

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
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)	
Allocations and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands)	WT Docket No. 02-146
)	
)	
Loea Communications Corporation Petition for Rulemaking)	RM-10288
)	

REPLY COMMENTS OF CISCO SYSTEMS, INC.

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SUMMARY

In these Reply Comments, Cisco replies to the various comments filed in this proceeding regarding allocations and service rules in the 71-76 GHz and 81-86 GHz bands. The comments show an extremely high degree of consensus about the most important questions raised in the Commission's NPRM, and that consensus has subsequently expanded thanks to discussions among the terrestrial wireless commenters. Cisco's reply comments will necessarily draw attention to the differences that exist among the commenters, but these further elaborations should not be allowed to obscure the fact that on a wide range of important questions the commenters have spoken as if with one voice.

In these individual Reply Comments, Cisco makes the following major points:

- The Commission should defer any decision about adding a Mobile allocation to the 70/80 GHz bands;
- The Commission should not adopt the satellite/terrestrial sharing regulations offered by either Boeing or the WCA, as Boeing's proposal would effectively kill any near-term commercial development of the band and the WCA's approach would seriously and prematurely constrain terrestrial operations without any real evidence that such a highly regulatory approach is necessary.
- The Commission should adopt some form of path-based yet streamlined licensing under Part 101, such as the blanket licensing proposal advanced by Cisco. The comments contained a number of similar proposals of this type. The comments showed widespread agreement that (1) any form of

path-based licensing is superior to the geographic alternative; and (2) some sort of streamlining (either by rule, or by relying on path coordinators, or both) is essential.

- Government and Non-Government assignments must be brought within the same coordination process in one way or another. Cisco advocates the use of one or more “Trusted Path Coordinators” with the security clearances necessary to hold any frequency assignments that are classified.
- In Cisco’s view, the record does not yet support enlargement of the RAS coordination zones. However, Cisco is encouraged by the National Academy’s agreement that commercial licensees should be able to coordinate with all RAS observatories by visiting a single web site, which will be programmed to make a realistic interference assessment in light of azimuth, terrain, and other factors that are currently ignored by the very large coordination zones. Cisco endorses the FWCC proposal that such a web site be run by one or more commercial frequency coordinators.
- The Commission should adopt technical service rules that ensure the high spatial efficiency that is necessary for the promise of these frequencies to be realized. In most cases, the Commission can do this by adopting a position that has achieved widespread industry consensus, including the following:
 - Pairing the 71-76 GHz and 81-86 GHz bands for dual-band frequency division duplexing;
 - Requiring adaptive transmitter power control with the necessary dynamic range;

- Adopting consensus specifications for total radiated power and antenna directionality;
- Applying the existing out-of-band emission limits; and
- Requiring digital modulation in areas where coordination with the radio astronomy service is required.

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REPLY COMMENTS OF CISCO SYSTEMS, INC.

Cisco Systems, Inc. hereby replies to the various comments filed in this proceeding regarding allocations and service rules in large portions of the 71-95 GHz band. Those comments show an extremely high degree of consensus about the most important questions raised in the Commission's NPRM,¹ including the services for which the spectrum should be allocated, the need for licensing under Part 101, the importance of streamlining the coordination process (especially with government users), and the tremendous public benefits that will flow from putting these bands to use promptly. Even with respect to detailed coordination procedures and technical service rules, the comments generally evidence a unity of purpose even where concrete proposals differ, resembling a cooperative brainstorming session far more than a clash of conflicting interests. Cisco's reply comments, and doubtless those of the other parties, will necessarily draw attention to the differences that exist among the commenters, but these

¹ *Notice of Proposed Rulemaking*, FCC 02-180 (June 28, 2002).

further elaborations should not be allowed to obscure the fact that on a wide range of important questions the commenters have spoken as if with one voice.

The consensus among the parties now is even more expansive than it was when the initial comments were filed, thanks to the efforts of the Wireless Communications Association (“WCA”) and its members. Cisco and other parties worked cooperatively throughout January 2003 in order to evaluate each other’s technical proposals and synthesize them into a package of rule proposals that would enjoy unanimous or nearly unanimous support from the terrestrial microwave manufacturers and users who have commented in this proceeding. The results of those discussions are summarized in Joint Reply comments being filed this day. Cisco supports the vast majority of the positions in the Joint Reply, but submits these individual Reply Comments in order to elaborate on the issues that are most important to Cisco, including a few areas of disagreement and a number of issues that are not addressed in the Joint Reply.

In these individual Reply Comments, which apply only to the 71-76 GHz and 81-86 GHz bands, Cisco first cautions the Commission against premature measures that could limit near-term deployment of commercial systems. In this regard, Cisco urges the Commission to defer any decision about adding a Mobile allocation to the 70/80 GHz bands, and to reject any over-regulatory “solution” to satellite/terrestrial sharing until there is a problem to be solved. In Part II, Cisco highlights the extraordinary consensus in the record in support of streamlined licensing under Part 101 in conjunction with a path-based coordination process that is both speedy and comprehensive enough to encompass most, if not all, Government spectrum assignments. In Part III, Cisco comments on the most important of the technical issues addressed in the comments.

I. THE COMMISSION MUST AVOID PREMATURE OR OVER-REGULATORY MEASURES THAT WOULD LIMIT NEAR-TERM DEPLOYMENT OF COMMERCIAL SYSTEMS.

A strong theme running throughout the comments is that the Commission should make its rules as flexible as possible and rely on users to work out whatever sharing issues are presented through the coordination process. This general principle explains, for example, why nearly every commenter agreed that the 71-76 GHz and 81-86 GHz bands should be made available without channelization. Cisco enthusiastically endorses this general principle. There are, however, exceptions both to the general principle and to the degree of consensus about it, and in this section Cisco responds to other commenters' suggestions regarding mobile and fixed-satellite use of the 70/80 GHz bands.

A. Mobile Use of the 71-76 GHz and 81-86 GHz Bands

First, Cisco agrees with Harris Corporation and the Fixed Wireless Communications Coalition that mobile use of the 71-76 GHz and 81-86 GHz bands is incompatible with co-frequency use by the fixed service. No commenter has come forward to suggest otherwise, nor has any commenter expressed any interest in mobile use of the band. By contrast, the record shows great enthusiasm for terrestrial fixed service in these bands, and even some interest from one satellite manufacturer. Under these circumstances, Cisco finds great merit in Harris's suggestion that any decision on mobile use of these bands be deferred until someone proposes it.

The FWCC is also correct to call attention to the distinction between a mobile *allocation* and the adoption of service rules for mobile licensing and operations. In that sense, the mere addition of a mobile allocation to the Table of Allocations would not, by itself, complicate frequency usage in the 70/80 GHz bands. However, mobile service is

so patently incompatible with every other service proposed for these bands, that even the allocation decision ought to be postponed until there is a concrete proposal for mobile service upon which the Commission can base some predictions about interference.

B. Satellite/Terrestrial Sharing Issues

The comments also evidence some anxiety about the extent to which fixed and fixed-satellite systems will be able to co-exist in these bands. However, as Cisco noted in its earlier comments, it is impossible to draw any firm conclusions at this time about sharing scenarios involving commercial satellite operations in the 70/80 GHz bands because there is simply no reliable link budget information. There is no reason to think that the sharing difficulties will be as great as they would be with mobile, and there is at least a history of FS-FSS sharing in the past (checkered though it may be); on that basis Cisco has supported making FSS and BSS allocations at this time. However, Cisco must take issue with two more specific proposals – by Boeing on the one hand and the Wireless Communications Association on the other – to regulate satellite-terrestrial sharing years before it presents any real-life, practical need for regulation.

Boeing proposes a new footnote USwww to the table of allocations that would protect both government and commercial satellite operations (including FSS, BSS, and even MSS) from any interference from terrestrial services. Boeing's version of USwww would make terrestrial services effectively secondary to satellite services across the entire band, giving satellite users the ability to evict even earlier-licensed terrestrial users. If such a footnote were adopted, it is difficult to see why any enterprise would spend good money to put up a terrestrial radio link that could be shut down indiscriminately by a satellite operator without any recourse. Certainly no commercial carrier could attract

investment with a hole this large in its business plan. And with no foreseeable demand from either carriers or enterprises, equipment manufacturers would have no incentive to develop radio equipment in these frequencies. Fixed deployment in both the 71-76 GHz band and the paired 81-86 GHz band would be effectively stillborn. And for what public benefit would this sacrifice be made? Boeing concedes that satellite services in these bands “may not be implemented on a commercial scale for some time.”² Boeing acknowledges that its footnote would make satellite operations superior in right even to “earlier deployment of fixed stations,”³ yet Boeing offers no defense of what amounts to a request for its own private eviction rights. Fortunately for the general public, the Commission has seen and articulated the great potential for terrestrial fixed use of the 71-76 GHz band. If that potential is ever to be realized, the Boeing proposal for footnote USwww must be soundly rejected.⁴

Unlike Boeing, the WCA appears to be motivated by a desire to find some equitable basis for accommodating both fixed and fixed-satellite use of the 70/80 GHz bands. The WCA thus endorses power flux-density limits for satellite operations in these bands, and the WCA’s proposed pfd mask would follow the traditional pattern of

² Boeing Comments at 4.

³ Boeing Comments at 5.

⁴ It is interesting to contrast Boeing’s USwww proposal with Boeing’s simultaneous argument against satellite power flux-density limits, a proposal that was supported by Cisco and others. Boeing opposes any regulation whatsoever of satellite power flux-density, on the ground that “[t]he FCC *should permit* satellite and fixed interests to perform studies . . . in order to determine *whether* PFD limits should be developed . . .” Boeing Comments at 4 (emphasis added). No one needs the FCC’s permission to perform a sharing study; the primary obstacle to sharing studies in the 70/80 GHz band appears to be that there are no satellite proposals to study, and according to Boeing there may not be “for some time.” *Id.* Under these circumstances, an interim PFD limit seems to Cisco to be prudent and would provide certainty for both satellite and terrestrial users, but that point is perhaps not worth insisting on. What *is* worth insisting on is that if USwww gives commercial satellite operations regulatory priority over terrestrial networks, making the latter effectively secondary, there will *never* be any substantial deployment of terrestrial services in these bands, and there will be no commercial service of *any* kind until satellite services begin to occupy the band, which may take a decade or more if indeed it ever occurs.

providing relatively more flexibility for terrestrial services at lower elevation angles and relatively more flexibility for satellite services at higher elevation angles. However, the WCA's proposal goes beyond traditional pfd masks with a hard limit on terrestrial elevation angles – a limit of only 25 degrees from the horizon. Although it is conceivable that such a hard limit on elevation angles might one day prove necessary, there is no reason at this time to believe that a traditional pfd approach would be unsuccessful. Moreover, because the links in the 70/80 GHz band will typically be very short – perhaps even just across the street – it only takes a small difference in building heights for a link from rooftop to rooftop to exceed 25 degrees in elevation angle. When one factors in the possibility for “window shots” by enterprises that cannot obtain roof rights, it becomes even more likely that there will be a significant number of enterprises who will require links with elevation angles in excess of the WCA's proposed hard limit.

Cisco therefore adheres to its stated view that it would be premature and unwise for the Commission to adopt any rigorously prescriptive sharing regime at this time. Interim pfd limits will give both satellite operators and terrestrial equipment manufacturers much-needed certainty about the interference environment in which they must be prepared to operate. Basing those interim limits on the V-band limits makes sense, since all available evidence suggests that the V band still remains somewhere comfortably beyond the commercial satellite industry's cutting edge. As Cisco noted in its original comments, “[I]t would be unwise to impose the certain and immediate constraints that result from detailed sharing rules in exchange for speculative and in any

event distant benefits that might someday result” if and when satellite services are introduced in these bands.⁵

II. THERE IS OVERWHELMING SUPPORT FOR STREAMLINED LICENSING UNDER PART 101, TOGETHER WITH AN EFFICIENT AND COMPREHENSIVE COORDINATION PROCESS.

The NPRM offered up a number of different procedural possibilities for getting 70/80 GHz radios authorized: unlicensed use, site-by-site licensing under Part 101, geographic licensing to carriers, and geographic licensing to band managers. The record on which the NPRM was based – compiled after the filing of a petition for rulemaking by Loea – had been strongly in favor of site-by-site licensing, but the NPRM raised several points that made pure site-by-site licensing somewhat less attractive to the Commission than it had seemed to the parties who commented on Loea’s petition.

In response to the NPRM, the comments unanimously rejected unlicensed use in the 70/80 GHz bands, and unanimously rejected geographic licensing either to carriers or to band managers. However, the comments did not entirely support site-by-site licensing either. Instead, Cisco and many other commenters proposed hybrid licensing regimes that fully address the concerns expressed in the NPRM regarding site-by-site licensing. These various proposals form an encouraging foundation for an industry-consensus plan, and Cisco is currently working with other interested parties to develop such a plan. But even now, the outlines of such a consensus licensing regime are readily apparent from the comments. In a nutshell, the public interest requires that the Commission adopt some form of streamlined licensing, together with a “bigger and better” coordination regime

⁵ Cisco Comments at 17.

that brings Government users into the process and automates as much of the process as possible.

A. Streamlined Licensing

The NPRM drew attention to a number of administrative concerns about site-by-site licensing, including the volume of individual applications that might be filed (and the resulting drain on the Commission’s resources), the cost to the applicants in filing fees, and the lost flexibility that goes along with needing FCC approval of station modifications. The commenters proposed a number of ways to address these concerns. Cisco proposed a blanket licensing regime, under which the Commission would be required to license only the first link deployed by any given licensee; deployment of subsequent links would be handled solely by path coordinators, who would merely *notify* the Commission of new links and modifications to existing links after successfully coordinating them. Loea proposed a blanket licensing regime that is substantially the same as that proposed by Cisco.⁶ The WCA also endorsed this concept,⁷ even though the WCA evidently prefers to have all applications go through the Commission’s Universal Licensing System (“ULS”).⁸ The FWCC proposes “frequency-coordinated licensing by rule,” which seems to be broadly similar to Cisco’s proposal.⁹ Comsearch observes that electronic “batching” of ULS applications by private path coordinators significantly

⁶ Loea Comments at 19-22.

⁷ WCA Comments at 15.

⁸ WCA Comments at 14; see also Terabeam Comments at 11.

⁹ FWCC Comments at 11.

reduces the administrative burden on the Commission even if every link is individually licensed.¹⁰

Reply comments often highlight conflicting proposals and argue strenuously for one over the others. However, in this case such an exercise would run the risk of obscuring three points about the proposals that should instead be highlighted: (1) the *unanimous* view of the commenters that any form of path-based licensing is superior to the geographic alternative; (2) the remarkable consensus in favor of some sort of streamlining (either by rule, or by relying on path coordinators, or both); and (3) the essential compatibility of the various ideas that have been advanced. Cisco is already working with the other commenters who have expressed views on this point, in the hope of crafting a single proposal that can be supported by the entire terrestrial broadband wireless industry. In the meantime, however, the Commission should recognize that the loud and clear message from the comments filed so far is that the public interest will be best served by streamlined, path-based licensing under Part 101.

B. Fast, Comprehensive Government/Non-Government Coordination

Streamlining the licensing process – *i.e.*, the paper trail – is only half the battle in a path-based licensing regime. Another very significant source of delay is the fact that third party path coordinators have historically been unable to provide coordination services vis-à-vis Government users. Instead, that part of the coordination is effected with the Frequency Assignment Subcommittee (“FAS”) of the Interdepartmental Radio Advisory Council (“IRAC”). As Comsearch convincingly demonstrates,¹¹ the procedure for IRAC coordination virtually *precludes* successful coordination in anything less than

¹⁰ Comsearch Comments at 4-5.

¹¹ Comsearch Comments at 12-16.

50 or 60 days, and the lack of transparency throughout the process makes it all too easy for applications to simply disappear for months on end. The delay by itself is costly enough, but it is the *indefinite length* of the delay that imposes the highest cost because it makes it absolutely impossible for a prospective user of the band to control his or her “worst-case” risk. The prospective user’s rational response could be to choose a different technology. Thus, because the 70/80 GHz bands are shared between Government and Non-Government users, this problem must be corrected in order to spur commercial development of these vacant frequencies.

Again, the commenters are largely in accord on the nature and severity of the problem, and they suggest some promising solutions. Cisco, Loea, Comsearch, and the WCA all suggest that Government and Non-Government assignments must be brought within the same coordination process in one way or another. Cisco advocates the use of one or more “Trusted Path Coordinators,” similar to existing path coordinators but with the security clearances necessary to hold any frequency assignments that are classified.¹² Comsearch has commented favorably on this possibility,¹³ and Loea and the WCA have made similar proposals (though less explicit on the matter of clearance).¹⁴ The Commission’s own proposal (at least in the context of the radio astronomy service) was for the Government users themselves to operate websites that would provide virtually instantaneous coordination. Cisco, Comsearch, and the WCA responded favorably to this type of arrangement as well.¹⁵ Cisco, Comsearch, and the WCA also noted that

¹² Cisco Comments at 15.

¹³ Comsearch Comments at 16-17.

¹⁴ Loea Comments at 15; WCA Comments at 10 n.23.

¹⁵ Cisco Comments at 15-16; Comsearch Comments at 16; WCA Comments at 10.

unclassified Government assignments should be shared with *all* path coordinators, so that at least that much of the Government/Non-Government coordination backlog could be eliminated.

Protection of radio astronomy operations deserves special mention, not only because of the Commission's specific proposal on RAS protection, but also because of the claim by the National Academy of Sciences that the coordination zones proposed by the Commission do not provide adequate protection and must be enlarged.¹⁶ In Cisco's view, the record does not yet support such a claim for enlargement of the RAS coordination zones. The National Academy's failure to put a technical justification for the requested enlargement in the record is unfortunate not only because it leaves commercial interests in the dark about actual requirements, but also because it represents a missed opportunity to promote greater awareness of RAS protection requirements. At the same time, however, Cisco is encouraged by the National Academy's agreement that commercial licensees should be able to coordinate with all RAS observatories by visiting a single web site, which will be programmed to make a realistic interference assessment in light of azimuth, terrain, and other factors that are currently ignored by the very large coordination zones. The RAS community shows little interest in developing or hosting the web site, but the FWCC proposes that such a web site could be run by one or more commercial frequency coordinators, and Cisco endorses the FWCC's proposal on that point.

The WCA endorses the Commission's suggestion that perhaps the 100 most populous cities should be excluded from the RAS coordination requirement imposed by

¹⁶ National Academy of Sciences Comments at 7.

proposed footnote USzzz.¹⁷ The National Academy of Sciences states that this proposal is acceptable provided that the 18 sites in USzzz are grandfathered. Cisco notes that the only way for the 100-city exclusion to have any effect at all is for it to apply to the enumerated 18 sites; outside those 18 sites USzzz would not provide any RAS protection regardless of whether a large city were nearby. Under the circumstances, Cisco continues to adhere to its view that the 18-site list is sufficient without any hundred-city exclusion, provided that the coordination diameters in USzzz are reduced or at least not expanded – a position that differs from WCA on the one hand and from the National Academy of Sciences on the other. Cisco is willing to work with the WCA, the National Academy of Sciences, and other interested parties to reach some further agreement on this issue.

Cisco is pleased to note the recent Memorandum of Understanding between the FCC and NTIA regarding spectrum coordination.¹⁸ The proposal for fast and unified coordination of all Government and Non-Government frequency assignments should be near the top of the agenda for the very first of the meetings contemplated by the MoU. The prospect of having all assignments cleared by a “Trusted Path Coordinator” within just a few business days would clearly benefit both Government and Non-Government users, and the relatively fallow 70/80 GHz bands present the Commission and NTIA with the ideal opportunity to implement this approach.

III. TERRESTRIAL COMMENTERS STRONGLY SUPPORT THE USE OF TECHNICAL SERVICE RULES TO REDUCE INTERFERENCE

The NPRM called attention to the incredible potential for intensive spatial re-use of the 70/80 GHz frequencies, and this view was echoed by Cisco and virtually every

¹⁷ WCA Comments at 10.

¹⁸ “FCC and NTIA Sign New Memorandum of Understanding on Spectrum Coordination,” FCC News Release (Jan. 31, 2003).

other commenter. However, a number of commenters including Cisco also pointed out that for this vision of high frequency re-use to become a reality, the Commission would have to adopt technical service rules developed specifically with that end in mind. Because the commenters followed different paths toward this common goal, their original proposals differed significantly. However, after further consultation among the commenters, it appears that the Commission will be able to adopt many rules that are unanimously supported by the terrestrial fixed wireless commenters, plus some others that enjoy overwhelming (though not unanimous) support. The extent of the consensus is reported in Joint Reply comments being filed this day by the interested parties, but Cisco comments below on the most important technical issues.

A. Pairing and Channelization

Cisco and every other commenter supported the Commission’s proposal not to segment or channelize the 71-76 GHz and 81-86 GHz bands. Cisco, however, proposed to pair these two bands and require dual-band frequency division duplexing (“FDD”) – or to put it another way, to prohibit the use of either band for transmission in more than one direction. Pairing the bands will permit higher deployment densities in “hub and spoke” networks, and will allow some relaxation of other technical constraints without any adverse consequences for frequency re-use.

If time-division duplexing or single-band FDD is permitted, the separation distances between stations will be so large as to preclude, in many cases, the deployment of as few as three radios by different licensees on the same rooftop. As a consequence, usage of the 70/80 GHz bands would for all practical purposes be restricted to carriers with the resources to contract for total control over a rooftop, rather than the enterprises

who Cisco believes will be major users of this technology. In addition, a dual-band FDD requirement will facilitate smooth planning and implementation of upgrades to higher capacities. Fiber-like throughputs will eventually require the use of both bands in a dual-band FDD configuration; since the potential for that kind of capacity is one of the major public interest benefits the Commission is trying to promote here, it makes sense for the Commission to adopt rules *now* that will prevent the spectrum from becoming cluttered with incompatible frequency plans that would only have to be phased out later.

No other commenter originally proposed to require dual-band FDD in the 70/80 GHz bands. However, as a result of recent conversations under the auspices of the WCA, it now appears that a clear majority of terrestrial microwave interests will support this requirement.

B. Adaptive Transmitter Power Control (“ATPC”)

The discussions among the terrestrial commenters also produced a very important agreement to require ATPC in all 70/80 GHz radios. Specifically, Cisco and the other commenters now agree that transmitters in the 71-76 GHz and 81-86 GHz bands with EIRP in excess of +23 dBW must possess the capability for ATPC over a dynamic range in dB of at least EIRP-23, with EIRP expressed in dBW. This requirement is less stringent than Cisco originally advocated, but it will nonetheless be sufficient to make a very significant positive contribution toward managing interference in the 70/80 GHz bands, and it will make the early production of radios in these bands somewhat more economical.

There remains some disagreement about the means by which the actual use of ATPC should be regulated. Cisco continues to believe that ATPC should be adjusted so

as to be no greater than 10 dB above the user's own required C/N threshold at the receiver, unless the transmitter has already reduced its output power to its specified minimum. Other interested parties would rather tie the reduction to a specific power flux-density, but Cisco believes that choosing a specific PFD level forces an unattractive choice between a high PFD level that makes ATPC less effective, or a low PFD level that may limit modulation techniques that could increase spectral efficiency (capacity) – techniques that might otherwise be used a mere six or eight years from now. Cisco expects that this portion of the ATPC issue will continue to be discussed by the interested parties, in the hope of expanding the emerging consensus.

C. Interference Protection Criteria

The NPRM discussed in some detail the “DEMS” interference protection criteria of section 101.105, and sought comment on the suitability of applying that section to terrestrial operations in the 70/80 GHz band.¹⁹ The WCA, supported by Loea, commented that this application of the “DEMS” criteria in section 101.105 would be inappropriate for path-by-path coordination in the 70/80 GHz bands.²⁰ Cisco understood the question in the NPRM to be somewhat broader, and therefore commented that section 101.105 could be applied to the 70/80 GHz band as long as TIA's Telecommunications Systems Bulletin TSB 10 were updated for application in these frequencies.²¹ There is less controversy here than meets the eye. All parties appear to agree that 70/80 GHz coordinations should be governed by protection criteria that are appropriate for these particular bands and the uses that are made of them. No commenter proposes specific

¹⁹ NPRM ¶ 98.

²⁰ WCA Comments at 26; Loea Comments at 33-34.

²¹ Cisco Comments at 28.

changes to section 101.105 to accommodate these bands. It is therefore incumbent upon the terrestrial microwave community to ensure that the governing TSB 10 criteria are updated as necessary.

D. Total Radiated Power and Antenna Directionality

The comments provided an opportunity for further development of the power and antenna parameters originally proposed by Loea and included by the Commission in the NPRM, and many commenters (including Loea) urged the Commission to move away from such a heavy emphasis on high antenna gain and narrow half-power beamwidths. Consequently, there were a number of proposals to give system designers the flexibility to trade gain for power, to narrow the half-power beamwidth, and to provide a more complete specification of the overall radiation pattern envelope to which each antenna would be expected to conform.

In the weeks since the comments were filed, Cisco has met with the other terrestrial commenters and can now support the following compromise proposals regarding power and antenna directionality.

- First, there is now a consensus in favor of several hard limits proposed by one or more terrestrial commenters: minimum antenna gain of 43 dBi, maximum half-power beamwidth of 1.2 degrees, and maximum EIRP of +55 dBW.
- Second, the maximum transmitter power spectral density should be limited to 150 mW/100 MHz, rather than the 65 mW/100 MHz proposed in Cisco's original comments. This relaxation should facilitate practical

hardware implementations such as reasonable and more economical amplifier gain variation across the band.

- Third, there is now widespread agreement that there should be a 2:1 “power penalty” for each dB reduction in gain – which is roughly in the middle of the various proposals that were made in the first round of comments on this point. Specifically, antenna gains less than 50 dBi (but greater than 43 dBi) are permitted with a proportional reduction in maximum EIRP (in dBW) of 2 dB of power per 1 dB of gain.

In addition to these areas in which consensus has already been achieved, the parties have made great progress in related areas, though some points of disagreement remain. For example, at the last WCA-sponsored meeting held before these Reply Comments were required to be filed, the conferring parties agreed that the Commission should adopt cross-polar discrimination standards, and further agreed on what the co-polar and cross-polar discrimination standards should be, at least for so-called “Category A” antenna sites.²² The fully agreed-upon values are as follows:

Frequency (MHz)	Category	Maximum beamwidth to 3dB points (incl. angle in degrees)	Minimum antenna gain (dBi)	Minimum radiation suppression to angle in degrees from center-line of main beam in decibels								
				0° to 1.2°	1.2° to 5°	5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
71,000 to 76,000 (co-polar)	A	1.2	43*	N/a	L ₁ **	35	40	45	50	50	55	55
71,000 to 76,000 (cross-polar)	A	1.2	43*	25	25	45	50	50	55	55	55	55

²² See 47 C.F.R. § 101.115.

Frequency (MHz)	Category	Maximum beamwidth to 3dB points (incl. angle in degrees)	Minimum antenna gain (dBi)	Minimum radiation suppression to angle in degrees from center-line of main beam in decibels								
				0° to 1.2°	1.2° to 5°	5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
81,000 to 86,000 (co-polar)	A	1.2	43*	N/a	L ₁ **	35	40	45	50	50	55	55
81,000 to 86,000 (cross-polar)	A	1.2	43*	25	25	45	50	50	55	55	55	55

* Antenna gain less than 50 dBi (but greater than 43 dBi) is permitted only with a proportional reduction in maximum authorized EIRP in a ratio of 2 dB of power per 1 dB of gain, so that the maximum allowable EIRP (in dBW) for antennas of less than 50 dBi gain becomes $+55 - 2(50-G)$, where G is the antenna gain in dBi.

** $L_1 = G - 28$, where G is the antenna gain in dBi.

However, the parties were unable to agree on whether there should be separate standards for Category B sites. Cisco believes that the Category A standards should apply to all areas, for at least two reasons.

First, it is not clear when the deployment in a given area becomes high enough to make it an area of “frequency congestion” that is subject to the Category A standards. Right now, it is safe to say there are no areas of “frequency congestion” for Part 101 services in the 70/80 GHz band, and allowing the deployment of radios with inferior discrimination capabilities can only pollute the interference environment and complicate later installations. But second and more fundamentally, the A/B dichotomy that was developed for channelized environments does not transfer well to the unchannelized 70/80 GHz environment. The use of less spatially efficient “B” antennas increases co-channel separation distances, but in a channelized band this would not cause any real scarcity unless there were so much “frequency congestion” that *all channels were occupied*. However, when each licensee is authorized for the entire available bandwidth,

the issue becomes *spatial congestion* rather than “frequency congestion.” Even in less heavily populated areas, Cisco believes it is critically important for multiple enterprises within a single building to be able to install radios on the rooftop independently of each other, and control of the antenna’s RPE is essential to maintain abundant reuse of the bands. In an unchannelized environment this demands adherence to the same antenna standards that apply in areas of “frequency congestion.” Or to put the matter somewhat differently: In an unchannelized band, the installation of even one radio is enough to turn any given rooftop into an area of “frequency congestion.” For these reasons, Cisco believes that all 70/80 GHz radios should be required to meet the Category A standards that have been unanimously endorsed by the industry.

E. Out-of-Band Emissions

Loea’s original petition for rulemaking proposed to apply the out-of-band emission limits already contained in section 101.111(2)(ii) of the FCC’s rules. This proposal received widespread support. Cisco’s initial comments proposed an alternative limit on out-of-band emissions, but after consultation with other terrestrial interests Cisco believes that the application of section 101.111(2)(ii) will be appropriate. Cisco therefore supports the consensus position that section 101.111(2)(ii) limits should apply.

F. Digital Modulation

Cisco’s initial comments proposed to require digital modulation in the 71-76 GHz and 81-86 GHz bands, arguing that such a requirement would help protect radio astronomy observations and that it was unlikely anyone would plan analog operations in these bands in any event. After consultation with other terrestrial interests, Cisco has learned that some companies may wish to offer analog products. At the same time, the

industry remains interested in techniques to reduce interference to radio astronomy sites. These views can be reconciled by requiring digital modulation only within the RAS coordination zones specified in proposed footnote USzzz. Consequently, Cisco agrees with all other terrestrial commenters that within the RAS protection zones specified in footnote USzzz, the path coordinator may require a fixed-service operator to use digital modulation so as to spread radiated energy as uniformly as possible across the 81-86 GHz band.

IV. CONCLUSION

The Commission can take great satisfaction in the considerable extent to which the NPRM has produced industry consensus. There is every reason to expect that the consensus will expand in the coming months, to embrace even more issues. Cisco urges the Commission to implement the consensus and resolve the outstanding issues quickly so that these frequencies can be used to facilitate broadband deployment in the very near term.

Respectfully submitted,

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