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Excerpts

FCC 95-287

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5 - 29.5 GHz Frequency Band, to Reallocate the 29.5 - 30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services	)	CC Docket No. 92-297
	)	
and	)	
	)	
Suite 12 Group Petition for Pioneer's Preference	)	PP-22

THIRD NOTICE OF PROPOSED RULEMAKING AND SUPPLEMENTAL TENTATIVE DECISION

Adopted: July 13, 1995 Released: July 28, 1995

Comment Date: August 28, 1995
Reply Comment Date: September 18, 1995

By the Commission:

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I. Introduction 1

achieved between FSS gateway stations[8] (either non-geostationary or geostationary orbit) and LMDS.

16. In the following text, we describe the characteristics of the particular systems proposed. Each of these systems has particular technical characteristics which may render it more suitable for some types of uses or services than other systems. Each also is, in our view, a potentially critical component of both the national and global information infrastructure. Each system description should be read bearing in mind that our ultimate goal is to accommodate the strengths of systems so that, through private investment, competition and ubiquitous service result.

A. Specific Satellite Proposals

17. Permitting satellites to operate in the 28 GHz band will contribute to the national and global information infrastructure by modernizing existing communications infrastructures of local telephone service, providing enhanced wide-area mobile services and access to advanced, digital, broadband communications and video services. These advanced services can potentially be provided to every person in the world, whether in an urban or remote location. As a consequence, satellites have significant potential to stimulate economic growth in the United States and abroad. The United States has led the world in developing and implementing satellite technology and the satellite proposals before us represent an opportunity for the United States to continue its leadership role through enhanced communications infrastructures and services.

18. Three types of satellite system uses have been proposed for the 28 GHz frequency bands. First, the Commission has received applications for geostationary fixed satellite service (GSO/FSS) licenses. Second, the Commission has received one application for a non-geostationary fixed satellite service (NGSO/FSS) system. Finally the Commission has multiple requests for the assignment of feeder links to be used in conjunction with non-geostationary mobile satellite service (NGSO/MSS) systems, including specific requests for assignment of frequencies in the 28 GHz band, as well as conditional requests that 28 GHz frequencies be made available for feeder links in the event feeder link assignments cannot be made in other bands. We address each of these types of satellite uses.

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[8] Gateways are earth stations generally larger than user terminals that support multiple carriers. These stations provide interconnection with the terrestrial Public Switched Network. By their nature, they are not deployed in the same ubiquitous way as the user transceivers.

1. *Geostationary Fixed-Satellite Service Proposals*[9]

19. Hughes Communications Galaxy, Inc. ("Hughes") submitted an application in December 1993 to construct, launch and operate two domestic fixed-satellites to operate in the Ka-band, a system which it calls "Spaceway." Hughes later amended this application to expand the system to 17 interconnected satellites with global coverage. Four of these satellites are proposed to serve the United States. These four satellites serving the U.S. would use 1000 MHz of spectrum at 29.0 - 30.0 GHz for uplinks.[10] Hughes proposes to provide low-cost, ubiquitous, high-speed data, video, and videotelephony communications services. Spaceway proposes to offer United States domestic service, domestic service within other countries, intra-regional service, and global international services. The services will be available "on demand" with an estimated domestic satellite capacity of 21,650 simultaneous duplex 384 Kbs channels and 92,000 such channels system wide. The first satellites in the Spaceway network are scheduled to be operational in 1998.

20. Hughes proposes to co-locate two of the four domestic satellites at 101 degrees W.L. and the other two at 99 degrees W.L. Hughes plans to operate each of the co-located satellites over 500 MHz of spectrum, with one operating in the 29.0-29.5 GHz band and the other in the 29.5-30.0 GHz band. Each proposed satellite will incorporate forty-eight 120 MHz spot beams for uplink and downlink communications, twenty-four in each polarization direction. By proposing multiple satellites at each of the orbital locations, Hughes represents the Spaceway network will be able to use power levels that will allow customers to use small, inexpensive earth terminals. By proposing two satellites at two locations, instead of one satellite at four different locations, more geostationary satellites will be accommodated and spectrum efficiency is enhanced.

21. Loral Aerospace Holdings, Inc. ("LAHI") filed an application in April 1995, requesting authority to construct, launch, and operate a Ka-band geostationary fixed satellite, "CyberStar." CyberStar would use 1250 MHz at 28.75 GHz to 30.0 GHz for satellite

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[9] The Commission issued Norris Satellite Communications, Inc. ("Norris") authority in July 1992, to construct, launch and operate a fixed-satellite service system in the 29.5-30.0 GHz band. *See Norris Satellite Communications, Inc.*, 7 FCC Rcd 4289 (1992). In granting Norris's application, we waived our financial qualification standard in light of the facts that no other application was then pending for use of the 28 GHz band, and that Norris's satellite would not preclude other uses of the band, since "the entire orbital arc remains available for future applicants." 7 FCC Rcd at 4290. We also imposed construction milestones and indicated they would not be routinely extended. The milestones require Norris to begin construction of a satellite by July 1993, complete construction by September 1996, and launch the satellite by January 1997.

[10] Hughes proposes to use frequencies from 19.2 to 20.2 GHz for downlinks in the U.S.

point use; instead, it proposed to redesignate the 28 GHz band, to the extent that it is used for terrestrial services, for point-to-multipoint services.

52. In this Notice we again decline to dedicate part or all of the 28 GHz band solely to point-to-point services, as requested by Harris and Digital. At this time we believe it is in the public interest to provide terrestrial licensees in the 28 GHz band with the flexibility to offer a variety of services and to develop innovative new services. Harris and Digital have not demonstrated that the public interest in point-to-point services is greater than the interest in the myriad LMDS services proposed by other manufacturers and developers during the course of this proceeding.

53. Entities interested in providing point-to-point services may apply for LMDS spectrum themselves, they may seek geographic partitioning and/or spectrum disaggregation opportunities to the extent that these options are adopted in final LMDS rules, or they may lease spectrum from LMDS operators, to the extent permitted by our rules. Finally, we believe that we have made sufficient point-to-point spectrum available for support of wired and wireless telecommunications systems for the present.[55]

b. Primary GSO/FSS Spectrum

54. Next, we propose to designate 1000 MHz of spectrum on a primary basis to GSO/FSS systems from 28.35 to 28.60 GHz and 29.25 to 30.0 GHz. We also propose to allow NGSO/FSS systems to operate on a secondary basis to GSO/FSS systems in these bands and to allow MSS feeder links to operate on a co-primary basis in the 29.25 to 29.5 GHz band.[56] This matches the request submitted by Hughes for 1000 MHz for operation of Spaceway, its proposed GSO/FSS system. It is, however, less than the amount of spectrum proposed by two other applicants, specifically PanAmSat and Loral. PanAmSat requests 2500 MHz of spectrum for operation of its proposed satellite, PAS-9, which will also operate in the C and Ku bands, and Loral requests 1250 MHz of spectrum for operation of its satellite system, CyberStar. Moreover, this plan assumes GSO/FSS systems and MSS feeder links can operate in the same band.

55. Several factors contribute to designating 1000 MHz of spectrum for the GSO/FSS systems. First, U.S. satellites currently providing fixed-satellite services in the C (4/6 GHz) and Ku (12/14 GHz) frequency bands are required, for spectrum efficiency, to use full frequency reuse, and to operate across the entire 500 MHz of each frequency band in each transmission direction. In response to the increased demand for satellite services, most FSS systems being built today are hybrid satellites, that is, they operate in both the C and Ku bands, thus utilizing 1000 MHz. Currently, the C and Ku bands are heavily utilized. Second, the GSO/FSS systems proposed for operation in the Ka band are proposing broadband

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[55] *Hye Crest Management, Inc.* 6 FCC Rcd 332, para. 23 (1991).

[56] *See* discussion at para. 64, *infra*.

applications. Broadband applications require more bandwidth than current data operations. We therefore believe that 1000 MHz of spectrum is needed to support multiple Ka-band GSO/FSS systems. Further, 250 MHz of this 1000 MHz of spectrum will be shared on a co-primary basis between GSO/FSS systems and MSS feeder links, as explained in more detail below.[57]

3. Primary NGSO/FSS Spectrum

56. We propose to designate 500 MHz of spectrum on a primary basis, at 28.60 to 29.1 GHz, to NGSO/FSS systems. We also propose to allow GSO/FSS systems to operate in this segment on a secondary basis. Teledesic has requested 1200 MHz of spectrum for its system. It proposes to operate user terminals over 400 MHz of spectrum and its gateway or high data rate (GigaLink) terminals over 800 MHz of spectrum.[58] Various technical analyses, submitted to the Commission and to industry preparatory groups for WRC-95, have demonstrated that the ubiquitous deployment of user terminals for a NGSO/FSS system, such as Teledesic's, will receive and cause unacceptable amounts of interference to other satellite users in the frequency band. These same analyses also conclude that the gateway terminals pose fewer problems for coordination than do the user terminals. This means that the user terminals are prime candidates to operate on a primary non-shared basis, and the gateway terminals are prime candidates to operate, for the most part, on a secondary basis in other bands. In particular, we propose secondary NGSO/FSS operations in the 750 MHz of spectrum in the 28.35 to 28.60 GHz and 29.5 to 30.0 GHz bands.[59]

57. We believe designating NGSO/FSS systems to only 400 MHz of primary spectrum, however, could call into question the system's operational ability. Relegating all gateway terminals to secondary status may lead to operational uncertainty. Not only would the gateway terminals bear the burden of coordinating with domestic GSO system operations, but they would be subject to the International Telecommunication Union Radio Regulation 2613, which requires NGSO systems to cease operations if they cause unacceptable interference into a GSO system.[60] Consequently, we propose to designate NGSO/FSS systems 500 MHz on a primary basis. The additional 100 MHz will ensure that at least some spectrum could be used for gateway terminals, and not be subject to secondary user constraints and RR 2613.

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[57] *Id.*

[58] *See* Teledesic's application at 2.

[59] *See* paras. 54 - 55, *supra.*

[60] *See* ITU Radio Regulation 2613. The Commission has proposed that the ITU eliminate NGSO's secondary status, *see* WRC Preparatory Report, FCC 95-256 (released June 15, 1995) at paras. 59-68.

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Excerpts

FCC 96-311

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services	)	CC Docket No. 92-297

FIRST REPORT AND ORDER

and

FOURTH NOTICE OF PROPOSED RULEMAKING

Adopted: July 17, 1996 Released: July 22, 1996

Comment Date: August 12, 1996
Reply Comment Date: August 22, 1996

By the Commission:

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band plan to permit all of the proposed services in the 28 GHz band - LMDS, geostationary-orbit FSS ("GSO/FSS") systems, non-geostationary orbit FSS ("NGSO/FSS") systems, and feeder links for non-geostationary orbit MSS ("NGSO/MSS" or "Big LEO") systems. We also proposed rules and policies to govern the LMDS service, issued a Supplemental Tentative Proposal on CellularVision U.S.A.'s ("CellularVision") pioneer's preference application, proposed auction rules for LMDS, and proposed to change the MSS allocation at the 29.5-30.0 GHz band.

5. In response to the *Third NPRM*, we received forty-four comments and nineteen reply comments from entities representing diverse segments of the communications industry.[4] The majority of commenters, representing LMDS proponents and the satellite industry, recognized that our proposed band plan was a reasonable compromise to accommodate all interested parties in the band and generally expressed the desire for more unencumbered spectrum in the 28 GHz band for their proposed service. We will address issues relating to service rules for both GSO/FSS and NGSO/FSS systems proposing to operate in the 28 GHz band in a forthcoming *Report and Order*. Service and auction rules relating to LMDS will also be addressed in a separate *Report and Order*.

II. BACKGROUND

6. The 27.5-29.5 GHz frequency band is allocated for fixed service, fixed-satellite service uplinks and mobile service.[5] In January 1991, the Commission granted the application of CellularVision's predecessor-in-interest, Hye Crest, Inc., for a license to provide LMDS in the 27.5-28.5 GHz frequency band within the New York City Primary Metropolitan Statistical Area (NYPMSA).[6]

7. Meanwhile, NASA's successful launch and operation of its experimental Advanced Communications Technology Satellite (ACTS) initiated demand by satellite entities for the use of the 28 GHz band, and its associated downlink bands. In 1990, Motorola Satellite Communications, Inc. applied for feeder links for its NGSO/MSS system in this band.[7]

Petition for Pioneer's Preference, CC Docket No. 92-297, 11 F.C.C. Rcd. 53 (1995) ("*Third NPRM*").

[4] A complete list of commenters is provided in Appendix A.

[5] *See* 47 C.F.R. § 2.106.

[6] *Hye Crest Management, Inc.* 6 F.C.C Rcd. 332 (1991). The Commission granted the application pursuant to waiver of the point-to-point rules in Part 21 to allow a fixed cellular point-to-multipoint operation for video distribution.

[7] In July 1990, Norris Satellite Communications Inc., filed an application to provide satellite services in the 28 GHz band and obtained an authorization in 1992. However, the Commission has recently declared Norris' authorization null and void for failing to begin timely system construction. *See In The Matter of Norris Satellite Communications, Inc. For Authority to Construct, Launch, and Operate a Ka-Band Satellite*

We expect that LMDS providers will offer facilities-based competition to traditional cable and telephone carriers -- greatly enhancing customer choice, and facilitating the rapid dissemination of innovative communications services with the entry of multiple providers into the market.

15. The wealth of innovative services possible with the LMDS broadband spectrum we make available includes two-way video, teleconferencing, telemedicine, telecommuting, data services and global networks. LMDS systems have the capacity to provide broadband video-on-demand and distance learning. Moreover, LMDS' cellular-like capabilities enable it to offer diverse services within the same region, and to jointly offer services traditionally provided by separate communications service providers.

16. LMDS has attracted attention from both developed and developing countries. Canada has begun licensing this technology (called LMCS) in three gigahertz of spectrum in the frequency band 25.35 to 28.35 GHz. At least six other countries, including Mexico and Venezuela, have licensed LMDS on an experimental or permanent basis in the 28 GHz band.[16] LMDS developers offer the prospect of modern wireless telephone systems, video distribution, and other communications services to developing countries that lack wireline or cable infrastructure.

2. Satellite Proposals:

17. The satellite industry perceives the 28 GHz band as primarily the location for the development of new FSS broadband services provided directly to the home, but also as the expansion band for accommodating growth in existing FSS services. The band is also seen as the location of feeder links for MSS use. The 28 GHz band has the capability to sustain the use of very small earth station antennas and to provide high-speed, broadband interactive services on demand. Three different types of satellite system uses have been proposed in this band: GSO/FSS, NGSO/FSS and feeder links for NGSO/MSS systems. Below we describe new applications, modifications or amendments to existing applications since the adoption of the *Third NPRM*.

a. *Geostationary-Orbit Fixed-Satellite Service Proposals ("GSO/FSS")*

18. Concurrent with the release of the *Third NPRM*, the Commission placed the five Ka-band satellite applications which were on file on public notice and established a September 29, 1995 cut-off date for filing applications to be considered with them.[17] In response, we received thirteen new satellite system applications, amendments, or modifications to

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[16] *Ex parte* notice letter, Michael Gardner, P.C., to William Caton, Acting Secretary, Federal Communications Commission, February 16, 1995; *ex parte* notice letter, Texas Instruments, Inc., to William Caton, June 1, 1995.

[17] Public Notice, Report No. SPB-20, Release No. DA 95-1689, July 28, 1995.

LMDS systems in this band disagree, and contend that we should not preclude the possibility of future co-frequency sharing in the band.[34] For example, CellularVision suggests that the Commission adopt a mechanism that would allow it to incorporate co-frequency sharing into the band plan, should any party demonstrate that sharing is feasible.[35] Bell Atlantic asserts that the Commission should permit interested parties to develop the record further on this issue or negotiate co-frequency arrangements.[36] However, these proponents do not supply any additional technical findings on the co-frequency sharing issue and how such co-frequency operations could be implemented.

26. Hughes argues that the Commission should decline to "leave the door open" for co-frequency sharing between LMDS and FSS.[37] Teledesic also asserts that there has been no engineering study submitted in this proceeding demonstrating that such sharing is technically achievable.[38] NASA further asserts that studies by Bellcore and GeoWave have been unsuccessful in finding techniques that would allow co-frequency sharing between LMDS and satellite systems each with ubiquitous consumer terminals operating in the same geographical areas.[39] Comtech Associates asserts that "sharing arrangements as proposed in the Bellcore study will place unnecessary technical and financial burdens on small LMDS operators. Additionally the technical uncertainty surrounding the inability to adequately field test the necessary conditions resulting from multiple service providers in the 28 GHz band will introduce business and financial uncertainty making raising capital for service providers more difficult."[40]

27. We conclude, based on the entire record before us, that co-frequency sharing between either GSO/FSS or NGSO/FSS ubiquitously deployed terminals and LMDS with its

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[33] *See e.g.* Comments of Hughes at 31; Reply Comments of Hughes at 25; Comments of NASA at 7; Comments of ComTech Associates at 2-3; Comments of GHz Equipment Company, Inc. at 3; Comments of Teledesic at 14.

[34] *See e.g.* Comments of CellularVision at 4-5; Comments of Bell Atlantic at 3, and Comments of Endgate Corporation at 4.

[35] *See* Comments of CellularVision at 5.

[36] Comments of Bell Atlantic at 3.

[37] Reply Comments of Hughes at 25-26.

[38] Reply Comments of Teledesic at 4.

[39] Comments of NASA at 8. BellCore and GeoWave each submitted studies after the conclusion of the NRMC, that they contend demonstrate that co-frequency sharing between LMDS and FSS systems is possible. For summaries of the BellCore and GeoWave studies *see Third NPRM* ¶¶ 40-43.

[40] Comments of Comtech Associates at 3.

ubiquitously deployed subscriber terminals, is not feasible at this time.[41] At this time no party has demonstrated the feasibility of sharing, and our conclusion in the *Third NPRM* was clearly supported by the record to date. However, if future technology becomes available to facilitate this type of sharing we would consider revisiting this conclusion.

28. We also deny Qualcomm Incorporated's request to reopen the record in this proceeding, on a limited basis, for supplemental comments on sharing issues among NGSO/FSS systems.[42] Teledesic opposes this request. QualComm's Petition raises issues directly relating to intra-service sharing and licensing policies for NGSO/FSS systems. A forthcoming *Report and Order* will address NGSO/FSS service rules and we do not believe that the adoption of the domestic band segmentation plan precludes the possibility of sharing between NGSO/FSS systems. Therefore, we conclude that reopening the formal comment period in this proceeding is not warranted. Consistent with our *ex parte* rules,[43] several parties have filed comments after the formal comment deadline.

B. Services above 40 GHz

29. In the *Third NPRM*, we also tentatively concluded that the 40.5-42.5 GHz ("40 GHz band") is not currently suitable for either the LMDS or fixed satellite services, as proposed in this docket.[44] Many LMDS proponents agree with our tentative conclusion.[45] CellularVision, for example, contends it and other parties demonstrated in comments in ET Docket 94-124[46] that based on "significant differences in signal propagation characteristics, component technology and system implementation, the cost of providing LMDS service at 40 GHz would be significantly more expensive than the cost at 28 GHz, thus rendering 40 GHz LMDS

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[41] Andrew Corporation claims its prototype conical antenna facilitates co-frequency sharing. *See* Comments of Andrew Corporation at 3. Pacific Telesis asserts that system proponents consider the antenna in system designs, but the Commission should not consider an additional period of negotiations and evaluations. Reply Comments of PacificTelesis at 2. Hughes argues that this antenna is "unproven" and the technical data submitted with Andrew's Comments provides no support for its conclusion that LMDS and GSO/FSS can share the spectrum. Reply Comments of Hughes at 25. The record demonstrates that co-frequency sharing between LMDS and FSS is a multifaceted problem. We believe that the antenna silo performance Andrew claims to fix is only one aspect of the sharing problem and alone does not permit us to determine that co-frequency sharing is feasible.

[42] *See Petition for Supplemental Comments of QualComm, Incorporated* CC Docket No. 92-297, (filed Feb. 28, 1996).

[43] *See generally*, 47 C.F.R. § 1.1206.

[44] *See Third NPRM* at ¶¶ 36-38.

[45] Comments of CellularVision at 5.

[46] *In the Matter of Parts 2, 15, and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, (*NPRM*), 9 F.C.C. Rcd. 7078 (ET Docket No. 94-124).

LMDS as a potential source of competition in the local telephony and multi-channel video programming distribution ("MVPD") markets, we believe it is important to immediately authorize deployment of LMDS. While the 40 GHz band may prove useable in the longer term for some or all of the types of services proposed by LMDS, or satellite services, we make no decisions here regarding use of the 40 GHz band. Rather, we will address such uses in the pending above 40 GHz proceeding.[56]

C. Band plan proposed in the Third NPRM and Alternative Band Plans Considered

1. Third NPRM

32. The band plan proposed in the *Third NPRM* was the result of months of discussions with interested parties and filings in the proceeding. Specifically, we proposed to segment the 28 GHz band by designating 1000 MHz each for LMDS and GSO/FSS systems; 500 MHz for NGSO/FSS systems; and 400 MHz for MSS feeder links. We proposed sharing in 150 MHz between NGSO/MSS feeder links and LMDS at 29.1-29.25 GHz, with a prohibition on subscriber-to-hub transmissions for LMDS systems. We also proposed sharing in 250 MHz between GSO/FSS systems and NGSO/MSS feeder links at 29.25-29.5 GHz. We proposed coordination between these systems on a "first-come-first served" basis.[57] We also indicated in the *Third NPRM* that we may authorize the feeder links of at least one NGSO/MSS system, TRW, on a reverse band working basis in the 19.4-19.7 GHz band.[58] The band plan as proposed in the *Third NPRM* is represented as follows:

LMDS fss	GSO/FSS ngso/fss	NGSO/FSS gso/fss	MSS FEEDER LINKS & LMDS (h-s)	MSS FEEDER LINKS & GSO/FSS	GSO/FSS ngso/fss
850 MHz	250 MHz	500 MHz	150 MHz	250 MHz	500 MHz

27.5 28.35 28.60 29.1 29.25 29.5 30.0

33. The majority of commenters supported our proposed band plan as a reasonable compromise to accommodate all proposed services in the band. However, commenters did

[56] *Supra* note 46.

[57] *See Third NPRM* at ¶ 64.

[58] *See supra* note 31 for definition of reverse band working.

2. Commission Band Segmentation Options Considered

38. The Commission considered various band segmentation plans over the last several months with the goal of accommodating the various divergent proposals made in response to the band plan proposed in the *Third NPRM*.[75] For example, we considered plans which ultimately proved to require difficult inter-service sharing rules and to not completely support interactivity of LMDS systems.[76] We also considered a band plan that designated 1000 MHz each for GSO/FSS and LMDS service. That plan, however, would have divided LMDS among three non-contiguous spectrum segments.[77] This option was not acceptable to the potential LMDS service providers because, they argued, it would have significantly decreased spectrum efficiency for LMDS, resulting in increased cost and delay in offering both subscriber and hub equipment.[78] We also considered two band plans that designated GSO/FSS systems with less than 1000 MHz.[79] These options were unacceptable to the GSO/FSS applicants because, they argued, any of these plans would result in a significant loss of system capacity and revenue.[80] Another plan, resulting from a GSO/FSS applicant's proposal, was also considered. It would have designated a total of 1010 MHz to GSO/FSS applicants and 985 MHz to LMDS, but required sharing of 135 MHz between GSO/FSS and LMDS.[81] However, the mutually acceptable sharing principles required to implement this

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[75] *See ex parte* submission filed by the International Bureau to William F. Caton, (Feb. 6, 1996) for diagrams of Commission Band Plan Options 1, 2, 2A, 2B, 3(a), 4 and 5. *See ex parte* submission filed by the International Bureau (March 5, 1996) for diagram of Option 4 prime.

[76] *See* Options 2, 2(a), and 2(b).

[77] *See* Option 5.

[78] *See* letter from representatives of Endgate Technologies, Hewlett-Packard, and Texas Instruments to William F. Caton (March 6, 1996). *See also* letter from Michael R. Gardner (Counsel, CellularVision) to Scott Blake Harris (Chief, International Bureau) and Michele Farquhar (Chief, Wireless Telecommunications Bureau) (March 6, 1996).

[79] *See* Options 3(a) and 4.

[80] *See ex parte* letter from representatives of Hughes, AT&T, Lockheed Martin, GE and Loral to Scott Blake Harris and Michele Farquhar (February 28, 1996). Option 4 also reduces the amount of usable spectrum available to Motorola by 50% and severely impacts its system's communications link of "last resort" for the control of the satellite. *See* Letter from Michael D. Kennedy (Vice President and Director, Regulatory Relations, Motorola) to William F. Caton (February 22, 1996).

[81] *See* Option 4 prime. *See also* Letter from Thomas K. Gump (Counsel, Lockheed Martin) to William F. Caton (February 23, 1996) "Option 4A." However, Option 4A involved the sharing of only 75 MHz of spectrum with LMDS.

plan were not developed by the LMDS and GSO/FSS parties.[82] We were also unable to successfully propose sharing criteria.

39. In March 1996, NASA was also asked to undertake an immediate study to assess whether its space services and LMDS could share spectrum below 27.5 GHz.[83] NASA concluded three weeks later that no rules acceptable to all parties could be drafted which would guarantee protection of NASA space services from harmful interference.[84] NASA also concluded that coordination with other space service systems in the band from other administrations would make this a difficult option to implement effectively. Texas Instruments requests that we decide, as part of this *Report and Order* "to reopen discussions with NTIA to reexamine the federal spectrum requirements and the possibilities for federal/non-federal sharing in or reallocation of the 25.25-27.0 GHz and 27.0-27.5 GHz bands and to pursue those discussions at the earliest possible time."[85] Notwithstanding NASA's initial conclusions on sharing, and the band plan we adopt today, we agree that more in-depth sharing studies of fixed services and LMDS and Government spectrum below 27.5 GHz may yield more positive results. Accordingly, we direct the staff to continue discussions with NTIA through the Interdepartment Radio Advisory Committee (IRAC) process to explore the feasibility of shared use or reallocation of some portion of this band from the Government for commercial usage.

40. We conclude that many of the alternative band plans described above fail to provide adequately for the operational needs of one or more of the proposed systems. We find, based on the record and for the reasons discussed below, that the band plan proposed in the *Third NPRM*, along with the additional inter-service sharing rules, is the most reasonable compromise to allow all proposed systems in the 28 GHz band to be authorized. In addition, we adopt a *Fourth Notice of Proposed Rulemaking* proposing that the 31.0-31.3 GHz band be designated for LMDS use. We propose that potential LMDS service providers be able to use this additional spectrum to meet the interactive needs of some of the proposed LMDS technologies. We are aware that some LMDS proponents oppose, for a variety of reasons,

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[82] *See* Letter from Charles M. Kupperman (Vice President, Washington Operations, Space and Missiles Sector, Lockheed Martin) to William F. Caton (June 3, 1996). Hughes also argues that the primary consequences of adopting Options 4 or 4 Prime would be (i) delay in provision of broadband satellite service in the U.S. (ii) significantly decreased service capabilities, and (iii) increased cost to consumers. *See* Letter from Edward J. Fitzpatrick, (Vice President of Hughes Communications) to Chairman Hundt and the Commissioners (March 15, 1996).

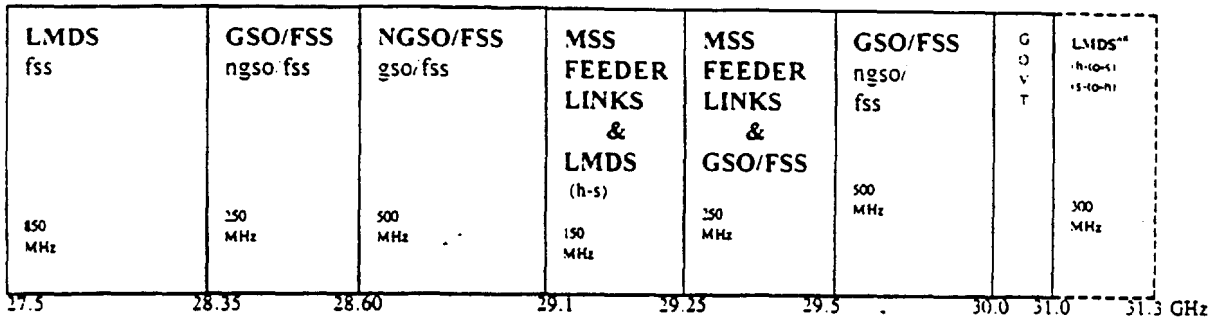
[83] Frequencies in this range are currently allocated for government use.

[84] *See* Letter from Charles T. Force (Associate Administer for Space Communications, NASA) to Mr. Lionel S. Johns (Associate Director of Technology, Office of Science and Technology Policy), and enclosure *Feasibility of Sharing between NASA Space Systems and LMDS systems near 27 GHz* (April 17, 1996).

[85] *See, e.g.*, Letter from Robert L. Pettit (Counsel, Texas Instruments) to Chairman Hundt and Commissioners (July 9, 1996).

42. The Commission's band segmentation plan is depicted graphically as follows:

Uplink Band 27.5 - 30.0 GHz



43. The plan we adopt designates co-frequency sharing in band segments where the Commission and the parties have concluded it is technically feasible. We conclude that adoption of this band plan promotes spectrum efficiency and facilitates the deployment of diverse, interactive, competitive services for consumers.[89]

44. The band segmentation plan will be implemented through appropriate changes in Part 25 and Part 101 of our rules. We are designating discrete spectrum bands for specific types of systems. Services designated for domestic licensing priority are specified in capital letters in the graphic depiction of the band plan. These services have licensing priority vis-a-vis any other type of service allocated domestically or internationally in the band. Lower-case letters indicate services in a particular band segment which also have licensing priority vis-a-vis any third service allocated domestically or internationally in the band, but have no licensing priority over the service in capital letters in the band segment and must operate on a non-interference basis and must accept interference vis-a-vis that service.[90] Services designated with two priority users have equal licensing rights based on the sharing principles adopted for that particular band segment. See discussion *infra* ¶¶ 63-74 on sharing.

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[88] *See infra* Part IV *Fourth Notice of Proposed Rulemaking* on 31 GHz band.

[89] Although some parties have pointed out to the Commission the potential of raising substantial revenues from auctions in discussions of the various band plans, the Commission, pursuant to 47 U.S.C. § 309(j)(7)(A), may not consider auction revenues in making spectrum allocation determinations and has not done so in this proceeding.

[90] Teledesic recommends that the Commission adopt a local priority designation for LMDS in the band segment proposed for LMDS rather than amend the domestic table of frequency allocations to establish a primary or co-primary designation for LMDS. Comments of Teledesic at 6. However, since we are not amending the domestic table of frequency allocations, it is necessary to adopt domestic priority designations not just for LMDS, but for NGSO/FSS, GSO/FSS and MSS feeder links.

segmentation plan for the 28 GHz band, a full year has passed since adoption of the *Third NPRM*. Since we intend to facilitate both LMDS and the GSO/FSS applicants for the 28 GHz band, we find that it is reasonable to grandfather CellularVision for the same benchmark, i.e., the expected launch of the first GSO/FSS satellite. Since that projected launch date has not changed, we believe it is fair to set the sunset period for 24 months from the release date of this *Report and Order*. Moreover, we do not believe that this decision results in unfairness to CellularVision because its expansion applications have been granted, and CellularVision has had the authority to build out its system throughout the NYPMSA on its original authorization of 1 GHz at 27.5-28.5. The same expansion which would have been possible under the grandfather provision has been available to CellularVision for this length of time. Therefore, we require CellularVision to vacate the 28.35-28.50 GHz band by 24 months following the release date of this *Report and Order*, or by the date of launch of the first GSO/FSS satellite intended to provide service in the United States in this band, whichever occurs later.

b. Effect of Band Segmentation on CellularVision's NYPMSA License

56. The effect of this band plan is to require CellularVision to transition to the non-contiguous spectrum designated in this *Report and Order*, which may necessitate retuning or replacing existing equipment. As a result, we believe it is appropriate to facilitate CellularVision's transition to the band plan we adopt today by authorizing its concurrent use of its authorized 1 GHz at 27.5-28.5 GHz and the newly designated 150 MHz at 29.1-29.25 for hub-to-subscriber transmissions during the grandfathered period.

2. Primary GSO/FSS Spectrum

57. We designate 750 MHz of exclusive primary spectrum for GSO/FSS systems, in two non-contiguous segments at 28.35-28.60 GHz and 29.5-30.0 GHz. NGSO/FSS systems will have secondary status in these segments. We also designate GSO/FSS use for 250 MHz on a co-primary basis with NGSO/MSS feeder links at 29.25-29.5 GHz.[111]

58. In the *Third NPRM* we stated that broadband satellite applications require more bandwidth than current data operations, and that 1000 MHz of spectrum is needed to support multiple 28-GHz band GSO/FSS systems. NASA and Loral Space Communications, Ltd. (Loral) contend that GSO/FSS systems require more than 1000 MHz of 28 GHz band spectrum.[112] Several GSO/FSS proponents have indicated that 1000 MHz of 28 GHz spectrum, free from technical constraints, is the minimum amount of spectrum needed to

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[111] *See* discussion on sharing issues *infra* ¶¶ 72-74.

[112] PanAmSat Corporation suggests that the entire Ka-band should be allocated to satellite services. Comments of PanAmSat at 2. CellularVision argues that PanAmSat provides no basis for exclusion of LMDS from the band and that Loral's plan to give FSS 1.25 GHz of contiguous spectrum does not provide justification. Reply Comments of CellularVision at 8-9.

operate commercially viable GSO/FSS systems.[113] Although we designate 250 MHz on a shared basis with NGSO/MSS feeder links, we find that broadband GSO/FSS applications proposed for this band can be supported within our total designation of 1000 MHz.

3. Primary NGSO FSS Spectrum

59. Consistent with the band plan proposed in the *Third NPRM*, the U.S. position at the WRC-95, and our intention to continue to propose 500 MHz for NGSO/FSS at WRC-97, we designate 500 MHz at 28.6-29.1 GHz for NGSO/FSS systems. Until such time as studies are completed in the ITU-R,[114] we cannot conclude that co-frequency sharing is possible between GSO/FSS systems and NGSO/FSS systems and therefore a separate band designation is warranted.[115] We believe designating 500 MHz is necessary to accommodate the increasing worldwide demand for 28 GHz spectrum for NGSO/FSS systems.[116] Significantly, this 500 MHz designation preserves the possibility that competitive NGSO/FSS systems may be implemented in this band.

60. Accordingly, we reject TRW's request that we defer consideration of an NGSO/FSS designation until we determine whether to grant an authorization to the sole currently pending domestic applicant for an NGSO/FSS system.[117] In view of the fact that we are adopting designations for a number of different types of services, we decline to forego adopting a designation when that action is both contrary to the international allocation in this band and could be perceived as foreclosing competitive systems proposed by other countries.

61. In its comments, Teledesic also recommends that the Commission designate use of the 28.6-29.1 GHz and 18.8-19.3 GHz bands for both FSS and MSS.[118] Hughes

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[113] *See* Comments of GE Americom at 5-6; Reply Comments of GE Americom at 2-3; Comments of Hughes at 3; Comments of Orion Network Systems at 2-3; Reply Comments of Orion Network Systems at 3. In the comments, some satellite proponents contend that the non-contiguous nature of the GSO/FSS spectrum, as proposed in the *Third NPRM*, also adds complexity and cost to system design. Comments of Loral at 3, Reply Comments of GE Americom at 6-7 and Reply Comments of Orion at 3-4. *See also* ex parte letter from Stephen L. Goodman, Counsel to AT&T, to Scott Blake Harris and Michele C. Farquhar (March 7, 1996) and Letter from Edward J. Fitzpatrick to Scott Blake Harris and Michele C. Farquhar (March 1, 1996).

[114] *Supra* ¶ 23.

[115] We will address the issue of international service in this band with respect to U.S. GSO/FSS systems in the individual licenses of GSO/FSS systems.

[116] In this regard, we note that France recently submitted information to the ITU of its intention to construct two such NGSO/FSS systems, and Russia also submitted such information for one system.

[117] TRW Comments at 36-37.

[118] Comments of Teledesic at 22.

miles from the borders of the 100 largest MSAs or in any MSA not included in the 100 largest MSAs. Any location allotted for one range of MSAs may be taken from an MSA below that range.

71. We adopt a prohibition on transmission of LMDS subscriber transceivers in this shared 150 MHz band segment. As previously discussed, the LMDS and NGSO/MSS interested parties were unable to reach a consensus on sharing criteria for MSS feeder links and LMDS subscriber-to-hub transmissions, *supra* ¶ 37. At this time we find it necessary to restrict LMDS use of this band segment to hub-to-subscriber transmissions. However, as indicated earlier, should the LMDS proponents in the future be able to demonstrate definitively that they can technically operate subscriber-to-hub links on a non-interference basis to the NGSO/MSS feeder links, particularly the satellite constellation, we would revisit the restriction we adopt today.

3. Sharing between NGSO/MSS feeder link earth stations and GSO/FSS systems in the 29.25 - 29.5 GHz Band (250 MHz)

72. The proposal in the *Third NPRM* designated co-primary usage of 250 MHz for NGSO/MSS feeder links and GSO/FSS systems.[127] We stated that any coordination between the GSO/FSS systems and the NGSO/MSS feeder link earth stations would be "on a first-come-first served" basis.[128] Since the adoption of the *Third NPRM*, TRW and Hughes have negotiated mutually acceptable sharing principles. Although these sharing principles were worked out between TRW and Hughes, other GSO/FSS applicants, GE Americom, AT&T and Lockheed Martin, support the principles. Therefore, we conclude that the "first-come-first served" coordination proposal is no longer necessary. Instead, we endorse the spectrum sharing principles developed by TRW and Hughes and supported by other GSO/FSS applicants, for their systems in the 29.25-29.5 GHz band.[129] In the following text, we describe these principles. The specific technical sharing rules we adopt are provided in Appendix B of this *Report and Order*.

73. Specifically, TRW and Hughes agreed that the system causing unacceptable interference has primary responsibility to mitigate the interference, but that neither system

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[127] *See Third NPRM* at ¶ 64.

[128] *Id.* Many GSO/FSS proponents commented on this issue and urged the Commission to eliminate the proposed first-come-first-served rule because MSS systems will likely be deployed before GSO/FSS systems and would have the advantage in coordinating. *See* Comments of GE Americom at 4; Comments of Hughes at 17 and Reply Comments of Orion at 6-7. *But see* Joint Comments of Motorola and Iridium Inc. at 14.

[129] *See ex parte* submission filed by the International Bureau to William F. Caton, (Feb. 6, 1996): *Co-Directional Frequency Sharing Between Odyssey Feeder Links and GSO/FSS Service Links in 29.25-29.5 GHz and 19.45-19.7 GHz Bands* p. 7 (dated Feb. 5, 1996).

would be required to disrupt or alter its transmissions.[130] Moreover, TRW will provide the locations of its two feeder link earth stations in the United States.[131] All GSO/FSS proponents will implement frequency and polarization selection techniques in the area of TRW's earth station complexes in order to minimize instances of unacceptable interference.

74. Furthermore, use of the band 29.25 - 29.5 GHz by another NGSO/MSS system for feeder link earth station uplinks will be subject to coordination agreements with existing GSO/FSS parties.

F. Downlink 17.7-20.2 GHz Frequency Band Segmentation

75. In the *Third NPRM*, we asked commenters to address issues concerning satellite system use of the 17.7-20.2 GHz band. Specifically, we sought comment on possible methods of accommodating NGSO/MSS feeder links operating on a reverse band working basis in the 19.4-19.7 GHz band. We also sought comment on the related issue of whether, in order to facilitate reverse band working, GSO/FSS downlinks should be designated on a non-conventional paired basis at 18.3-18.55 GHz or on a conventional basis at 19.3-19.425 GHz and 19.575-19.7 GHz for pairing with the 29.25-29.5 GHz uplink band.[132] We also sought comment on any other issues concerning downlinks that might affect the band segmentation plan.

76. Several parties commented on this issue. TRW urges the Commission to designate the 18.3-18.55 GHz band as the paired downlink for the 29.25-29.5 GHz GSO/FSS uplink band, regardless of whether reverse band working is used at 19.4-19.7 GHz.[133] It argues that doing so would facilitate deployment of NGSO/MSS feeder links. Motorola also supports providing GSO/FSS applicants flexibility regarding selection of downlink frequencies below 19.2 GHz to be paired with uplinks at frequencies below 29.5 GHz.[134] Hughes suggests that GSO/FSS systems should be allowed to use frequencies not only in the 18.3-18.55 GHz band for downlinks, but also in the 17.7-18.3 GHz band. It notes that, particularly in the 19.45-19.7 GHz band, NGSO/MSS feeder links are likely to impose significant constraints, such as exclusion and coordination zones, on GSO/FSS operations. It suggests

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[130] *Id.* at 7.

[131] TRW has identified one location in the San Luis Obispo area. The other location will be on the east coast in a low population density area.

[132] Under "conventional" uplink and downlink pairing, part of the 28 GHz band would be separated by 9.8 GHz from the uplink band. Under "non-conventional" pairing, this frequency separation may vary according to the designation of spectrum for GSO/FSS systems in different parts of the band.

[133] Comments of TRW at 29.

[134] Joint Comments of Motorola and Iridium at 16-17.

that, in order to solve this problem, applicants should be provided the additional flexibility that operations in these other frequency bands will allow. Teledesic, on the other hand, opposes designating any frequencies below 18.55 GHz for GSO/FSS uses.[135] It argues that doing so would reduce the frequencies available for pairing with its gateways and high data rate (gigalink) terminal uplinks in the 27.5-28.35 GHz bands. In response, TRW argues that Teledesic's request for sole use of frequencies in the 17.7-18.55 GHz range is unjustified.[136] Hughes notes that the uses for which Teledesic seeks protection are secondary uses. Several commenters also observed that, in the 18.6-18.8 GHz band, power limitations imposed by the ITU Radio Regulations and U.S. domestic allocations to support Space Research and Earth Exploration Satellite Service may render the band difficult to use for GSO/FSS systems, and thus flexibility is required in the pairing of uplink and downlink frequencies.

77. The 17.7-20.2 GHz band segmentation plan can be depicted as follows:

Downlink Band 17.7 - 20.2 GHz

GSO/FSS FIXED ngso/fss 1100 MHz	NGSO/FSS FIXED gso/fss 500 MHz	MSS F.L. FIXED gso/fss 400 MHz	GSO/FSS ngso/fss 500 MHz

17.7 18.80 19.30 19.70 20.20 GHz

This plan specifically designates downlinks in the 17.7-18.8 GHz band for GSO/FSS uses, the 18.8-19.3 GHz band for NGSO/FSS uses, the 19.3-19.7 GHz band for NGSO/MSS feeder links, and the 19.7-20.2 GHz band for GSO/FSS uses. These designations do not preclude the authorized use of these bands by other satellite applications on a secondary basis to the primary satellite application designated in the band.

78. With respect to GSO/FSS uses, we have designated the 19.7-20.20 GHz GSO/FSS band segment for a "conventional" downlink pairing with GSO/FSS uplinks at 29.5-30.0 GHz. In order to provide flexibility for GSO/FSS applicants, we are also designating the 17.7-18.8 GHz band for GSO/FSS uses. Although there are several restrictions on the use of this band, including the need to protect feeder links for the Broadcast Satellite Service in the 17.7-17.8 GHz band segment, power flux density limits to protect the Earth Exploration

[135] Comments of Teledesic at 7.

[136] TRW Reply Comments 22-24.

Satellite Service in the 18.6-18.8 GHz band, and the need to coordinate with Fixed Services in the 17.7-19.7 GHz band, we conclude that the flexibility afforded by 1.1 GHz of spectrum should provide sufficient downlink capacity to correspond with the 1000 MHz of uplink spectrum designated for GSO/FSS in the 27.5-30.0 GHz range.[137] We decline to limit GSO/FSS use of the bands below 18.55 GHz as requested by Teledesic. The use of these bands by GSO/FSS should not preclude their use by Teledesic on the secondary basis vis-a-vis GSO/FSS which Teledesic has proposed.

79. With respect to the NGSO/FSS uses, we designate the 18.8-19.3 GHz band segment for paired downlinks with the 500 MHz of NGSO/FSS uplinks at 28.6-29.1 GHz. As discussed *supra*, we conclude that an unconditional designation of 500 MHz for domestic NGSO/FSS use is warranted. Furthermore, while there will be constraints imposed on NGSO/FSS subscriber terminals by fixed services in the 18.8-19.3 GHz band, there is no indication on the record that the single NGSO/FSS system proposed lacks sufficient flexibility to provide downlink capacity to correspond with the designated 500 MHz of uplink spectrum.[138] Therefore, we are not designating any additional downlink spectrum for primary NGSO/FSS uses.

80. We designate the 19.3-19.7 GHz band segment for downlink NGSO/MSS feeder links. This band should be able to accommodate the systems proposed by two current licensees and could potentially accommodate additional systems, either for downlinks, or, if the system operates on a reverse band working basis, for uplinks.[139] The record establishes that sharing between all currently proposed GSO/FSS systems and NGSO/MSS feeder links is generally not feasible without imposing unacceptable constraints on the deployment of several of the proposed systems.

1. Coordination Procedures

81. GSO/FSS, NGSO/MSS feeder links and NGSO/FSS systems are all fixed satellite services. Under current rules, such services share the 17.7-19.7 GHz band with fixed services on a coequal basis.[140] Current rules require coordination of these services pursuant to

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[137] Our downlink proposal is also supported by several of the satellite applicants. *See ex parte* letter from Edward J. Fitzpatrick, (Vice President of Hughes Communications Galaxy, Inc.), Waring Partridge, (Vice President, AT&T), Philip V. Otero, (Vice President and General Counsel, GE American Communications, Inc.), and Michael D. Kennedy, (Vice President and Director Regulatory Relations), Motorola, Inc. to William F. Caton (June 5, 1996).

[138] For example the Digital Electronic Messaging Service ("DEMS") is licensed in the 18.82-18.92 GHz band.

[139] The ability to accommodate additional systems may depend on a number of factors, including bandwidth required, system orbit geometry, operation in reverse band mode, and the outcome of the WRC-97's deliberations concerning the 29.4-29.5 GHz and 19.6-19.7 GHz bands. *See* RES-120 (WRC-95).

[140] *See* 47 C.F.R. 25.202 (a)(1).