups have been developing procedures that could aid administrations in determining compliance with the Additional Operational Limits, especially in the case of a dispute. In fact, a possible procedure, contained in ITU-R Recommendation 1325(rev.1), was recently sent by Working Party 4A to Study Group 4 for approval.[81] Due to the operational nature of these limits, such techniques will not be used by the ITU-BR to assess compliance in the same way that is being done for the Validation Limits. Rather they are intended to be tools that can be employed by administrations, as needed, to resolve disputes.

Obviously, the Commission needs some assurance regarding each NGSO FSS system's ability to comply with these limits prior to the start of service.[82] Indeed, the Commission will certify to the ITU that a given system will comply with the limits in the APS4

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[81] See ITU-R Document 4A/Temp 46; ITU-R Document [4/10]. Work continues on alternative methods, but to date, no such methods have been tested and approved.

[82] As the Commission notes, it lacks "experience through actual operation of these systems," and once the Commission and industry "gain experience through actual operation of these new systems, the Commission may choose to revisit the requirement for such a detailed demonstration prior to an NGSO FSS system becoming operational." R&O, ¶ 96.

filing, which is forwarded to the ITU-BR *well before* the showing required in the Commission's rules. What the Commission really needs to support its certification obligation is a framework that will ensure that each system has the technical capability to modify its operations, if needed, in the unlikely event of a violation of the Additional Operational Limits.

Therefore, as in the case of the Operational Limits, as a starting point, the Commission should require each NGSO FSS system to commit, as part of the licensing process, to meeting the Additional Operational Limits once in service.[83] Depending on the technical parameters and capabilities of a particular NGSO FSS system, the Commission may request additional supporting evidence that the operator would be able to expeditiously remedy any demonstrated violations by its system. This will ensure that, in the unlikely case of a violation of the Additional Operational Limits into an identified operational GSO earth station, the offending NGSO FSS system will rapidly be able to unilaterally resolve the problem.

Consistent with the above, the Commission should establish a requirement that, once a system is in operation, the licensee must demonstrate compliance with the Additional Operational Limits, in response to any credible complaint of a violation of those limits into an identified operational GSO earth station.[84] This technical showing presumably would employ computer simulations, based on relevant ITU-R Recommendations, using as input the actual system parameters being used at the time, and the actual location and pointing direction of the affected GSO earth station. Although the data upon which these simulations rely will change

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[83] As noted above, this is the course the Commission takes with hard limits applicable to satellite systems, such as the PFD limits for the protection of FS systems and the out-of-band emissions requirements. See supra note 78.

[84] Such a requirement would parallel that applicable to FSS earth station antenna performance requirements. See 47 C.F.R. § § 25.209, 25.132.

from time to time, and therefore can not be used prior to operation to demonstrate compliance with the limits, a licensee clearly must be prepared to make an appropriate demonstration of compliance to the Commission in the event of a credible claim of a rule violation.

As demonstrated above, there are obvious practical difficulties in requiring a pre-operational showing of compliance with the Additional Operational Limits, as currently required by the Commission. In theory, the Commission could require each licensee to provide simulation results ($EPFD_{down}$ statistics) based on ITU-R Recommendation 1325(rev.1) at a limited number of test points (random or selected),[85] employing more realistic operating parameters than those used by the validation software approach, in order to show that a marginal number of cases if any have been found to be in excess of the Additional Operational Limits. However, it is not at all clear how such a showing could be evaluated from a regulatory standpoint.

First, unless every test point corresponds to the location and pointing direction of an operating 3 or 10 m earth station, results showing some points where the limits are exceeded would not constitute a violation of the limits. An even more difficult task would be defining the operating parameters for the simulation, because these change with evolving traffic patterns, and it is critical to the definition of the limits that actual *operational* parameters be used. While within the ITU-R study process SkyBridge has always taken great pains to show the impact of the worst-case operation of its system according to realistic traffic patterns, it is not clear how

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[85] Test points could be selected as sets of GSO earth station/GSO satellite pairs for which in-line events would occur. This would focus the assessment on short term interference, which the Additional Operational Limits are meant to bound.

such parameters could be defined from a regulatory standpoint.[86] As the Commission well knows, any showing that would be made would be aggressively attacked by GSO operators, and in the absence of clear and unambiguous specifications for the showing, such disputes would be impossible to resolve.[87] Unless and until solutions to these problems can be developed (which is unlikely, given that these very same problems led the ITU-R to develop both "validation" and "operational" limits), SkyBridge urges the Commission to eliminate its requirements for a pre-operational showing of compliance with the Additional Operational Limits.

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[86] For example, the Commission has adopted a requirement that the licensee employ PFD masks for each satellite. Although the use of PFD masks for this purpose has been proposed in the last meeting of ITU-R Working Party 4A (September 2000) as an alternative to the use of Recommendation S.1325 (rev.1), at this point the proposal has not been evaluated in terms of complexity, and ability to simulate *actual operational* interference levels. Indeed, as an example, it is not clear how the PFD mask approach would model cell layout for NGSO FSS systems employing sticky beams, which, at the very least, must be modelled in an operating system. As the Commission recognized, "more exact system parameters . . . will need to be used in order to simulate actual NGSO FSS interference levels" and not just "real antenna patterns." R&O, ¶ 97, n.216.

[87] This concern is amplified in the context of the detailed showing of compliance with the Additional Operational Limits currently required by the Commission, which would necessarily result in truly voluminous submissions of unprecedented technical complexity just prior to the start of service by the NGSO FSS licensee. It can be expected that any and all opponents to the new system (whether co-frequency operators or market competitors) would use the volume and complexity of these submissions, *and the numerous ambiguities in the rules explained above*, to raise questions designed to stall the licensee's service date. It is wholly unrealistic that such disputes could be definitively resolved within the 90-day window provided by the Commission. As the Commission well knows, the power usage by a constellation is proportional to the service it is providing, and it will likely take several years before a licensee is operating at the full power levels used in conjunction with the validation software, for example. Although the Commission certainly must resolve all disputes regarding compliance with the Operational and Additional Operational Limits as they arise, it cannot allow a rule requiring a pre-operational demonstration of operational power levels to delay start of service, or to require any constraint in operation other than compliance with the limits themselves.

One final point must be addressed with respect to any demonstration of compliance with the Operational or Additional Operational Limits. Because these detailed simulations, and the software used to produce them, can contain highly proprietary information, the Commission should afford confidential treatment to any such submission.[88] As SkyBridge has explained on numerous prior occasions, the parameters used to generate operational power levels involve the actual cells where service is provided, the amount of bandwidth used at a given point in time (i.e., the traffic demand) and thus the switching algorithms used to provide capacity to various markets. Such commercial information is highly proprietary, and it would be contrary to the public interest for the Commission to require such data to be made publicly available.[89] The software itself can be also highly proprietary.[90] Due to the importance of confidentiality in this context, SkyBridge urges the Commission to explicitly state in Section 25.146 that confidential treatment will be afforded, if requested, as proposed in Exhibit A.[91]

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[88] See 47 C.F.R. §§ 0.457-0.459.

[89] It would be particularly unreasonable of the Commission to require such information in this context, because the problem of providing confidential operating parameters to regulatory bodies was one of the reasons that led to the adoption of both validation and operational limits.

[90] The software used internally by an operator to produce accurate data on its EPFD statistics is often very sophisticated, company-proprietary, and not developed as a commercial product to be user-friendly. Alternatively, it could be based on a commercial product (assuming the product permitted accurate modeling of the given NGSO FSS system), and the codes for commercial products are not generally public. It would be counterproductive to the Commission's goals and unnecessarily burdensome to licensee if the Commission, by its rules, necessitated development by licensees of new non-proprietary, but less optimum, software. It would also thwart the purpose of the "operational" types of limits, by preventing licensees from using the most realistic simulations possible for their systems.

[91] In note 216 of the Report & Order, the Commission states that an applicant can request confidential treatment, but also notes that it intends to make some information public.

(continued...)

3. The Commission Should Address Compliance With The Aggregate Limits In The Context Of The Licensing Of, Or Sharing Among, NGSO FSS Systems.

SkyBridge agrees with the Commission's determination that issues related to compliance with the aggregate limits are best left to the upcoming NGSO/NGSO sharing proceeding, or to the licensing process itself, because these limits bound the interference from all of the operating systems, collectively. However, one statement by the Commission in the Report & Order requires clarification. The Commission states that each applicant must certify that it will meet the aggregate limits.[92] Such a certification would be impossible for any applicant to make. Compliance with the aggregate limits depends on the operation of all of the NGSO FSS systems that have commenced operation at any given frequency, some of which may not even be licensed for serving the U.S. The Commission should clarify or retract this misleading statement, with the understanding that compliance issues will be resolved in a later proceeding.

C. The Commission Should Adopt The WRC-2000 GSO Earth Station Off-Axis EIRP Limits, Which Were A Fundamental Component Of The Regulatory Regime Finalized At WRC-2000.

As the Commission well knows, the off-axis EIRP limits on GSO FSS earth stations adopted by WRC-2000 constituted a truly critical part of the compromise agreement.[93]

91/ (...continued)
Given the importance of confidentiality for certain of the data that the Commission requires, SkyBridge believes that it is critical to clarify *in the rules* that such data *will* be kept confidential.

92/ R&O, ¶ 107.

93/ See Article S22, Section VI, WRC-2000. WRC-2000, with strong U.S. support, accepted these limits, in combination with language specifying that NGSO FSS operators may not claim protection from GSO FSS systems operating in accordance with these limits (and other applicable Radio Regulations). These provisions together provide important regulatory certainty for both NGSO FSS and GSO FSS operators. As the Commission
(continued...)

Although the limits will not unduly burden GSO operations, they establish a clear bound on GSO emissions that NGSO operators can rely upon and use in designing their systems.[94] In the Report & Order, however, the Commission declined to adopt the WRC-2000 limits, arguing that its current rules impose stricter limitations on GSO operations, and that adopting the WRC-2000 limits "would, in effect, allow GSO FSS earth stations to transmit at a higher level . . . than is currently permitted under our rules. . . . "[95] For the following reasons, the Commission's explanation is very difficult to comprehend.

First, no combination of existing rules (including those cited by the Commission in the Report & Order [96]) comprehensively limits the off-axis EIRP of GSO earth stations in all cases. Section 25.209 prescribes earth station antenna *patterns*, but these do not themselves limit the off-axis EIRP that a GSO earth station may emit. Sections 25.211(d) and 25.212(c) each prescribe limits on maximum power into an antenna, but these apply only for (1) certain antenna sizes, (2) certain services, and (3) antennas for which routine licensing is being sought. Section

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[93] (...continued)
noted in the NPRM, at ¶ 76, limiting the signal energy radiated by GSO FSS earth stations places an upper bound on the level of uplink interference that NGSO FSS systems must tolerate.

[94] The WRC-2000 limits were designed to permit the continued use of existing earth stations, while ensuring the protection of NGSO FSS systems against significant changes in the interference environment that could conceivably be caused by future generations of GSO systems in the absence of any such restrictions. The limits are relaxed as compared to pre-existing ITU-R recommendations, and are subject to grandfather provisions. There is no reason to believe that GSO FSS earth station operators will find it difficult to meet these limit. Moreover, no substantial regulatory complications will be introduced by these limits. WRC-2000 decided against compliance-testing at the ITU level; instead operators will simply certify in their filings that their earth stations meet the applicable requirements.

[95] R&O, ¶ 237.

[96] R&O, ¶ 237, note 501.

25.208(b), also cited by the Commission, limits the PFD of GSO *satellite* emissions, and does not even govern earth station emissions. The Commission's provisions, therefore, are far from comprehensive, and it is entirely unclear how many earth stations are covered by limits comparable to the WRC-2000 limits.

Furthermore, the Commission's concern that adopting the WRC-2000 limits would "in effect" permit licensees to violate these rules is entirely misplaced. Addition of the new limits does not automatically render other Commission rules inapplicable. Moreover, rules can be drafted to specifically prevent any such interpretation. In Exhibit A, SkyBridge proposes text for a new rule that would introduce these limits, consistent with the WRC-2000 compromise.

D. Certain Changes Are Needed With Respect To The Commission's Rules For NGSO FSS Sharing With FS Systems.

1. The PFD Limits Must Be Treated As Hard Limits And Not As Coordination Triggers.

SkyBridge generally agrees with the Commission's rules regarding sharing between NGSO FSS and fixed point-to-point FS systems, and its proposal for further study of certain issues.[97] However, one statement in the Report & Order concerning these rules deviates from the international agreements reached to govern such sharing. In explaining how the PFD limits applicable to NGSO satellites for the protection of FS links will be implemented by the Commission, the Commission states:

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[97] As the Commission noted, many of these rules are based on an agreement reached between SkyBridge and the Fixed Wireless Communications Council. See Written *Ex Parte* Communications in ET Docket No. 98-206, jointly submitted by the FWCC and SkyBridge, December 8, 1999 and December 22, 1999.

> In frequency bands with co-primary services, new entrants in a band must coordinate their operations with incumbent operations in order to minimize the possibility of harmful interference between the sharing services. Therefore, new NGSO FSS applicants that operate in bands used by the FS must ensure that their operations will not result in harmful interference to incumbent operations. In most cases, the PFD limits we are adopting should ensure this result . . . [E]ach NGSO FSS licensee will have to determine whether incumbent FS operations with elevation angles more than 5 degrees above the horizon will be affected and will be responsible for avoiding interference to incumbents . . . . [98]

This explanation ignores a key characteristic of the PFD limits. As in the case of the PFD limits that have long applied for the protection of FS by GSO systems in all bands shared by these two services,[99] as well as the EPFD limits for the protection of GSO systems,[100] the PFD limits confirmed at WRC-2000 constitute essentially a "pre-coordination." They are hard limits, and not coordination triggers or thresholds. They were developed and adopted in view of the virtual impossibility of requiring new NGSO FSS systems to individually coordinate their satellite operations with each FS operator within the global NGSO FSS service area.[101] Therefore, while the local, terrestrial operations of NGSO FSS systems (i.e., the gateways) will be individually coordinated with neighboring FS links, there will be no coordination between the space segment of NGSO FSS systems and FS systems. The PFD limits are intended to fully

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[98] R&O, ¶ 42.

[99] 47 C.F.R. § 25.208(a)-(f).

[100] 47 C.F.R. § 25.208(g)-(m).

[101] Indeed, such an approach would require that a database be established and maintained containing all FS links, their path length, elevation and azimuth, their radio characteristics (margin, link availability, feeder losses, antenna gain, etc.) and their sensitivity. This database would also have to include the terrain profile around each FS link so that relevant calculations could be performed. Such an approach is not workable and is not justified by any real technical concerns, which, as discussed below, have already been studied and resolved within the ITU-R.

replace such coordination, and the Commission's statements in the Report & Order undermine this critical aspect of the PFD limits.[102]

The Commission's concern in this regard appears to center on whether the limits will adequately protect FS stations operating at high elevation angles. Within the ITU-R study groups, debate on this point stemmed from the fact that, using simplified analysis, interference levels appear to increase as the FS elevation angle increases. However, the ITU-R working groups called for and employed parameters of operating FS links (elevation, sensitivity, antenna gain, feeder losses, etc.). In the case of high elevation angle receivers, the fact that the transmitter will be located on top of a natural or artificial obstacles was taken into account, because in such cases, use of the free space loss propagation model for the satellite emission propagation in the direction of the FS receiver leads to a pessimistic and unrealistic result.[103] Such link-specific studies indicated that higher-elevation links would be protected by the PFD limits.

Perhaps the best evidence that the participants agreed that such systems would be protected is that agreement was reached on these limits -- which were studied by several groups of technical experts (WP 9A, JWP 4-9S, and JTG 4-9-11) -- more than one year before WRC-2000. Had any concerned parties any unresolved questions, there was ample time to continue studies and debate. Moreover, there have been no filings in this docket following the adoption of the limits by WRC-2000 requesting the Commission to re-open the debate about the appropriateness of the PFD limits to protect FS links in the U.S.

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[102] Moreover, there are no coordination procedures in the Commission's rules that would apply to such coordination, nor does the Commission adopt any in the Report & Order.

[103] In the ITU-R working groups, the final analysis that lead to the agreement on the S21 limits was based on the use of a free space loss propagation model on the satellite path.

SkyBridge therefore urges the Commission to clarify that an NGSO FSS system operating in compliance with the PFD limits shall be considered as having fulfilled its obligations to protect incumbent FS systems from downlink interference, and is not required take any further steps to protect individual links.

2. The Commission's Definition Of NGSO FSS "Gateway" Must Not Prohibit Connection To Private Networks.

While SkyBridge generally agrees with the Commission's proposed definition of NGSO FSS "gateway," one important change is required. The joint SkyBridge/FWCC proposal for regulation of gateways specified that gateways should not "connect directly to customer-owned or customer-operated private distribution networks." The Commission's definition simplifies this concept to prohibit gateways "from connecting directly with a private communications network." In some cases the result could be quite different. The SkyBridge/FWCC proposal was crafted to ensure that the definition of gateway could not be interpreted to cover large user terminals deployed by a customer to handle traffic to many users with a company intra-net, for example. However, legitimate gateways may connect to private networks, in addition to the public-switched telephone network, in order to provide important services to customers via satellite. Thus, "customer-owned or customer-operated" private communications networks more accurately describes the prohibited gateway connection, and should be retained in the Commission's rules.

E. The Commission Should Continue To Examine Ways To Come Into Compliance With International Agreements For NGSO FSS Sharing With Radiolocation In The 13.75-14.0 GHz Band.

SkyBridge notes that the Commission's rules regarding sharing in the 13.75-14.0 GHz between FSS and Radiolocation systems do not comport with the WRC-2000 agreements in

several significant respects.[104] It is unclear why the U.S. would agree to certain provisions at that WRC meeting, and then not follow through by following the international consensus in the domestic rules. As WRC-2000 formed a working group to continue study of certain issues related to this band, SkyBridge hopes that the Commission and NTIA will continue to examine carefully its rules for this band, and ultimately find a way to come into compliance with the international agreements.[105]

F. The Commission Should Continue To Study Methods For NGSO FSS Sharing With GSO BSS In The 17.3-17.8 GHz Band.

SkyBridge accepts the WRC-2000 agreement not to permit entry of NGSO FSS systems in the 17.3-17.8 GHz band at this juncture, and therefore the Commission's conforming decision in the Report & Order. However, as sharing studies in this band continue, SkyBridge urges the Commission to maintain an open mind regarding use of this band by NGSO FSS gateways in the future, particularly in view of the glaring inconsistencies between its long-held position against NGSO FSS use in this band to avoid any constraint on GSO BSS deployment, and its permitted use of the 12.2-12.7 GHz band by MVDDS systems, as explained in Section I.C.1 above.

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[104] Among the points of differentiation are (1) the Commission's failure to adopt the WRC-2000 extension of the 59 dBW average maximum EIRP limit on radiolocation radar to the entire space (rather than toward the GSO arc only), and (2) the Commission's extension of the bandwidth over which the Space Science TDRSS spacecraft receives protection from 6 MHz to 10 MHz. R&O, ¶¶ 143-146. In this latter case, the extension has never been raised and debated in any appropriate forum, and the technical basis for the decision is unclear.

[105] The mandate of this new working group does not focus on NGSO FSS sharing with Radiolocation/Radionavigation in particular. Rather the group will examine the constraints placed on all of the services sharing the subject bands, as defined in footnotes S5.502 and S5.503 as of the end of WRC-2000, with a view to relaxing some of these constraints, if possible.

G. NGSO FSS Coordination With Radio Astronomy Should Be Conducted In Accordance With Relevant ITU Standards And Procedures.

Since the ITU-R studies on protection of radio astronomy by NGSO FSS systems are not complete, SkyBridge can support the Commission's requirement, contained in footnote US355, to coordinate with specific Radio Astronomy facilities prior to commencing operations in the 10.7-11.7 GHz band, with one caveat, however: Such coordination must be conducted according to the relevant ITU standards and procedures. As SkyBridge has explained in earlier filings, much work has been performed in the ITU on this issue, taking into account the dynamic nature of NGSO FSS interference, as compared to GSO interference.[106] In Exhibit A, SkyBridge proposes a small change to US355 to ensure that the appropriate ITU protection levels and calculation methodologies are employed.

CONCLUSION

The Commission's decision to permit entry of MVDDS systems in the 12.2-12.7 GHz band is fatally defective, both procedurally and technically, and in no way furthers the goals of the SHVIA. For these reasons, the Commission should reverse this decision, pending the resolution of the technical issues through proper Commission process. Moreover, the

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[106] See, e.g., SkyBridge NPRM Comments at 101; Comments of SkyBridge on Results of WRC-2000, ET Docket No. 98-206, July 20, 2000, at 17. The protection requirements for radio astronomy are defined in Article S29, which points to Recommendations ITU-R SA.769 and SM329, the latter of which was revised by the Radiocommunication Assembly in May 2000. These methodologies define how the specified protection levels should be applied to emissions from GSO systems. However, work is ongoing on how to apply them to NGSO systems. The protection requirement in SA.769 is defined as an average integrated over 2000 seconds, and it would be appropriate to base the NGSO methodology on the same principle. This has been proposed to ITU-R WP 7B and TG 1/5, and it is expected that further elements will be developed in the coming study period to complete this analysis, and more particularly the procedures for interference assessment.

Commission's decision not to allocate the 13.15-13.2125 GHz band to NGSO FSS systems is not supported by the record, and, because sharing with incumbent services appears to be entirely feasible, the Commission should reconsider this decision. Finally, the Commission should amend its rules regarding NGSO FSS compliance with the WRC-2000 power limits to render them consistent with the purpose of those limits and with technical decisions taken at WRC-2000.

Respectfully submitted,

SKYBRIDGE L.L.C.

By: _____

Phillip L. Spector
Jeffrey H. Olson
Diane C. Gaylor

PAUL, WEISS, RIFKIND, WHARTON & GARRISON
1615 L Street, N.W., Suite 1300
Washington, D.C. 20036
Telephone: 202-223-7300
Facsimile: 202-223-7420

Its Attorneys

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EXHIBIT A

Proposed Changes to Commission Rules for NGSO FSS Systems

- *Amend US355 as follows:*

US355 In the band 10.7-11.7 GHz, non-geostationary satellite orbit licensees in the fixed-satellite service (space-to-Earth), prior to commencing operation, shall coordinate with the following radio astronomy observatories to achieve a mutually acceptable agreement regarding the protection of the radio telescope facilities operating in the band 10.6-11.7 GHz in accordance with the protection levels and calculation methodologies of Article S29 of the ITU Radio Regulations relevant to NGSO FSS/Radio Astronomy interference configurations:

* * * * *

- *Amend § 25.146 as follows:*

§25.146 Licensing and operating authorization provisions for the non-geostationary satellite orbit fixed-satellite service (NGSO FSS) in the bands 10.7 GHz to 14.5 GHz.

(a) A comprehensive technical showing shall be submitted for the proposed non-geostationary satellite orbit fixed-satellite service (NGSO FSS) system in the bands 10.7 GHz to 14.5 GHz. The technical information shall demonstrate that the proposed NGSO FSS system would not exceed the validation equivalent power flux-density (EPFD) limits as specified in § 25.208 (g), (k), and (l) for $EPFD_{down}$, and $EPFD_{up}$ (not including the operational limits specified in notes 2 and 3 to the table in § 25.208(l)). If the technical demonstration exceeds the validation EPFD limits at the test point determined by the validation software ~~any test points within the U.S. for domestic service and at any points outside of the U.S. for international service or at any points in the geostationary satellite orbit, as appropriate~~, the application would be unacceptable for filing and will be returned to the applicant with a brief statement identifying the non-compliance technical demonstration. The technical showing consists of the following:

(1) Single-entry validation equivalent power flux-density, in the space-to-Earth direction, ($EPFD_{down}$) limits:

(i) Provide a set of power flux-density (pfd) masks, on the surface of the Earth, for each space station in the NGSO FSS system. The pfd masks shall be generated in accordance with the specification stipulated in the ITU-R Recommendation BO.1503, "Functional Description to be used in Developing Software Tools for Determining Conformity of Non-GSO FSS networks with Limits Contained in Article S22 of the Radio Regulations." In particular, the pfd mask must encompass the power flux-density radiated by the space station regardless of the satellite transmitter power resource allocation and traffic/beam switching strategy that are used at different periods of a NGSO FSS system life. The pfd masks shall also be in an electronic form that can be accessed by the computer program contained in paragraph (a)(1)(iii) of this section.

(ii) Identify and describe in detail the assumptions and conditions used in generating the power flux-density masks.

(iii) If the applicant elects not to use a computer program that has been approved by the ITU for determining compliance with the single-entry $EPFD_{down}$ validation limits, or such approved program is not yet available, the applicant must ~~P~~provide a computer program for the single-entry $EPFD_{down}$ validation computation, including both the source code and the executable file. This computer program shall be developed in accordance with the specification stipulated in the ITU-R-Recommendation BO.1503.

(iv) Identify and describe in detail the necessary input parameters for the execution of the computer program identified in paragraph (a)(1)(iii) of this section.

(v) Provide the result, the cumulative probability distribution function of EPFD, of the execution of the computer program described in paragraph (a)(1)(iii) of this section by using only the input parameters contained in paragraphs (a)(1)(i) and (a)(1)(iv) of this section. ~~The result must contain the worst three (3) test points in the U.S. for domestic service and the worst three (3) test points on each continent, except Antarctica, outside of the U.S. for international services, and as many points as the number of service areas; i.e., foot-prints. The center of each beam service area should be the test point coordinate.~~

(2) Single-entry validation equivalent power flux-density, in the Earth-to-space direction, $EPFD_{up}$ limits:

(i) Provide a set of NGSO FSS earth station maximum equivalent isotopically radiated power (e.i.r.p.) mask as a function of the off-axis angle generated by a NGSO FSS earth station. The maximum e.i.r.p. mask shall be generated in accordance with the specification stipulated in the ITU-R Recommendation BO.1503. In particular, the results of calculations encompass what would be radiated regardless of the earth station transmitter power resource allocation and traffic/beam switching strategy are used at different periods of a NGSO FSS system life. The e.i.r.p. masks shall also be in an electronic form that can be assessed by the computer program contained in paragraph (a)(2)(iii) of this section.

(ii) Identify and describe in detail the assumptions and conditions used in generating the maximum earth station e.i.r.p. mask.

(iii) If the applicant elects not to use a computer program that has been approved by the ITU for determining compliance with the single-entry $EPFD_{down}$ validation limits, or such approved program is not yet available, the applicant must ~~P~~provide a computer program for the single-entry $EPFD_{up}$ validation computation, including both the source code and the executable file. This computer program shall be developed in accordance with the specification stipulated in ITU-R Recommendation BO.1503.

(iv) Identify and describe in detail the necessary input parameters for the execution of the computer program identified in paragraph (a)(2)(iii) of this section.

(v) Provide the result of the execution of the computer program described in paragraph (a)(2)(iii) of this section by using only the input parameters contained in paragraph (a)(2)(1) and (a)(2)(iv) of this section. ~~The result must contain an $EPFD_{up}$ for every longitudinal location on the geostationary satellite orbit at every two-degree spacing that is visible to the U.S. for domestic service and every three-degree longitudinal location in the geostationary satellite orbit for service outside of the U.S.~~

~~(b) Ninety days prior to the initiation of service to the public, the NGSO FSS system licensee shall submit a comprehensive technical showing for the non-geostationary satellite orbit fixed-satellite service (NGSO FSS) system in the bands 10.7 GHz to 14.5 GHz. The technical information shall demonstrate that the NGSO FSS system is expected not to operate in excess of the additional operational EPFD$_{down}$ limits and the operational EPFD$_{down}$ limits as specified in §25.208 (i), (j) and notes 2 and 3 to the table in paragraph (l). If the technical demonstration exceeds the additional operational EPFD$_{down}$ limits or the operational EPFD$_{down}$ limits at any test points with the U.S. for domestic service and at any test points out side of the U.S. for international service, the NGSO FSS system licensee shall not initiate service to the public until the deficiency has been rectified by reducing satellite transmission power or other adjustments. This must be substantiated by subsequent technical showings. The technical showings consist of the following:~~

~~(1) Single-entry additional operation equivalent power flux-density, in the space-to-Earth direction, (additional operational EPFD$_{down}$) limits:~~

~~(i) Provide a set of anticipated operational power flux-density (pfd) masks, on the surface of the Earth, for each space station in the NGSO FSS system. The anticipated operational power flux-density masks could be generated by using the method specified in ITU-R Recommendation BO. 1503. In particular, the anticipated operational pfd mask shall take into account the expected maximum traffic loading distributions and geographic specific scheduling of the actual measured space station antenna patterns (see §25.210(k)). The anticipated operational power flux-density masks shall also be in an electronic form that can be assessed by the computer program contained in paragraph (b)(1)(iii) of this section.~~

~~(ii) Identify and describe in detail the assumptions and conditions used in generating the anticipated operational power flux-density masks.~~

~~(iii) Provide a computer program for the single-entry additional operation EPFD$_{down}$ verification computation, including both the source code and the executable file. This computer program could be developed by using the method specified in ITU-R Recommendation BO.1503.~~

~~(iv) Identify and describe in detail the necessary input parameters for the execution of the additional operational EPFD$_{down}$ verification computer program identified in paragraph (b)(1)(iii) of this section.~~

~~(v) Provide the result, the cumulative probability distribution function of EPFD, of the execution of the verification computer program described in paragraph (b)(1)(iii) of this section by using only the input parameters contained in paragraphs (b)(1)(i) and (b)(1)(iv) of this section. The result must contains the worst three (3) test points in the U.S. for domestic service and the worst three (3) test points in each continent, excluding Antarctica, out side of the U.S. for international service plus as many points as the number of service areas, i.e., foot-prints. The center of each beam service area should be the test point coordinate.~~

~~(2) Operational equivalent power flux-density, space-to-Earth direction, (operational $EPFD_{down}$) limits:~~

~~Using the information contained in (b)(1) of this section plus the measured space station antenna patterns, provide the result of the execution of the computer simulation for the anticipated in-line operational $EPFD_{down}$ levels for the 3.0, 4.5, 6.2 and 10 m GSO FSS receiving earth station antennas having an efficiency of 65%. The result must contain the worst three (3) test points in the U.S. for domestic service and the worst three (3) test points per continent, exclude Antarctica, outside of the U.S. for international service plus as many points as the number of service areas; i.e., foot-prints. The center of each beam service area should be the test point coordinate. In addition, also using the information contained in (b)(1) of this section plus the measured space station antenna patterns, provide the result of the execution of the computer simulation for the anticipated in-line operational $EPFD_{down}$ levels for the 180 cm GSO BSS receiving earth station antennas in Hawaii, and for 240 cm GSO BSS receiving earth station antennas in Alaska, assuming an efficiency of 65%. The result must contain the worst test point in Alaska and Hawaii, plus as many points as the number of service areas; i.e., foot-prints, in these areas, using the center of each beam service area should be the test point coordinate.~~

(c) The NGSO FSS system licensee will, prior to commencement of operations, certify to the Commission that, when in service, the system will meet the limits specified in § 25.208(i) and (j) and notes 2 and 3 to the table in § 25.208(l). The NGSO FSS system licensee shall, on June 30 of each year, file a report with the International Bureau and the Commission's Columbia Operations Center in Columbia, Maryland, certifying that the system continues to operate within the bounds of the pfd and e.i.r.p. masks and other input parameters specified in § 25.146(a)(1) and (2), and describing the status of its compliance with the additional operational $EPFD_{down}$ limits specified in §25.208 (i) ~~levels into the 3 m and 10 m GSO FSS receiving earth station antennas~~, and the operational $EPFD_{down}$ limits specified in § 25.208(j) and notes 2 and 3 to the table in § 25.208(l) ~~levels into the 3 m, 4,5 m, 6.2 m, and 10 m GSO FSS receiving earth station antenna and the operational $EPFD_{down}$ levels into the 180 cm GSO BSS receiving earth station antennas in Hawaii and 240 GSO BSS receiving earth stations in Alaska~~ , including any claims made over the prior year regarding suspected violations any of these operational limits into an operational earth station, and how any such claim was resolved.

(d) In the event of a credible claim by a GSO earth station licensee that the NGSO FSS system licensee is violating the limits specified in § 25.208(i) and (j) and notes 2 and 3 to the table in § 25.208(l) into an operational earth station governed by those limits,~~T~~the Commission may request ~~at any time~~ additional information and technical showings from the NGSO FSS system ~~applicant or~~ licensee concerning the EPFD levels ~~and related technical showings~~ generated into that operational earth station. These technical showings may involve simulations of the system operation at the time of the violation, in the case of the additional operational limits, or may involve measurement of the EPFD levels at the subject earth station, in the case of the operational limits. If the additional information and technical showings indicate a violation of these limits into the earth station, the NGSO FSS licensee shall be required to reduce power or take other measures

to bring the emissions of its system into the earth station into compliance with those limits. Upon request by the licensee, any satellite/earth station resource allocation strategies according to traffic demands, any spacecraft antenna switching algorithms, and any source code or executable files submitted as a part of any technical showing under this paragraph will be afforded confidential treatment by the Commission under §§ 0.457-0.459.

- *Amend the definition of "gateway earth station" in § 25.201 as follows:*

§ 25.201 Definitions.

* * * * (2) is prohibited from connecting directly with a customer-owned or customer-operated private communication network; * * * *

- *Amend the table of § 25.202(a)(1) as follows:*

§ 25.202 Frequencies, frequency tolerance and emission limitations.

(a)(1) * * * * *

Space-to-Earth (GHz)	Earth-to-space (GHz)
* * * * *	* * * * * ~~12.75-13.15[1,12]~~ ~~13.2125-13.25[1,12]~~ 12.75-13.25[1,12] * * * * *

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- *Amend § 25.204 by adding a new paragraph (g) as follows:*

§ 25.204(g) Power limits.

* * * * *

(g) The level of equivalent isotropically radiate power (e.i.r.p.) emitted by an earth station of a geostationary-satellite network in the frequency bands 12.75-13.25 GHz and 13.75-14.5 GHz shall not exceed the following values for any off-axis angle, θ, which is 3 degrees or more off the main-lobe axis of an earth station antenna:

Off-axis angle	Maximum e.i.r.p. density (dBW/40kHz)
$3° \leq \theta \leq 7°$	$42-25 \log \theta$
$7° < \theta \leq 9.2°$	21
$9.2° < \theta \leq 48°$	$42-25 \log \theta$
$48° < \theta \leq 180°$	3

For FM-TV emissions with energy dispersal, the above limits may be exceeded by up to 3 dB, provided that the off-axis total e.i.r.p. of the transmitted FM-TV carrier does not exceed the following values:

Off-axis angle	Maximum e.i.r.p. (dBW)
$3° \leq \theta \leq 7°$	$56-25 \log \theta$
$7° < \theta \leq 9.2°$	35
$9.2° < \theta \leq 48°$	$59-25 \log \theta$
$48° < \theta \leq 180°$	17

FM-TV carriers which operate without energy dispersal should be modulated at all time with program material or appropriate test patterns. In this case, the off-axis total e.i.r.p. of the emitted FM-TV carrier shall not exceed the following values:

Off-axis angle	Maximum e.i.r.p. (dBW)
$3° \leq \theta \leq 7°$	$56-25 \log \theta$
$7° < \theta \leq 9.2°$	35
$9.2° < \theta \leq 48°$	$59-25 \log \theta$
$48° < \theta \leq 180°$	17

These limits apply under clear-sky conditions. During rain-fade conditions, the limits may be exceeded by earth stations when using uplink power control.

These limits do not apply to earth stations in service or ready to be in service (i.e., installed, but service has been delayed due to force majeure) prior to 2 June 2000, nor to earth stations associated with a satellite network in the fixed-satellite service for which complete coordination or notification information has been received before 2 June 2000.

Telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service in normal mode of operation (i.e., earth station transmitting telecommand and ranging carriers to a directional receiving antenna on the space station) may exceed the above levels by no more than 16 dB in the frequency bands 12.75-13.25 GHz and 13.75-14.5 GHz. In all other modes of operation, and in the case of *force majeure*, telecommand and ranging carriers transmitted to geostationary satellites in the fixed-satellite service are exempted from the above levels.

The provisions of this section shall not be used for coordination or, or to evaluate interference between, GSO FSS networks.

Although the provisions of this section cover off-axis power limitations in all directions, the radiation pattern of GSO FSS earth station antennas in more than two orthogonal planes is not required.

These off-axis e.i.r.p. limits do not affect in any way each GSO FSS earth station licensee's obligation to meet all other applicable limits related to earth station emissions, including sections 25.208(b), 25.209, 25.211(d), and 25.212(c), even where such other limits necessitate using off-axis e.i.r.p. levels lower than those specified in this section.

- *Amend § 25.208(h) (aggregate $EPFD_{down}$ limits for the protection of GSO FSS systems) by adding footnotes 3 and 4 to the table as follows:*

§ 25.208 Power flux density limits.

* * * * *

(h)

* * * * *

[3] The values for the 3 m and 10 m antennas are applicable only for the methodology referred to in invites ITU-R 1 of Resolution 76, WRC-2000.

[4] For each reference antenna diameter, the limit consists of the complete curve on a plot which is linear in decibels for the $EPFD_{down}$ levels and logarithmic for the time percentages, with straight lines joining the data points.

* * * * *

- *Amend § 25.208(i) (additional operational $EPFD_{down}$ limits for the protection of GSO FSS systems) as follows:*

§ 25.208 Power flux density limits.

* * * * *

(i)

* * * * * at any operational GSO FSS 3 m or 10 m earth station antenna located at any point on the Earth's surface * * * * *

* * * * * These limits relate to the equivalent power flux density~~, which is obtained under free-space propagation conditions,~~ for all conditions and for all methods of modulation.

- *Amend § 25.208(j) (operational $EPFD_{down}$ limits for the protection of GSO FSS systems) as follows:*

§ 25.208 Power flux density limits.

* * * * *

(j)

* * * * * at any <u>operational GSO FSS earth station antenna having a diameter greater than 3 meters located at any</u> point on the Earth's surface * * * * *

* * * * * These limits relate to the operational equivalent power flux density ~~which would be obtained under free-space propagation conditions,~~ for all conditions, for all methods of modulation and for the specified GSO FSS operations.

- *Amend footnote 1 of § 25.208(k) ($EPFD_{up}$ limits for the protection of GSO FSS systems) as follows:*

§ 25.208 Power flux density limits.

* * * * *

(k)

* * * * *

[1] * * * * in the equations in ~~the~~ Annex <u>1</u> of Recommendation ITU-R S.672-4 for single-feed circular beams. In all cases of I_s, the parabolic main beam equation ~~should~~ <u>shall</u> start at zero.

* * * * *

- *Amend the footnotes of § 25.208(l) ($EPFD_{down}$ limits for the protection of GSO BSS systems) as follows:*

§ 25.208 Power flux density limits

* * * * *

(l)

* * * * *

[2] For 240 cm GSO BSS earth station antennas located in ~~Alaska~~ Region 2 west of 140° W, north of 60° N , * * * * * . This limit applies only until [, 2016].

* * * * *

[5] For each reference antenna diameter , the limit consists of the complete curve on a plot which is linear in decibels for the EPFD levels and logarithmic for the time percentages, with straight lines joining the data points.

* * * * *

- *Amend the footnotes of § 25.208(m) (aggregate $EPFD_{down}$ limits for the protection of GSO BSS systems) as follows:*

* * * * *

§ 25.208 Power flux density limits.

* * * * *

[2] For 240 cm GSO BSS earth station antennas located in ~~Alaska~~ Region 2 west of 140° W, north of 60° N , * * * * * . This limit applies only until [, 2016].

* * * * *

[5] For each reference antenna diameter , the limit consists of the complete curve on a plot which is linear in decibels for the EPFD levels and logarithmic for the time percentages, with straight lines joining the data points.

* * * * *

- *Amend § 25.271 as follows:*

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(e) The licensee of an NGSO FSS system operating in the 10.7-14.5 GHz bands shall maintain an electronic web site bulletin board to list the satellite ephemeris data, for each satellite in the constellation, using the North American Aerospace Defense Command (NORAD) two-line orbital element format. The orbital elements shall be updated at least once every ~~three~~ ten days. In addition, the NGSO FSS licensee shall provide assistance to GSO operators to obtain the most current ephemeris data for the NGSO FSS constellation, if necessary to identify a source of interference.