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March 6, 1996

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW
Washington, DC 20554

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re Spectrum Band Plans
CC Docket 92-297

Dear Mr. Caton:

In a meeting convened February 16, 1996, the FCC's staff notified participants in this proceeding that the International and Wireless Telecommunications Bureaus and the Offices of Plans and Policy and Engineering and Technology collectively had, within the previous day, recommended the 28 GHz band plan known as "Option 4" to the Commission. Nevertheless, and with the strong encouragement of various satellite interests, some bureaus and offices still are discussing alternatives.

The undersigned parties ("the Parties") are writing to respond to a letter from Hughes Communications Galaxy, Inc. ("Hughes"),[1] and to address various questions recently raised about Option 4 and another plan, known as "Option 5," which was not recommended by the staff.[2] The recent questions concern (1) the cost of the new option to the local multipoint distribution service ("LMDS") and (2) the cost of the staff-recommended option to the geostationary orbit fixed-satellite service ("GSO FSS").

Summary

The Parties believe that Option 4 is the best approach to solve the 28 GHz spectrum sharing impasse. The Parties also believe that Option 5 would untenably and unfairly burden the LMDS. If Option 5 is adopted, LMDS spectrum efficiency would decrease, the cost of LMDS equipment would increase, and auction revenues would suffer.

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1 *Letter*, Edward J. Fitzpatrick, Hughes Communications Galaxy, Inc., to Scott Blake Harris and Michele Farquhar, Mar. 1, 1996.

2 Several parties already have expressed support for the staff's recommendation and opposition to Option 5. *See Letter*, Gene Robinson, Texas Instruments, Inc., to William Caton, Feb. 28, 1996; *Letter*, Donald Brittingham, Bell Atlantic, *et al.*, to William Caton, Mar. 4, 1996.

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The record in this proceeding is replete with information sufficient for the Commission to act. The Parties firmly believe that the record contains no new information sufficient to warrant reconsideration of the staff recommendation. Furthermore, the Parties remain extremely concerned about additional postponements. Far more than any other proposed service in the band, LMDS is disadvantaged by delay. Indeed, a stalled decision process works primarily to the advantage of competitors to LMDS, including direct broadcast satellite ("DBS") service and cable. If Option 5 offered a reasonable way to proceed, the LMDS community, including the Parties, would have embraced it immediately.

Response to Hughes Letter

On March 1, 1996, Hughes submitted a letter in which it offered opinions on the economic impact of various 28 GHz band plans on LMDS. Hughes also briefly mentioned, but only in qualitative terms, the potential costs of some band plans to the GSO FSS. Specifically, Hughes alleged that the costs to LMDS under Option 5 would be only slightly greater than under any other option considered by the staff and, in any case, would be no greater than the costs to the GSO FSS under Option 4.

Splitting and separating the spectrum used for transmissions *in a single direction*, as is contemplated under Option 5, is an entirely different matter from the LMDS band splits contained in other options.[3] Indeed, Option 5 is the only band plan under which LMDS operators would be required to spread transmissions in a single direction across more than 1 GHz.[4] The other options would be used primarily by placing all downstream (hub) traffic in the larger (850 MHZ) lower band and all upstream (subscriber) traffic in the smaller (125 or 150 MHZ) upper band. Thus, the maximum band spread in one direction would be only 850 MHZ.

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[3] LMDS must, by FCC design, meet all of its spectrum needs in the 28 GHz band. The GSO FSS, on the other hand, will receive an allocation of roughly 900 MHZ in that band, plus 1600 MHZ in the 17.7-20.2 GHz band. The satellite service, therefore, will have over 2500 MHZ available for bi-directional operations, without being subjected to competitive bidding. (The Hughes letter confirms that GSO FSS operators have no intention of paying for spectrum in an auction.) The LMDS, even under the most favorable band plan, will receive only 1000 MHZ for bi-directional operations, and LMDS service providers will be licensed through auctions.

[4] As is well-documented in this proceeding, typical LMDS operations will require more spectrum for hub-to-subscriber transmissions than for return links. The only practical use of the bands under Option 5, therefore, would be to place hub transmissions in the upper band (where subscriber transmissions would be banned) and lower band (which would provide sufficient additional hub capacity) and subscriber transmissions in the remaining middle band.

As described below, splitting and separating the traffic in a single direction by over 1 GHz would cause serious spectrum inefficiencies and increases in system complexity and cost that are not practicable for consumer-based equipment. This situation is exacerbated by the fact that transmissions in the middle band will be in the opposite direction from the transmissions in the LMDS bands above and below.

Contrary to Hughes' assertions, set-top box complexity and costs would increase significantly under Option 5.[5] There is no "off-the-shelf" LMDS set-top box, as Hughes suggests. The ComStream set-top box noted by Hughes is not typical of the boxes that are or will be used in the industries (cable and DBS) against which LMDS providers must compete in this country. Further, this ComStream box does not provide the two-way functionality required for LMDS.

Hughes points out that, under Option 4, GSO FSS systems would be required to transmit in separate 28 GHz subbands in the same direction and concludes that the LMDS situation under Option 5 would be no different. Hughes has overlooked, however, the inefficiencies of guard banding related to proximate forward and reverse links. Such inefficiencies are not a factor for the satellite service, because GSO FSS operators are not required to operate in two directions within the same frequency band. Indeed, not only does the GSO FSS allocation of 1600 MHZ at 17.7-20.2 GHz give the GSO FSS enormous capacity, it also provides an advantageous separation of forward and reverse links.

Impact of Option 5 on LMDS

Notwithstanding Hughes' claims, Commission adoption of Option 5 would impose substantial delays and heavy, if not fatal, cost penalties on LMDS. Solely because of such a regulatory decision, U.S. consumers would need to wait for LMDS and then spend more money for the myriad benefits of American-developed technology. Meanwhile, citizens of South America and other regions of the world would see LMDS implemented in their countries. The delayed availability and higher equipment prices, of course, would drive down LMDS auction prices.

The LMDS equipment market is extremely cost-sensitive. LMDS must compete with existing entrenched services such as cable television, direct broadcast satellite service (in which Hughes itself is a major player through DirecTV), and MMDS. Without competitive pricing, LMDS never will succeed. Furthermore, most LMDS subscribers -- key purchasers/lessees of LMDS equipment -- will be individual consumers for whom price sensitivity is even higher than for businesses.

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[5] Hughes' analysis focusses on only one component (the set-top box) of LMDS systems. As described below, however, many more aspects of LMDS systems would become more complex and expensive under Option 5.

LMDS system components would be more expensive under Option 5 than under Option 4. In general, RF front ends would have to be wider for downstream transmissions. For example, it would be very difficult to achieve precise hub coverage patterns within cell sectors under Option 5 without comparatively expensive antenna designs. This is because signal polarization (which, for different frequencies, is lost at different rates as the angle from boresight increases) would become less manageable along the sector edges. As a result, interference among sectors within a cell would become far more complex to contain. Implementation of dual hub transmit and subscriber receive antennas may be the best solution to this problem, but would double their complexity and cost.

In addition, Option 5 would require LMDS manufacturers to redesign significant portions of their overall system architectures. The redesign would need to cover at least (1) the addition of two new filters (for each side of the new "middle" band); (2) improved roll-off of two existing filters (on the high side of the lower band and low side of the higher band) due to the proximate reverse-band traffic; and (3) more complex frequency generation and mixer downconverters (to cover the hub-to-subscriber transmissions in the upper band).

LMDS also would suffer a substantial increase in guardband -- and corresponding loss of spectrum efficiency and capacity -- due to the addition of a third operating band. The need for additional guardband is exacerbated because return link traffic under Option 5 must be carried in the middle band between the outbound bands. In some manufacturers' designs, Option 5 would result in decreased spectrum efficiency while increasing the complexity of the hub design.

In sum, LMDS system complexity and costs would increase under Option 5 because several individual components would become more expensive, system architectures would need to be redesigned, and inherent spectral inefficiencies would increase.

Further, Option 5 would result in delay. The extent of such a delay is even more serious than "merely" temporarily denying the service to American consumers. If Option 5 were adopted, some manufacturers, including those of which are poised to be major suppliers of LMDS equipment in the early years of the service, seriously would reconsider active participation (such as marketing and early manufacturing) in the U.S. market. At some point, of course, these equipment makers might enter the domestic market, but perhaps only after years of supplying foreign countries that (ironically) have more stable regulatory situations. Potential LMDS auction bidders would be aware of these manufacturers' intentions and, accordingly, auction prices could be expected to fall even further.

To summarize, as compared with the staff-recommended Option 4, adoption of Option 5 would have the following effects: (1) significant spectrum inefficiencies for LMDS not faced by any other services under any other band plan considered by the staff; (2) significantly increased cost of LMDS equipment (both hub and subscriber units); (3) delayed availability of equipment and

corresponding longer return on investment; and (4) the possible loss of interest by key equipment designers and manufacturers. All of these factors would serve to reduce auction revenues.[6]

Clearly, the FCC's choice of a band plan will determine LMDS auction revenues. If the Commission adopts the staff-recommended Option 4, the agency can expect a healthy LMDS preceded by equally healthy auction prices. If, however, the FCC adopts Option 5, auction revenues may be very disappointing. In any case, the Parties believe that continued consideration of 28 GHz band plans may push the LMDS auctions beyond the end of summer.

Impact of Option 4 on GSO FSS

Band plan changes at this point can barely affect the GSO FSS as a service, and very few (if any) of the individual proposed systems will be significantly harmed. The reasons are obvious. First, most of the proposed GSO FSS systems are only in the very earliest stages of design, and those which are somewhat more advanced are still several years from construction and deployment. Furthermore, each of these systems all will make (or will contract for) its own equipment. This is in stark contrast to the LMDS situation where the hundreds of service providers will purchase large quantities of equipment from a handful of manufacturers. Thus, the impact of a design change on a single satellite system, *e.g.*, Hughes' Galaxy, will affect only that one system, whereas fundamental redesigns of the key LMDS manufacturers' systems will affect the entire LMDS industry.

The Parties continue to believe that proponents of GSO FSS systems seek additional spectrum at least in part to avoid mutual exclusivity and auctions. Although slightly less spectrum may not accommodate all the applicants for the free spectrum, it certainly could accommodate some. This situation, of course, parallels the earlier FCC decision to switch from two LMDS providers per area in a total of 2000 MHZ to a single provider per area in half the spectrum. By doing so, the agency virtually guaranteed mutual exclusivity and, thus, auctions in every LMDS service area. In fairness, and for the sake of sound spectrum management goals (*e.g.*, to prevent spectrum warehousing), the Commission should take the same course with the GSO FSS.

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[6] It is no answer to suggest that the diminished auction prices under Option 5 simply would offset the increased costs of equipment. Such a situation would be, in effect, a redistribution of wealth from the U.S. Treasury and LMDS systems to the inchoate GSO satellite systems. Obviously, it would be difficult to explain to American consumers or Congress why such a course would be taken.

Conclusion

The Parties believe that Option 4 is the best approach to solve the 28 GHz spectrum sharing impasse. The Parties also believe that Option 5 would untenably and unfairly burden the LMDS. If Option 5 is adopted, LMDS spectrum efficiency would decrease, the cost of LMDS equipment would increase, and auction revenues would suffer. Accordingly, the Parties request that the Commission reject Option 5 and move expeditiously to adopt the staff-recommended Option 4.

Sincerely yours,

Doug Lockie
Endgate Technologies

Samir Kamal
Hewlett-Packard

Gene Robinson
Texas Instruments

cc Chairman Reed E. Hundt
Commissioner James H. Quello
Commissioner Andrew C. Barrett
Commissioner Susan Ness
Commissioner Rachelle Chong

Mr. Rudolfo Baca
Ms. Lauren Belvin
Ms. Jackie Chorney
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