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

In Re:	)	
	)	
Amendment of the Commission's Rules to	)	ET Docket No. 97-99
Relocate the Digital Electronic Message Service	)	
From the 18 GHz Band to the 24 GHz Band	)	
and to Allocate the 24 GHz Band for Fixed	)	
Service	)	

MEMORANDUM OPINION AND ORDER

Adopted: July 9, 1998 **Released:** July 17, 1998

By the Commission:

I. INTRODUCTION

1. In this Memorandum Opinion and Order, we deny Petitions for Reconsideration filed by WebCel Communications, Inc. (WebCel), DirecTV Enterprises, Inc. (DirecTV), and BellSouth Corporation (BellSouth) as well as a Petition for Partial Reconsideration filed by the Millimeter Wave Carrier Association, Inc. (MWCA) (collectively, Petitioners).[1] In doing so, we have conducted a de novo review of the decisions that gave rise to the petitions. Based on this comprehensive review, we affirm the decisions at issue.

2. Petitioners request reconsideration of an order[2] in which the Commission, acting in response to a request by the National Telecommunications and Information Administration (NTIA), amended the U.S. Table of Frequency Allocations and Part 101 of the Commission's rules regarding

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[1] Petitions for reconsideration were filed on June 5, 1997. On July 8, 1997, Digital Services Corporation (DSC), Teligent, L.L.C. (Teligent, formerly Associated Communications, L.L.C.), and Microwave Services, Inc. (MSI) filed a Joint Opposition to Petitions for Reconsideration, Partial Reconsideration, and Clarification (collectively DEMS licensees' Opposition). On the same date Teledesic Corporation (Teledesic) filed a Consolidated Opposition to Petitions for Reconsideration (Teledesic Opposition). On July 23, 1997, WebCel, DirecTV, BellSouth and, MWCA filed individual replies.

[2] *See Amendment of the Commission's Rules to Relocate the Digital Electronic Message Service from the 18 GHz Band to the 24 GHz Band and to Allocate the 24 GHz Band for Fixed Service*, 12 FCC Rcd. 3471 (1997), as corrected by Erratum, 12 FCC Rcd. 4990 (1997) (Relocation Order).

Fixed Services (FS).[3] The amended table permits FS use of the 24.25-24.45 gigahertz (GHz) and 25.05-25.25 GHz bands (collectively, the 24 GHz band) and the relocation of the Digital Electronic Message Service (DEMS) from the 18.82-18.92 GHz and 19.16-19.26 GHz bands (collectively, the 18 GHz band) to the 24 GHz band.

3. This Memorandum Opinion and Order addresses petitions for reconsideration of our decisions, including the decision to act without notice and comment procedures.[4] We conclude that our action complies with all relevant procedural and substantive requirements and serves the public interest by facilitating the provision of DEMS on a nationwide basis, promoting competition in the point-to-multipoint telecommunications market and protecting national security interests.[5]

II. BACKGROUND

4. By way of background, we briefly describe below the development of DEMS in the 18 GHz band, the history of Government requests for protection of military satellite systems in this band, and the Commission's responses to the Government's requests. We also describe the proposed use of the 18 GHz band by non-government Fixed Satellite Service (FSS) providers, which eventually led the satellite applicant in that service to agree to reimburse the DEMS licensees for certain costs associated with their relocation to the 24 GHz band in order to facilitate the relocation.

A. Development of Digital Electronic Message Service

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[3] The term "Fixed Service" refers to terrestrial point-to-point or point-to-multipoint microwave services.

[4] The DEMS licensees submitted a request to file a surreply, that WebCel opposed with an accompanying motion for expedited resolution. In addition, Teledesic had previously filed a petition to deny and a request for declaratory ruling to determine the underlying status of the DEMS licenses. However, Teledesic subsequently filed a request to withdraw that petition. WinStar Communications, Inc. also filed a petition for clarification on June 5, 1997, and a reply. However, on October 7, 1997 WinStar filed a request to withdraw these pleadings. Additionally, MWCA filed a motion for expedited resolution. We grant the DEMS licensees' request to file a surreply, Winstar's request to withdraw its petition for clarification, and Teledesic's request to withdraw its petition to deny. We also dismiss MWCA's and WebCel's motions for expedited resolution as moot in light of our decision today, and deny WebCel's opposition to the DEMS licensees' motion to file a surreply.

[5] We also deny applications for review and petitions for reconsideration filed by WebCel, BellSouth, MWCA and DirecTV of the Order dated June 24, 1997, issued by the Wireless Telecommunications Bureau's Public Safety and Private Wireless Division, modifying DEMS licenses to specify operation in the 24 GHz rather than the 18 GHz band. The parties argue that the Modification Order should not have been issued, or should be stayed, pending resolution of their challenges to the Relocation Order. Our denial of the challenges to the Relocation Order moots the petitioners' challenges to the Modification Order.

5. In 1983, the Commission adopted rules for DEMS, which was envisioned as a high-speed, two-way, point-to-multipoint terrestrial microwave transmission system.[6] The service was allocated spectrum in the 18.36-18.46 GHz band paired with the 18.94-19.04 GHz band. Subsequently, the Commission modified the initial DEMS allocation, instead designating spectrum in the 18.82-18.92 GHz and 19.16-19.26 GHz bands.[7]

6. The Commission began to grant DEMS licenses in the early 1980's, but the service was not initially commercially successful. Frequently, licensees had to return their licenses because they had not met construction requirements. The high cost of equipment appears to have been one of the many issues involved in the service's lack of early success. In the early 1990s, a small number of companies, including Associated, DSC, MSI and FirstMark, began acquiring licenses in approximately thirty of the country's largest markets.[8] These are the licenses that are now at issue.

B. NTIA Requests for Spectrum Reallocation.

1. NTIA Request to Amend The Table of Allocations to Permit Government Satellite System Operations in the 18 GHz Band.

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[6] DEMS systems are point-to-multipoint microwave networks designed to communicate information between a fixed main (nodal) station and a number of fixed user terminals. When the FCC originally identified spectrum in the 18 GHz band for DEMS in 1981, the primary use was expected to be by businesses requiring internal networks to distribute documents, share data, and hold teleconferences. Licensed for both common carrier and private use, DEMS is now governed by Part 101 of the FCC's rules. *See Amendment of Parts 2, 21, 74 and 94 of the Commission's Rules to Allocate Spectrum at 18 GHz for, and to Establish other Rules and Policies Pertaining to, the Use of Radio in Digital Termination Systems and in Point-to-Point Microwave Radio Systems for the Provision of Digital Electronic Message Services, and for other Common Carrier, Private Radio, and Broadcast Auxiliary Services; and to Establish Rules and Policies for the Private Radio Use of Digital Termination Systems at 10.6 GHz*, 54 R.R.2d 1091 (1983).

[7] *See Amendment of Parts 2, 21, 74 and 94 of the Commission's Rules to Allocate Spectrum at 18 GHz for, and to Establish other Rules and Policies Pertaining to, the Use of Radio in Digital Termination Systems and in Point-to-Point Microwave Radio Systems for the Provision of Digital Electronic Message Services, and for other Common Carrier, Private Radio, and Broadcast Auxiliary Services; and to Establish Rules and Policies for the Private Radio Use of Digital Termination Systems at 10.6 GHz*, 56 R.R.2d 1171 (1984).

[8] On March 5, 1996, DSC and MSI entered into the "Teligent joint venture." As a result, DSC and MSI jointly own Teligent L.L.C. (formerly Associated Communications L.L.C.). *See* DSC's, MSI's and Teligent's Joint Opposition at 1, 6. On March 10, 1997 Associated accepted the contribution of all of the issued and outstanding stock of Firstmark. *See* Joint Notice of Settlement Agreement and Motion to Withdraw and/or Amend Pending Applications, (FCC File No. 9407441 and 9407423).

7. Prior to 1995, the 17.7-19.7 GHz band, in which DEMS was located, was allocated only for non-government fixed service (FS), mobile, and fixed satellite service (FSS).[9] On July 12, 1995, NTIA requested that the Commission add a footnote to the U.S. Table of Frequency Allocations to designate, on a co-primary basis, the 17.8-20.2 GHz band for Government space-to-earth (downlink) FSS operations.[10] NTIA informed the Commission that this matter involved "military functions, as well as specific sensitive national security interests, of the United States," and that adding the footnote was "essential to fulfill requirements for Government space systems to perform satisfactorily."[11]

8. Relying on 5 U.S.C. § 553 (a)(1), (b)(3)(B) and *Bendix Aviation Corp. v. F.C.C.*,[12] NTIA asked the Commission to forego the usual notice and comment rulemaking procedures and immediately amend the U.S. Table of Frequency Allocations because the matter involved the exercise of military functions of the United States. Based on NTIA's statements, the Commission added footnote US334 to the U.S. Table of Frequency Allocations and amended Government Footnote G117 without public notice and comment.[13] This action gave Government military satellite systems co-primary status in the 17.8-20.2 GHz band. Because of the potential for non-government FS systems to cause harmful interference to Government FSS operations, NTIA requested that coordination procedures be established to protect two Government earth stations operating in accordance with footnote US334. Discussions between Commission and NTIA staff were initiated to determine appropriate coordination procedures. As a result of those discussions, the Commission adopted interim coordination procedures.[14]

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9 47 C.F.R. § 2.106 (1995).

10 Letter from Larry Irving, Administrator, NTIA to Reed E. Hundt, Chairman, FCC, dated July 12, 1995 (July 1995 NTIA letter). Section 305(a) of the Communications Act as amended (the Act), 47 U.S.C. § 305(a), authorizes the President to assign frequencies to Federal Government stations. This authority has been delegated to the Assistant Secretary of Commerce for Communications and Information, who also serves as the Administrator of NTIA. *See* Pub. Law 102-538, 106 Stat. 3533 (1992). The Commission administers non-Government spectrum and NTIA administers Government spectrum. *See* 47 C.F.R. § 2.105 (a).

11 July 1995 NTIA letter at 1.

12 272 F.2d 533 (D.C. Cir. 1959), *cert. denied sub nom., Aeronautical Radio, Inc. v. U.S.*, 361 U.S. 965 (1960) (*Bendix*).

13 *See Amendment of Part 2 of the Commission's Rule to Allocate Spectrum for the Fixed Satellite Service in the 17.8 - 20.2 GHz Band for Government Use*, 10 FCC Rcd. 9931 (1995) (adding footnote US334 and G117 to the U.S. Table of Frequency Allocations without public notice and comment based upon the military exemption to the APA). Footnote US334 reads: "In the Band 17.8-20.2 GHz, Government space stations and associated earth stations in the fixed-satellite (space-to-Earth) service may be authorized on a primary basis. For a Government geostationary satellite network to operate on a primary basis, the space station shall be located outside the arc measured from East to West, 70^0 W to 120^0 W. Coordination between Government fixed-satellite systems and non-government systems operating in accordance with the United States Table of Frequency Allocations is required." Footnote G117 limits Government Fixed Satellite Service (FSS) use of specified frequency bands to military systems. The amendment added the 17.8-20.2 GHz band to the bands listed in G117.

14 *See Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services*, 11 FCC Rcd. 13449, 13462 (1996).

2. *NTIA Requests to Protect Military Satellite Systems Operating in the 18 GHz Band from Interference.*

9. In January 1997, and again in March 1997, NTIA, on behalf of DoD, formally requested that the Commission take action to protect military satellite system operations in the 18 GHz band.[15] NTIA stated that DEMS use of frequencies in the 17.8-20.2 GHz bands within 40 kilometers of existing Government FSS earth stations "will not be possible."[16] As a result NTIA asked the Commission to protect those Government satellite earth stations operating in the 18 GHz band in Washington, D.C. and Denver, and "[e]xpeditiously undertake any other necessary actions, such as amending the Commission's rules and modifying Commission issued licenses."[17] Specifically, in its January 1997 letter, NTIA stated:

> We are asking that these actions be undertaken on an expedited basis. As we have previously indicated, this matter involves military functions, as well as specific sensitive national security interests of the United States. These actions are essential to fulfill requirements for Government space systems to perform satisfactorily.
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> The Commission is permitted to amend its Rules without complying with the notice provisions of the Administrative Procedures Act (APA) in cases involving any "military, naval of [sic] foreign affairs function of the United States" or where the agency for good cause finds "notice and public procedure. . . are impracticable, unnecessary, or contrary to the public interest."[18]

10. To protect the two Government earth stations from interference, NTIA proposed to make 400 MHz of spectrum available in the 24 GHz band so that the Commission could relocate DEMS licensees. Recognizing the Commission's objective of maintaining DEMS on a uniform, nationwide frequency band, NTIA stated that "[t]aking into account our common interests, [NTIA] could make available spectrum in the region of 24.25-24.65 GHz" and suggested that "the Commission take such steps as may be necessary to license DEMS stations in this spectrum. . . . "[19]

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[15] *See* Letter from Richard Parlow, Associate Administrator, Office of Spectrum Management, NTIA to Richard Smith, Chief, Office of Engineering and Technology, FCC dated January 7, 1997 (January 1997 NTIA letter); and Letter from Richard Parlow to Richard Smith, dated March 5, 1997 (March 1997 NTIA letter).

[16] January 1997 NTIA letter at 2.

[17] *Id.* at 1.

[18] *Id.* at 2 (citations omitted).

[19] *Id.*

11. On March 5, 1997, NTIA reiterated its request for protection of Government systems using the 18 GHz band and further discussed the issues regarding use of that spectrum.[20] NTIA stated again that it had "determined that both existing and anticipated FCC licensees could cause interference problems to the Federal Government use of the 18 GHz band."[21] Consequently, NTIA offered to withdraw Government co-primary allocations for radionavigation service in the 24.25-24.45 and 25.05-25.25 GHz bands to clear the way for DEMS relocation.[22]

C. The Relocation Order and The Modification Order

12. On March 14, 1997, the Commission amended its rules to adopt the changes requested by NTIA, without notice and comment. Specifically, it amended the U.S. Table of Frequency Allocations and Part 101 of its rules regarding FS.[23] The amendments permitted FS use of the 24 GHz band, thus facilitating the relocation of DEMS from the 18 GHz band to the 24 GHz band. It also required incumbent DEMS licensees to cease operations in the 18 GHz band in the Washington, D.C. and Denver, Colorado areas immediately in order to protect Government operations. In all other areas, incumbent DEMS licensees were directed to cease operations no later than January 1, 2001.[24] In order to effectuate the relocation, the Commission indicated that it would exercise its authority under section 316 of the Communications Act to modify licenses.[25] Explaining the basis for its decision to relocate the entire DEMS service, the Commission stated that "moving the Washington, D.C. and Denver, Colorado operations only . . . would effectively preclude these areas from getting DEMS service, since it is unlikely that 24 GHz equipment could be manufactured at economic prices solely for these two markets."[26] In addition, the Commission believed that maintaining DEMS on a single frequency band nationwide served the public interest "by ensuring that services are deployed so that consumers are not disadvantaged by greater complexity in providing

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[20] March 1997 NTIA letter.

[21] *Id*. at 1.

[22] These frequencies differed slightly from the 24.25-24.65 GHz band originally proposed in the January 1997 NTIA letter. The modified frequencies, 24.25-24.45 GHz and 25.05-25.25 GHz, maintain frequency separation between paired FS channels afforded DEMS at 18 GHz. This frequency separation simplifies and lowers the cost of equipment design and construction.

[23] Relocation Order at ¶ 13.

[24] *Id*. at ¶ 14.

[25] *Id.* (Section 316 provides that any station license or construction permit may be modified by the Commission either for a limited time or the duration of its term if in the Commission's view such action will promote the public interest, convenience, and necessity. Section 316(a)(1) of the Communications Act as amended, 47 U.S.C. §316).

[26] Relocation Order at ¶ 11.

service to their geographic location."[27] Accordingly, the Commission sought "to maintain the DEMS on a unified frequency band nationwide."[28]

13. The Commission also concluded that the 400 MHz of spectrum offered by NTIA in the 24 GHz band would adequately meet the needs of DEMS licensees. It determined that, because of differences in propagation characteristics between the 18 GHz and 24 GHz bands, a fourfold increase in spectrum was necessary to maintain DEMS system performance in the 24 GHz band at a level equivalent to that at which it had operated in the 18 GHz band.[29] Thus, the Commission allocated to DEMS the 400 MHz of spectrum offered by NTIA in the 24 GHz band. Subsequently, on June 25, 1997, the Wireless Telecommunications Bureau Public Safety and Private Wireless Division issued an Order (the Modification Order) modifying existing DEMS licenses pursuant to section 316 of the Act to provide for operation in the 24 GHz band instead of the 18 GHz band.[30]

D. Sharing Issues Between 18 GHz Non-Government Satellite Services and DEMS

14. The Commission's Relocation Order also had an impact on other issues that had arisen concerning potential interference between DEMS licensees and domestic non-geostationary orbit fixed satellite service (NGSO/FSS) licensees. Because the Petitioners for reconsideration raise issues concerning these matters, they are described briefly below.

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27 *Id*.

28 *Id*. We note that this is consistent with Commission policy with respect to other services. *See e.g. Amendment of Parts 2, 21, 74 and 94 of the Commission's Rules to Allocate Spectrum at 18 GHz*, 54 RR2d 1091, 1100 (1983)*; Amendment of Parts 2 and 90 of the Commission's Rules to Provide for the Use of 200 Channels outside the Designated Filing Areas in the 896-901 MHz and 935-940 MHz Bands allotted to the Specialized Mobile Radio Pool*, 8 FCC Rcd. 1469 (1993); *Amendment of Part 90 of the Commission's Rules to Provide for the Use of the 220-222 MHz band by the Private Land Mobile Radio Services*, 4 FCC Rcd. 8593 (1989); *Establishment of Policies and Procedures for Consideration of Application to Provide Specialized Common Carrier Service in the Domestic Public Point-to-Point Microwave Radio Service and Proposed Amendments to Parts 21, 43, and 61 of the Commission's Rules*, 29 FCC 2nd 870 (1971).

29 Relocation Order at ¶11.

30 *See In the Matter of Amendment of the Commission's Rules to Relocate the Digital Electronic Message Service from the 18 GHz Band to the 24 GHz Band and to Allocate the 24 GHz Band for Fixed Service*, 12 FCC Rcd. 8266 (1997).

15. In July 1996, the Commission designated 500 MHz of spectrum in the 18.8-19.3 GHz band for NGSO/FSS downlinks to help meet increased demand for spectrum for these services in the Ka-band.[31] In the order designating this spectrum (the 28 GHz Order),[32] the Commission observed that there was an overlap in the radio spectrum used by the NGSO/FSS downlinks and DEMS in the 18 GHz band that could possibly lead to harmful interference between the systems. However, consistent with its practice of coordinating FS and FSS use in other bands, the Commission stated that "[w]hile 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."[33]

16. At the time of the 28 GHz Order, Teledesic was the only applicant for an NGSO/FSS system in the 28 GHz band. Although it had previously taken the position that spectrum sharing in the 18 GHz band between NGSO/FSS and FS was feasible, Teledesic indicated shortly after the 28 GHz Order was issued that coordination between the two services might present difficulties. On August 23, 1996, Teledesic filed a request to freeze new license applications, renewals, extensions, amendments, or modifications for FS at 18.82-18.92 GHz and 19.16-19.26 GHz and any applications for NGSO/FSS earth stations intending to use the 18.80-19.3 GHz bands.[34] Teledesic suggested that, in light of a large number of applications filed at that time for new DEMS licenses, a freeze on the 18 GHz band would allow NGSO/FSS and DEMS licensees to discuss the potential for sharing in the 18 GHz band. On August 30, 1996, a joint order issued by the Commission's Wireless Telecommunications Bureau and the International Bureau (the Bureaus) froze new license applications, renewals, extensions, amendments, and modifications in these bands (18 GHz Freeze Order) for both DEMS and NGSO/FSS.[35]

17. On September 6, 1996, Teledesic also filed another pleading alleging various violations by DEMS licensees of the Commission's construction and licensing rules and opposing the grant of

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[31] The Ka-band refers to the uplinks in the 27.50-30.0 GHz frequency band, which is paired with downlinks in the 17.7-20.2 GHz band.

[32] *See 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*, 11 FCC Rcd. 19005 (1996) (28 GHz Order). The corresponding NGSO/FSS uplinks were designated in the 28 GHz band by that same order.

[33] *Id*. at ¶ 79.

[34] *See* Letter from Scott Blake Harris, counsel for Teledesic, to Michele Farquhar, Chief, Wireless Telecommunications Bureau dated, August 23, 1996 (requesting a freeze on acceptance of applications for new DEMS facilities and NGSO/FSS earth stations).

[35] *See Freeze on the Filing of Applications for New Licenses, Amendments, and Modifications in the 18.8 - 19.3 GHz Frequency Band*, 11 FCC Rcd. 22363 (1996). The DEMS licensees filed a petition for reconsideration of that order on September 30, 1996. Because the Relocation Order rescinded the Freeze Order, the DEMS licensees' petition is moot.

pending DEMS applications.[36] On September 27, 1996, MSI and DSC filed a petition for limited reconsideration of the 28 GHz Order, requesting that the Commission reconsider its designation of spectrum at 18.8-19.3 GHz band for NGSO/FSS downlinks.[37]

18. Meanwhile, Teledesic and the DEMS licensees were engaged in discussions regarding possible technical solutions to resolve the sharing issues that gave rise to the 18 GHz Freeze Order. On February 27, 1997, Teledesic and the DEMS licensees reached an agreement under which Teledesic agreed to reimburse the DEMS licensees for certain costs resulting from the relocation of DEMS licensees to the 24 GHz band. Teledesic supported this approach because it eliminated the potential for DEMS interference to Teledesic's planned satellite system.[38]

19. On March 14, 1997, the same day the Commission adopted the Relocation Order, Teledesic's pending applications to operate its NGSO/FSS satellite system in the 18 GHz band were granted.[39] The Commission concurrently rescinded the Bureaus' action in the 18 GHz Freeze Order and established procedures for addressing pending DEMS applications.[40] On March 21, 1997, Teledesic, in conjunction with MSI and DSC, filed a motion to withdraw Teledesic's September 6, 1996 petition regarding the DEMS licenses. After receiving the Teledesic filing, staff of the Commission's Compliance and Information Bureau, at the request of the WTB's Enforcement Division, conducted an investigation of the DEMS licensees's compliance with the Commission's construction and operating requirements. Through on-site inspections and information provided by the licensees, CIB staff determined that the licensees were in compliance with the Commission's construction and licensing rules. On April 2 and 8, 1997, the WTB's Enforcement Division informed MSI and DSC that it had concluded the investigation it had been conducting into MSI and DSC's

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36 Teledesic's Consolidated Petition to Deny and to Determine Status of Licenses (filed September 6, 1996) (asserting pending applications should be denied, grants of multiple channel pairs should be rescinded, and that the Commission determine if DEMS stations were properly constructed).

37 *See* Joint Petition for Limited Reconsideration (filed September 27, 1996).

38 *See* Letter from Russell Daggatt, President, Teledesic Corporation and Laurence Harris, Counsel for Association Communications, Inc. to Michelle Farquhar Chief, Wireless Telecommunications Bureau and Donald Gips, Chief, International Bureau dated February 27, 1997.

39 *See Teledesic Corporation Application for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the Domestic and International Fixed Satellite Service,* 12 FCC Rcd. 3154 (1997).

40 *See* Relocation Order at ¶¶ 16-17. We indicated that we would grant pending applications which had passed both the 30-day Public Notice period and the 60-day cut-off period for competing applications and for which no mutually exclusive applications had been filed. We also indicated we would grant pending applications for nodal stations within markets for which a license had been granted. DEMS applications that were pending at the time of the 18 GHz freeze but which had not passed the 60-day cut-off period for competing applications because of the freeze on the filing of new applications were dismissed because we could not predict if competing applications would have been filed and because of our decision to move DEMS operations to 24 GHz.

compliance with the Commission's DEMS rules and had decided not to take any enforcement action.[41]

III. DISCUSSION

20. BellSouth, DirecTV and WebCel filed petitions for reconsideration of the Relocation Order, and MWCA filed a petition for partial reconsideration. The petitions allege the following infirmities in the Relocation Order: (1) improper application of the APA's military and good cause exemptions from notice and comment rulemaking; (2) failure to address the underlying validity of the DEMS licenses; (3) failure to specify sufficient reasons to increase the amount of spectrum allocated for DEMS in the 24 GHz band; and (4) failure to consider the public interest consequences of creating a "de facto DEMS monopoly." DirecTV also argues that our action failed to address the potential uses of the 24 GHz band for feeder links in conjunction with the Broadcast Satellite Service (BSS).[42] We address these arguments below.

A. Application of the APA's "Military Affairs" and "Good Cause" Exemptions

21. Petitioners argue that the Commission's action reallocating spectrum for DEMS at 24 GHz on a nationwide basis was beyond the scope of the military affairs exemption and should, therefore, have been taken only after notice and comment. BellSouth argues that military affairs are not directly involved with the operations in the 24 GHz band because the military was using the 18 GHz band, not the 24 GHz band, and the military exemption would therefore only allow the Commission to restrict non-government use of the 18 GHz band.[43] Similarly, WebCel states that there is nothing involved in the nationwide relocation of DEMS from the 18 GHz to the 24 GHz band which directly involves national security or military affairs, and that if there is any legitimate national security issue, it applies only to DEMS licenses in the Washington, D.C. and Denver, Colorado areas.[44] DirecTV likewise asserts that "[t]he Commission's desire to maintain DEMS on a unified frequency band nationwide may or may not be a rational policy objective, but the Commission has not and cannot explain how the relocation of *all* DEMS licensees from the 18 GHz band . . . falls within the 'military function' exception to the APA."[45]

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41 Letter from Howard C. Davenport, Chief, Enforcement Division, Wireless Telecommunications Bureau, to Jay L. Birnbaum, Counsel for MSI, dated April 2, 1997, and Letter from Howard C. Davenport to Hal B. Perkins, Counsel for DSC, dated April 8, 1997.

42 Concurrently with the filing of its petition for reconsideration, DirecTV filed a petition for rulemaking seeking to implement an allocation at 24 GHz for BSS and an application for a BSS system to operate in that allocation.

43 BellSouth petition at 7.

44 WebCel petition at 10.

45 DirecTV petition at 15-16 (citation omitted) (emphasis in original).

22. The Petitioners do not contest the fact that continued operation of DEMS facilities posed a risk of interference to military satellite earth stations in Washington, D.C. and Denver, Colorado. Rather, they argue, in essence, that the Commission was obliged to fashion the narrowest possible solution to the national security problem. We reject petitioner's argument. There is nothing in the APA or the case law interpreting the military affairs exemption that suggests that the Commission was not permitted to consider the impact on Commission licensees and the public of various possible solutions to the potentially harmful interference that might be caused to the military satellite systems.

23. Section 553(a) of the APA states that "this section applies, according to the provisions thereof, except to the extent that there is involved- (1) a military or foreign affairs function of the United States."[46] In interpreting this provision, the courts have established that the military function exemption applies to civilian agencies when a military function is involved, and that the exemption applies when the activities being regulated directly impact that function. Moreover, there is nothing in the express terms of the statute, its legislative history, or case law interpreting it that suggests that where a military function is "involved" the agency must disentangle and treat separately those matters or concerns that are logically connected to, tied up with, or that naturally flow from, consideration of the military function at issue. Indeed, a fair reading of the statute suggests that it would be inappropriate to limit a civilian agency's discretion to apply the exemption merely to situations where a military function would be the only interest affected. Use of the term "involved" suggests that Congress intended the exemption to cover a broader category of administrative decisions. Thus, Section 553(a) of the APA permits the Commission to forego the procedural requirements that typically apply in rulemakings in matters directly impacting a military function of the United States.

24. We believe the Commission's actions in the Relocation Order are consistent with this standard. Contrary to Petitioner's suggestions, Section 553(a) does not constrain the Commission's authority to select the optimum solution to a problem involving a military function where matters and concerns logically connected to consideration of that function are also at issue. Although the Commission considered, as one possible solution, relocating only those DEMS licensees in the Washington, D.C. and Denver, Colorado regions, it concluded that doing so "would effectively preclude these areas from getting DEMS service since it is unlikely that 24 GHz equipment could be manufactured at economic prices solely for these two markets."[47] At the time the Commission reached that conclusion, there was no equipment commercially available to provide DEMS, or any other point-to-multipoint service at 24 GHz, nor had any company applied for type acceptance to manufacture such equipment. The nearest frequencies for which terrestrial fixed equipment was available was in the 23 GHz band, and that equipment was designed to provide point-to-point service

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[46] 5 U.S.C. § 553(a)(1).

[47] Relocation Order at ¶ 11.

and thus was not suitable for point-to-multipoint DEMS.[48] Based on the Commission's experience, the Commission believed it was unlikely that there would be sufficient demand for DEMS service in just two market areas to give manufacturers adequate incentives to develop and produce 24 GHz equipment to provide such service. And if such equipment were manufactured, the Commission believed it would be prohibitively expensive. Thus, the Commission concluded that modification of only the Washington, D.C. and Denver, Colorado licenses to specify operations at 24 GHz would have been tantamount, as a practical matter, to revoking authority for DEMS operations in those two cities.[49] It was entirely consistent with the APA exceptions for the Commission to take account of these concerns in the process of resolving the military function concerns at issue.

25. DEMS licensees are planning to use their licenses to provide wireless local phone and data services that will compete with local exchange services currently available only, or primarily, from local exchange carriers. Action resulting in the termination of DEMS in two major markets would have unnecessarily deprived the public of DEMS service in those markets. It also could have had a deleterious effect on competition in the point-to-multipoint communications market in those areas. Because NTIA's offer of 24 GHz spectrum enabled the Commission to avoid these potential adverse results, its decision was the most reasonable resolution of the interference problem and the one that best served the public interest.

26. Although the Petitioners suggest that public comment on use of the 24 GHz spectrum would have been useful, we note that NTIA made spectrum in the 24 GHz band available solely as a means to accommodate DEMS relocation. The spectrum was thus offered solely to relocate DEMS and thereby remove the source of potential interference to the military system. The spectrum was not available for any other purpose. Public rulemaking proceedings would not have altered these facts or enlarged the possible uses of that spectrum. DirecTV's argument that we should have held a rulemaking to determine "what impact the DEMS Order would have on other affected parties who had intended to use the 24 GHz band," and whether allocating a smaller amount of spectrum at 24 GHz "would have had a less preclusive effect on other 24 GHz services," ignores this essential fact.[50] In fact, the Relocation Order eliminated a preclusive effect by removing the government allocation in the 24 GHz band, thus clearing the way for the Commission to make additional assignments in that band more easily.

27. Moreover, piecemeal resolution of the issues facing the DEMS licensees -- by relocating the Washington, D.C. and Denver, Colorado DEMS licensees first and then conducting a rulemaking to determine the fate of the rest of the DEMS nationwide -- was not in the public

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[48] We note that in order to maintain service in the Washington, D.C. and Denver, Colorado areas DSC and MSI applied for temporary authority to operate non-type accepted, modified 23 GHz point-to-point equipment. Point-to-Point equipment is suitable to serve only a limited number of users and provides interim service while point-to-multipoint equipment is developed.

[49] Relocation Order at ¶11.

[50] *See* DirecTV petition at 13 and n. 37.

interest. Delaying the spectrum allocation decision would have subjected DEMS licensees to unnecessary and perhaps prolonged uncertainty (depending upon how long it took to conduct a rulemaking and resolve any challenges to the Commission's decision) and disrupted DEMS business plans just as the service was beginning. Our decision to relocate all DEMS licensees simultaneously clearly enhanced the prospects that manufacturers would respond with suitable equipment, and that DEMS would be a viable service.[51] Given the additional risks to the DEMS posed by piecemeal relocation, and the fact that allocating the 24 GHz spectrum offered by NTIA to DEMS did not deprive any non-government user of a legitimate expectation of access to that spectrum, we believe that the Commission properly exercised its discretion under the military affairs exemption to dispense with notice and comment.

28. Further, there would have been no assurance that DEMS licensees in Washington, D.C. and Denver, Colorado, faced with major questions concerning the continued viability of their service in a new frequency band, would have effectuated a speedy transition to the new spectrum if they alone had been required to relocate. Their voluntary compliance and cooperation avoided legal challenges to modification of their licenses under Section 316 of the Act, thereby expediting their relocation to the 24 GHz band. In short, the bifurcated procedure advocated by Petitioners would have created risks both to DEMS and to accomplishment of NTIA's military affairs objective, without any clear benefits. It was appropriate for the Commission to take these factors into account in its relocation decision.

29. BellSouth suggests that national security concerns were a mere pretext for the Commission's decision to relocate DEMS licensees to the 24 GHz band, and that the Commission "appears to have been driven more by the desire to aid Teledesic and Associated than to address Defense Department needs."[52] BellSouth's assertion that the military requirements advanced by NTIA were not urgent is belied by NTIA's January 7, 1997 and March 5, 1997 letters, both of which stressed the need for expeditious action by the Commission. The January 7 letter specifically stated:

> We are asking that these actions be undertaken on an expedited basis. As we have previously indicated, this matter involves military functions, as well as specific sensitive national security interests of the United States and that these actions are essential to fulfill requirements for Government space systems to perform satisfactorily.
>
> The Commission is permitted to amend its Rules without complying with the notice provisions of the Administrative Procedures Act (APA) in cases involving any, "military, naval of [sic] foreign affairs function of the United States". . . .[53]

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[51] Following release of the Relocation Order, we received the first application for type acceptance of 24 GHz equipment. *See* Type Acceptance of FCCID: JXB24XP4-04T granted May 20, 1997.

[52] Bell South Reply at 3.

[53] January 7, 1997 NTIA letter at 2 (citations omitted).

Thus, we disagree with BellSouth's suggestion that there was no urgent military need and its suggestion that the Commission's Relocation Order was not motivated to fulfill that need.

30. The only concrete statement that BellSouth cites to support its claim is a footnote contained in the Relocation Order that refers to the "consensual nature" of the DEMS relocation.[54] That footnote does not, as BellSouth asserts, demonstrate that the Commission's decision was "fundamentally intended to achieve the non-military objective of resolving the Associated-Teledesic dispute."[55] Rather, it stated the obvious fact that although the DEMS licensees would be afforded the 30-day protest period set forth in Section 316 of the Communications Act for license modifications, the Commission did not anticipate any protests because those licensees had agreed to the relocation.[56] The fact that DEMS licensees preferred having their licenses modified nationwide to specify the 24 GHz frequencies rather than being forced to operate in different frequency bands in different cities was not surprising because it appeared unlikely that affordable equipment would be manufactured for operation at 24 GHz in only two cities. In short, there is nothing in the Relocation Order to support BellSouth's allegation that the Commission's decision was not intended to resolve the military problem presented by NTIA.

31. The Commission's actions did have the additional, beneficial effect of avoiding interference between DEMS facilities and proposed satellite systems in the 18 GHz band. But that does not mean that solving the military's problem was a mere pretext for the Commission's action. The Relocation Order made it clear that the Commission was taking action there to "advance, support and accommodate the national defense."[57] The fact that the Commission was able to accommodate the military without harming DEMS service, and that its action had other beneficial public interest consequences, does not invalidate the Commission's decision or remove it from the scope of the military affairs exemption.

32. DirecTV and MWCA argue that the D.C. Circuit's decision in *Bendix* undercuts the Commission's action relocating DEMS to the 24 GHz band without notice and comment because the Commission conducted a notice and comment rulemaking before allocating replacement spectrum in the *Bendix* case.[58] We disagree with this interpretation. The *Bendix* case involved a number of frequency bands[59] in which the Commission in fact modified frequency allocations without any notice

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54 BellSouth Petition at 15.

55 *Id*.

56 *See* Relocation Order at ¶ 14 and n. 20.

57 *Id.* at ¶ 1. *See also Id.* at ¶¶ 2-6.

58 *See* DirecTV Reply at 8; MWCA Reply at 9.

59 These bands include: 1350-1400 MHz, 3100-3300 MHz, 3500-3700 MHz, 5100-5250 MHz, 8400-8500 MHz, 8500-9000 MHz, 9200-9300 MHz, 9500-9800 MHz and 13225-13250 MHz.

or opportunity for comment.[60] The court held that, considering national defense requirements, the Commission's action was justified and consistent with the military function exemption.[61]

33. Further, the Section 553(a) exemptions confer discretion on agencies to decide whether to conduct rulemaking proceedings when a matter involves a military or foreign affairs function of the United States.[62] The fact that the Commission may have found it useful to conduct such proceedings in one case does not limit its discretion to dispense with such proceedings in another case to which the exemption applies. For example, in the *Bendix* case, of the nine frequency bands reallocated by the Commission, two of which were reallocated from exclusive Government to exclusive non-government use as replacement bands,[63] no opportunity for comment was provided.[64] However, the public was afforded the opportunity to comment on a separate frequency band proposed as shared Government/non-government use.[65] The Commission sought comment on this band because it was concerned about the availability of equipment suitable for use in this "replacement" band proposed for displaced non-government radionavigation services.[66] In this proceeding, in contrast, the Commission's action *alleviated* concerns regarding the availability of appropriate equipment to be utilized in the replacement spectrum rather than giving rise to such concerns, as in *Bendix*. Thus, there was no need to seek public comment on additional frequency bands and, as discussed above, the delays associated with rulemaking proceedings would have unnecessarily increased the risks to DEMS licensees.

34. BellSouth and MWCA also assert that the Commission's actions exceed the scope of the military exemption, as interpreted by the Ninth Circuit in *Independent Guard Ass'n v. O'Leary*.[67] They argue that the Commission's relocation of DEMS licensees to the 24 GHz band was not within

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60 *See Amendment of Parts 2, 4 7, 8, 9, 10, 11, 12, 16 and 21 of the Commission's Rules and Regulations to reallocate certain frequency bands above 25 mc, now designated for exclusive Amateur or other non-Government use, to Government services on a shared or exclusive basis, and conversely to reallocate to non-Government use certain bands now designated for Government use,* 17 Rad. Reg. 1505 (P & F) (1958) (Amendment Order) (Reallocating nine frequency bands: six from shared Government/non-government use to exclusive Government use; two from exclusive Government use to exclusive non-government use and; one from shared Government/Non-government use to shared Government/amateur use).

61 *Bendix* at 542.

62 *See* 47 U.S.C. § 553(a); H. Rep. No. 1980, 79th Cong., 2d Sess. 23 (1946).

63 *See Amendment Order* at ¶ 3 (designating previously exclusive government bands as exclusive non-government bands as compensation for the loss of non-government bands).

64 Amendment Order at 1505-1506.

65 *See* Frequency Allocations and Radio Treaty Matters; General Rules and Regulations, Docket No. 12404 (April 18, 1958).

66 *Bendix* at 541; *see also* 17 R.R. 1587, 1597 (1958) (noting that the Commission will continue to license non-government operations in the 8800 MHz band until it finds that equipment is available for the 13 GHz band).

67 57 F.3d 766 (9th Cir. 1995) (*O'Leary*).

the scope of the military exemption because "military affairs are not 'clearly and directly involved' with the operations on the 24 GHz band," and there was no nexus between military functions and use of the 24 GHz band.[68]

35. Contrary to petitioners' suggestion, our actions in this case were consistent with *O'Leary*. In that case, the Ninth Circuit held that personnel rules, including employee qualifications requirements, adopted by the Department of Energy (DOE) could not be applied to civilian security guards employed by civilian contractors to guard DOE nuclear research, production and testing facilities. Noting that the military affairs exemption applies only to the extent that a "military function" is involved, the court focused on the nature of the contractor support activities that were regulated by the challenged DOE regulations. Reasoning that the civilian guards were "no more performing a 'military function' than civilian contract guards employed to guard judges are performing a 'judicial function,'"[69] the court held that the personnel rules did not fall within the military exemption.[70]

36. The Commission relocated DEMS licensees to the 24 GHz band in order to prevent interference to military satellite systems, in response to a request made on behalf of DoD. Thus, unlike the situation in *O'Leary*, the matter here directly and unquestionably involved a military function -- a direct threat to sensitive military satellite systems by licensed facilities that this Commission, and only this Commission, had jurisdiction to regulate. Thus, there is a clear nexus between that military function and the need to relocate DEMS licensees, and the 24 GHz spectrum was made available by NTIA for the specific purpose of solving the military problem. Thus, the link between the military problem and the relocation of DEMS licensees to the 24 GHz spectrum is indisputable. To be sure, one option open to the Commission was to relocate the DEMS licensees only in the two regions that presented an immediate risk of interference to military satellite systems. But faced with a choice between that option, which the Commission considered harmful to the public interest in nationwide DEMS service, and another solution made available by NTIA's offer of 24 GHz spectrum, the Commission chose the solution that solved the military's problem *without* harming the service that was causing the interference.

37. As discussed above, the military affairs exemption was the basis for the Commission's decision to forego notice and comment rulemaking in this case. Nevertheless, because the need to solve the problem of interference to military satellite systems required expeditious action by the Commission, the "good cause" exemption, also relied on by the Commission, provided an additional, independent basis for foregoing notice and comment rulemaking procedures. As discussed above,

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[68] MWCA reply at 8, 13; BellSouth petition at 7.

[69] *O'Leary* at 770.

[70] As the Court explained further: "If the Secretary's position were adopted, and contractor support activities held to be within the scope of the military function exception, maintenance staff, custodial help, food service workers and even window washers could find their undoubtedly necessary support tasks swept within the exception's ambit, and DOE's regulations affecting their employment exempt from notice and comment." *O'Leary* at 770.

NTIA repeatedly asked the Commission to act expeditiously to solve the problem of interference to the military satellite systems and, in order to accomplish that objective, offered to withdraw Government co-primary allocations to radionavigation service to accommodate on a nationwide basis the relocated DEMS licensees. Good cause existed here for foregoing public notice and comment because of the military's need for expedition, which made rulemaking procedures impracticable.[71]

38. BellSouth and DirecTV contend, however, that good cause did not exist for foregoing rulemaking proceedings with respect to the relocation of DEMS licensees outside of Washington, D.C. and Denver, Colorado. They argue that the transition period established by the Commission for relocation of DEMS licensees outside those two cities indicates that there was no urgency to relocate spectrum on a nationwide basis and undercuts the Commission's finding of good cause.[72] This argument is unpersuasive. As explained above and in the Relocation Order, the option of relocating DEMS licensees only in Washington, D.C. and Denver, Colorado was an inadequate solution because manufacturers would be unlikely to manufacture 24 GHz equipment to serve just those markets, and if they did, such equipment would have been prohibitively expensive. Thus, in the Commission's view, DEMS service would have been essentially terminated in those two metropolitan areas, completely negating the rationale for moving them in the first place -- to preserve DEMS service in those areas.[73] Further, as explained above, the bifurcated procedure advocated by the Petitioners could have delayed relocation of even the Washington, D.C. and Denver, Colorado DEMS licensees and disrupted business plans in the entire service while the licensees awaited the outcome of the rulemaking.

39. Just as good cause existed for the Commission to act expeditiously to solve the national security problem, as we believe is manifest here, good cause justified acting expeditiously to adopt a workable solution to that problem that did not harm the public interest. The fact that the solution to the military problem was to be implemented in phases, with DEMS licensees outside the Washington, D.C. and Denver, Colorado areas given more time to relocate, does not undercut the

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[71] *See Amendment of Parts 2, 4, 7, 8, 9, 10, 11, 12, 16 and 21 of the Commission's Rules and Regulations to reallocate certain frequency bands above 25 mc now designated for exclusive Amateur or other non-Government use, to Government services on a shared or exclusive basis, and conversely to reallocate to non-Government use certain bands now designated for Government use,* 23 Fed. Reg. 2676, 2677 (April 23, 1958), *on recon.,* 17 R.R. 1587, 1590 (1959) (relying in part on good cause exemption where vital national defense considerations made compliance with APA rulemaking requirements "impracticable and contrary to the public interest"), *aff'd, Bendix Aviation Corp., v. FCC,* 272 F.2d 533 (D.C. Cir. 1959), *cert. denied sub nom. Aeronautical Radio, Inc. v. United States,* 361 U.S. 965 (1960). *See also Hawaii Helicopter Operators Ass'n v. FAA,* 51 F.3d 212 (9th Cir. 1995) (good cause existed for dispensing with APA notice and comment rulemaking where FAA adopted safety rules for airplane and helicopter tours of Hawaii following increase in air tour accidents); *Northern Arapahoe Tribe v. Hodel,* 808 F.2d 741, 751 (10th Cir. 1987) (good cause existed to forego notice and comment in order to protect wildlife from becoming endangered or extinct).

[72] BellSouth petition at 11-12; DirecTV petition at 21-22.

[73] Relocation Order at ¶ 11.

urgency of adopting a comprehensive, workable solution to the problem of interference to military satellite systems.[74]

40. For these reasons, we affirm the Commission's previous conclusion that, in addition to the military exemption, the Commission had good cause to forego notice and comment in the Relocation Order.

B. Validity of the DEMS Licenses

41. WebCel asserts that the Commission failed to address the issues raised in Teledesic's now withdrawn pleading concerning the status of certain DEMS licenses.[75] Webcel argues that the Commission must address these issues prior to relocating DEMS from the 18 GHz band to the 24 GHz band. In its original pleading, Teledesic requested that the Commission: determine whether particular licenses of MSI and DSC had automatically lapsed for failure to meet construction requirements;[76] rescind improper grants to MSI of multiple channel pairs;[77] deny MSI's then pending applications for new nodal stations that were based upon MSI's multiple channel grants;[78] and immediately issue an interim order preventing MSI and DSC from further expansion of DEMS systems.[79]

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74 *See Bendix, supra*, 17 R.R. at 1591 (the fact that some licensed services were allowed to continue operating for the duration of their licenses did not lessen the urgency of Government military requirements or Government need to "plan and implement with certainty its utilization of these frequencies on an orderly basis").

75 WebCel petition at 4; *See* Teledesic's Consolidated Petition to Deny and Petition to Determine Status of Licenses (filed September 6, 1996) (Teledesic petition); request to withdraw filed March 21, 1997.

76 The licensees at issue are: Tampa, FL, call sign WMT308; Phoenix, AZ, call sign WMT309; Minneapolis, MN, call sign WMT310; Milwaukee, WI, call sign WMT311; Washington, D.C, call sign WMT312; Philadelphia, PA, call sign WMT313; Palmdale, CA, call sign WMT314; New York, New York, call sign WMT315; Indianapolis, IN, call sign WMT316; Atlanta, GA, call sign WMT317; Chicago, IL, call sign WMT318; Pittsburgh PA, call sign WMT319; Sacramento, CA, call sign WMT320; Portland, OR, call sign WMT321; Houston, TX, call sign WMT322; Seattle, WA, call sign WMT323; St. Louis, MO, call sign WMT324; Kansas City, MO, call sign WMT325; San Antonio, TX, call sign WMT326; Miami, FL, call sign WMT327; Boston, MA, call sign WMT328; Denver, CO, call sign WMT329; Dallas, TX, call sign WMT340; Cleveland, OH, call sign WMT341; Columbus, OH, call sign WMT342.

77 San Francisco, CA, call sign WMT336; Los Angeles, CA, call sign WMT337; Houston, TX, call sign WMT330; Dallas TX, call sign WMT331; Chicago IL, WMT332; Miami, FL, call sign WMT334; Atlanta GA, call sign WMT335; Washington, D.C, call sign WMT338; Philadelphia PA, call sign WMT339; Milwaukee, WI, call sign WMF840, Indianapolis, IN, call sign WMF 841; Portland OR, call sign WMF842; Sacramento CA, WMF843; San Diego, CA, WMF844, Minneapolis, MN, WMF845; Saint Louis, MO, call sign WMF846; Cincinnati, OH, WMF847; Kansas City, MO, WMF847; Clearwater, FL, call sign WMF849; Baltimore, MD, WMF850; Phoenix, AZ, WMF851; Pittsburgh, PA, call sign WMF852; Seattle, WA, call sign WMF854; San Jose, CA, call sign WPJC396; San Antonio, TX, call sign WPJC397; Detroit, MI, WPJD304; Cleveland, OH, call sign WPJD353.

78 Teledesic challenged the applications for new nodal stations in seven specific market locations: Chicago, IL, call sign WMT332; Philadelphia, PA., call sign WMT339; Washington, D.C., call sign WMT338; Dallas, TX., call sign WMT331; Atlanta, GA., call sign WMT335; Houston, TX., call sign WMT330 and Miami, FL., call sign WMT334.

79 Teledesic petition at 2.

42. The DEMS licensees filed an opposition to Teledesic's petition, arguing that: Teledesic lacked standing to challenge MSI's 174 applications for additional nodal stations and MSI's and DSC's existing DEMS licenses; MSI's and DSC's system build-outs fully complied with Commission rules and other DEMS precedents; and Teledesic's request to "rescind" MSI's previously issued licenses was untimely.[80] The DEMS licensees further asserted that they were established incumbents who have been licensed in the 18 GHz band for over two years and are providing service to the public. The DEMS licensees contended that complaints about the number of DEMS channels that the DEMS licensees had in certain markets were "stale" challenges against applications that were filed as early as October 1993 and granted between January 1995 and January 1996. Thus, according to the DEMS licensees, the licenses were validly issued and no longer subject to administrative or judicial review at the time Teledesic's petition was filed.[81]

43. In response to Teledesic's initial request, the Commission's staff investigated the validity of the DEMS licenses issued to DSC and MSI. The staff's inspections focused on MSI's and DSC's compliance with DEMS construction and operating requirements and found no violations of such requirements.[82] WebCel provides no facts to contradict the staff's conclusions.

44. In addition to Commission staff's conclusions that there were no violations of the applicable construction and operating requirements, we note, as asserted by the DEMS licensees, that Teledesic's challenges to MSI's multiple channel grants and the derivative applications for nodal stations were grossly untimely. Our fixed microwave services rules provide that petitions to deny must be filed within 30 days after the date of public notice of the challenged application.[83] In its petition, Teledesic listed 27 DEMS authorizations which it claimed were "improvidently" granted multiple channel pairs to MSI. All of these licenses were granted on either January 10, 1995, January 18, 1996 or January 28, 1996.[84] Teledesic filed its petition on September 6, 1996, almost eight months after the last of the MSI licenses had been granted. Because these challenges to MSI's initial grants were raised, first by Teledesic and now by WebCel, well beyond the authorized filing period, they are untimely. The assertion that the related nodal station applications should be dismissed is

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80 *See* Joint Opposition to Consolidated Petition to Deny and Petition to Determine Status of Licenses (filed September 16, 1996) at 1-2.

81 *Id.* at 33-34.

82 Letter from Howard C. Davenport, Chief, Enforcement Division, Wireless Telecommunications Bureau, to Jay L. Birnbaum and Terri B. Natoli, Counsel for Associated, dated April 8, 1997, and Letter from Howard C. Davenport to Hal B. Perkins, Counsel for DSC, dated April 8, 1997.

83 47 C.F.R. § 101.43 (a)(4)(5).

84 *See* Public Notice Report Nos. 1118, 1172 and 1176.

therefore also untimely. Moreover, nothing in the petitioners' allegations persuades us that there is any legal or public interest basis for rescinding these final grants.[85]

C. DEMS Channel Bandwidth

1. Introduction

45. When the Commission relocated DEMS from the 18 GHz band to the 24 GHz band, it designated channels that are four times wider at 24 GHz than the channels established at 18 GHz. The Commission concluded that, based upon similar equipment, transmission rates, reliability and power requirements, the DEMS licensees require more spectrum at 24 GHz than at 18 GHz to support equivalent operations. It therefore determined that the relocated DEMS licensees should be assigned more bandwidth per channel in the 24 GHz band than they had at 18 GHz.

46. The Petitioners question the Commission's technical assumptions and analysis for increasing the DEMS bandwidth at 24 GHz but, for the most part, offer no factual analysis to support their allegations.[86] They generally challenge the Commission's analyses with respect to a number of technical aspects: cell size and cost; service reliability; equipment cost and system buildout; effect of rain attenuation; modulation and coding; service resource allocation (dynamic vs. fixed bandwidth allocation); and assumptions regarding current and future DEMS equipment. As discussed in detail below, we have reviewed these arguments de novo and affirm the Commission's bandwidth allocation decision.

2. Discussion

47. For the purposes of channel bandwidth designation for DEMS, the major relevant difference between the 18 GHz and 24 GHz bands is the propagation properties in each frequency band.[87] When the Commission analyzed the spectrum propagation properties at 24 GHz in order to determine the requirements for DEMS, it assumed DEMS would use the same cell size, minimally modified equipment, and provide the same service reliability as it did at 18 GHz. For the reasons discussed below, the Commission determined that maintaining these parameters would allow as rapid

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85 We note that for the Commission to set aside a final grant, especially pursuant to an untimely filed petition to deny, the Commission requires that the petitioner demonstrate a very high public interest reason for revocation. At the very least, a timely filed petition must offer factual allegations sufficient to show that grant of the application was prima facie inconsistent with the public interest. *See* 47 C.F.R. §1.106 and §309(d) of the Communications Act of 1934, as amended.

86 Despite Petitioners's generalized complaints, we note that the only party to provide any specific technical analysis regarding the allocation was WinStar in its now withdrawn petition.

87 As radio waves travel, or "propagate" through the atmosphere, the strength of the signal is reduced as the signal spreads out over a larger area. In addition, the signal is attenuated by obstacles in its path (e.g. raindrops referred to as "rain attenuation"). These signal losses are a function of a signal's frequency. The higher the frequency the more susceptible a signal is to these losses.

a transition as possible from the 18 GHz band to the 24 GHz and would allow the DEMS licensees to maintain equivalent service.[88]

a. Cell Size and Cost

48. The typical DEMS cell has a radius of approximately 5 km.[89] Petitioners argue that cell size can be varied to accommodate differences in performance and propagation, thus negating the need for additional channel bandwidth. However, to achieve the same service reliability and system performance without increasing the bandwidth or power, a typical cell radius would have to be reduced from 4.81 to 2.84 km. Thus, moving the licensees to the 24 GHz band from the 18 GHz band would require reducing the cell size by 2.8 times.[90] As a result, in order to maintain the same service the DEMS licensees would need to increase significantly the number of cells to compensate for the reduced cell size.[91]

b. Service Reliability

49. In determining the channel bandwidth needs of the DEMS licensees in the 24 GHz band, the Commission assumed a service reliability factor of 99.99%, and ITU-R rain climate K was assumed as average for the United States. Using ITU-R rain climate K, DEMS providers could maintain the same channel bandwidth at 24 GHz as at 18 GHz and account for the increased rain attenuation by accepting a lower level of service reliability (i.e. less than 99.99%). However, we note that the service reliability offered is a business decision made by the DEMS licensees, and that 99.99% is the typical offering for a telephony service and was the level of reliability planned for by DEMS licensees in the 18 GHz band.[92] Therefore, the Commission determined that it was appropriate to assume the same level of service reliability.

c. Equipment Cost and System Build-Out

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88 For a more detailed explanation of the channel bandwidth designation, see Appendix A to this Memorandum Opinion and Order.

89 *See* Document No. 7 of supplement to Public Record submitted June 3, 1997.

90 This calculation is based on using the same user terminal antenna and power amplifier in order to minimize the cost and time of the transition. The antenna gain improvement at the higher band exactly offsets the 2.3 dB higher free space loss increase; however, the power amplifier has approximately 1 dB lower performance at 24 GHz. Rain attenuation for a path reliability of 99.99% results in an additional 9.5 dB of loss. Thus 10.5 dB (9.5 rain attenuation plus 1.0 for lower power) of performance would need to be overcome. As a result, the average cell radius would have to be reduced from 4.81 to 2.84 km to achieve the same data throughput. *See id.*

91 For example, seven cells of radius 4.81 km laid out in a hexagonal grid would cover approximately 160 square miles. Covering a similar area with cells of 2.84 km radius would require 20 cells.

92 *See* Letter from Dr. Rajendra Singh, Digital Services Corp., to Steve Sharkey, Chief, Satellite Engineering Branch, Federal Communications Commission dated January 14, 1997 (noting a 99.99% reliability assumption).

50. Because the Commission's intention was to enable DEMS to be relocated from the 18 GHz band to the 24 GHz band as quickly as practicable, it based its analysis of their channel bandwidth requirements on using the same or similar equipment.[93] Simply increasing the power to overcome the additional rain attenuation[94] found at 24 GHz, as some Petitioners have suggested, would require more than 10 times as much power from the terminal equipment. Achieving this level of power would entail significant redesign of the terminal equipment. Moreover, redesigning the terminal equipment would cause schedule delays in system buildout at 24 GHz. Further, equipment which would operate at 10 times the power would be more expensive than the equipment used at 18 GHz. Most significantly, this added expense would prevent a quick transition from the 18 GHz band to the 24 GHz band. Moreover, as discussed below, equipment meeting these requirements is not currently available.

d. Rain Attenuation, Modulation and Coding and Resource Allocation

51. Moving DEMS from the 18 GHz band to the 24 GHz band requires four times the channel bandwidth at 24 GHz to account for the combined system performance losses due to rain attenuation and diminished equipment performance. The combined system performance losses can be overcome in part by: 1) changing modulation techniques;[95] and 2) eliminating the current DEMS system's "dynamic bandwidth allocation" (DBA) technique.[96] As noted in the Relocation Order, maintaining the same cell coverage area, while using similar equipment to the maximum extent possible, requires changes in modulation and system operation.[97] The DEMS licensees plan to convert from the current modulation technique of 16-TCM to QPSK.[98] Such a switch makes up for 7 dB of performance loss. However, there must be a threefold increase in bandwidth to account for the less bandwidth-efficient modulation technique of QPSK.

52. Despite recouping some performance loss by changing modulation, there are additional performance losses which must be overcome. These losses can be overcome by eliminating DBA. If DBA is eliminated, a single signal can be permanently assigned all the power available from the power amplifier. This fixed bandwidth allocation (FBA) approach nets an additional 4 dB of improvement in system performance, assuming that the cell size is the same as the DEMS licensees

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93 *See* January 1997 NTIA letter at 1 (noting the basis for our intentions).

94 See discussion below at ¶51.

95 This change in modulation technique is possible with present equipment design.

96 DBA requires that the user terminal accommodate simultaneously two signals within the same power amplifier. This technique allows the bandwidth to be shared by users based on demand.

97 *See* Relocation Order at Appendix B.

98 Current DEMS systems use 16-TCM modulation with "Rate 3/4" forward error correction (FEC) coding, but are capable of switching to QPSK with Rate 1/2 FEC within the same equipment. This modulation technique assists in making up for performance losses. *See* Document No. 7 of supplement to Public Record submitted June 3, 1997 (delineating plan to use QPSK).

were using at 18 GHz. As in changing modulation techniques, sacrificing DBA and using FBA also increases the bandwidth required, in this case by a factor of approximately 2.6.[99] The combined capacity loss requires a bandwidth factor of 7.8 if QPSK and FBA are used throughout the cell.[100]

53. However, we note that the DEMS licensees do not require a full 7.8 bandwidth increase within the entire cell. By using some of the more efficient bandwidth techniques closer to the nodal station, the total amount of additional bandwidth required for equivalent service at 24 GHz can be reduced. Specifically, at a distance of less than 3.75 km from the nodal station, 16-TCM can be implemented along with FBA, recovering the threefold bandwidth loss due to modulation change. Similarly, at a distance closer than 2.84 km, both 16-TCM and DBA can again be used to achieve the same bandwidth efficiency as at 18 GHz. When the capacity loss levels are weighted according to cell area,[101] the final capacity loss is a factor somewhat greater than four. Accordingly, achieving the same capacity and reliability within the same cell area using similar equipment would require slightly more than a fourfold increase in bandwidth. This conclusion grounded the Commission's decision in the Relocation Order to replace the former DEMS channels at 18 GHz with channels at 24 GHz having four times as much bandwidth. Petitioners arguments fail to persuade us that this technical analysis is incorrect.

e. Assumptions Regarding Current and Future DEMS Equipment

54. Petitioners argue that future technology or design improvements will allow the DEMS licensees to improve capacity in the 24 GHz band and thus licensees could provide equivalent service at 24 GHz as at 18 GHz without the four fold increase in channel bandwidth. This may be true if sufficient time is available for the development of such future technology and design improvements. However, one of the Commission's objectives in the Relocation Order was to allow the DEMS licensees to provide equivalent service at 24 GHz as at 18 GHz using equipment currently available or available with minimal modification.[102] While, in the abstract, technology exists which could allow the DEMS licensees to provide equivalent service without the bandwidth increase, no DEMS equipment is currently available to do this. Petitioners provide no evidence to support their claims regarding future improvements in equipment. Without more information, we decline to curtail current operations pending theoretical future developments in DEMS equipment. Furthermore, it is likely that such improvements in DEMS equipment could also be used to improve capacity in the 18 GHz band by a similar amount.

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99 Assuming six 64-kbps lines per user terminal, 0.2 Erlangs per line during the busy hour, and 0.1% blockage probability during the busy hour.

100 This increased bandwidth requirement results from the threefold increase required to compensate for the modulation change multiplied by the 2.6 increase due to elimination of DBA.

101 A 7.8 bandwidth loss factor is used for distances of between 3.75 and 4.81 km, a 2.6 bandwidth loss factor is used for distances of between 2.84 and 3.75 km, and no loss is assumed for distances of less than 2.84 km.

102 *See* Relocation Order at ¶ 14.

D. Broadcast Satellite Service Allocation

55. DirecTV asserts that it has been planning a new satellite system designed to use part of the 24 GHz band and that the Relocation Order adversely affects its plans.[103] After the Commission adopted the Relocation Order, DirecTV submitted a petition for rulemaking proposing operation of Broadcast Satellite Service (BSS)[104] feederlink stations in the 24.75-25.25 GHz band and BSS downlinks at 17.3-17.8 GHz to expand and enhance its Direct Broadcast Satellite (DBS) service. DirecTV anticipates that its 24 GHz facilities will operate using multiple feederlink earth stations located in or near major cities around the United States.[105] DirecTV's preliminary analysis concludes that there will be zones around DirecTV's proposed feederlink earth stations where DEMS receive antennas would likely receive unacceptable interference.[106] Teledesic counters that the 24 GHz band has not been allocated domestically for Fixed Satellite Services in order to accommodate BSS feederlinks.[107]

56. There is not currently -- and never has been -- a U.S. allocation to accommodate DBS feederlinks in the 24 GHz band.[108] While the 24.75-25.25 GHz band was allocated internationally for fixed satellite service (Earth-to-space), with priority given to feederlinks for the BSS over other FSS users in Region 2 (the Americas) at WARC-92,[109] at the time of the Relocation Order those frequencies were not allocated for DBS feederlinks in the United States.[110] In addition, the international 24 GHz BSS feederlink allocation was intended to be used in connection with implementation of the 17.3-17.8 GHz BSS downlink allocation,[111] but that downlink allocation is not effective until 2007.[112] Numerous changes in spectrum usage and allocations can occur over the course of a decade and there was no certainty, even before the Commission's action in the Relocation

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103 DirecTV petition at 10-12.

104 BSS (Broadcast Satellite Service) is the term used in international allocations tables to refer to the service called DBS in the United States.

105 *See* DirecTV petition for rulemaking (filed June 5, 1997).

106 *Id*. at 10-11.

107 Teledesic opposition at 15.

108 In a separate proceeding we will consider DirecTV's petition for rulemaking proposing feederlink stations using the 24.25-24.75 GHz band and downlinks at 17.3-17.8 GHz.

109 World Administrative Radio Conference (WARC).

110 Prior to adoption of the Relocation Order, no party had expressed to the Commission any interest in implementation of the 1992 WARC allocation.

111 *See* International Telecommunication Union Radio Regulations RR 882G.

112 *See* International Telecommunication Union, Radio Regulations, RR 869A. DirecTV and other DBS operators currently use the 17.3-17.8 GHz band for feederlinks for their satellites and the 12.2-12.7 GHz band for downlinks.

Order, that the Commission would allocate 24 GHz spectrum for use by DBS feederlinks. Indeed, as discussed above, NTIA made this frequency band available only in order to facilitate relocation of the DEMS licensees and solve the problem of interference to military satellites. Had NTIA not voluntarily made this band available to solve the DEMS interference problem, DirecTV's prospects for being able to use the 24 GHz spectrum would have been highly speculative.

57. Because the Government allocation was deleted from this band following the Relocation Order, the Commission now has flexibility to allocate and assign spectrum in this band which it did not have before the Relocation Order. While that spectrum has been assigned to relocated DEMS stations in approximately thirty markets, we can now make further assignments to DEMS in the 24 GHz band throughout the rest of the country. Consequently, we expect to release a notice of proposed rulemaking later this year soliciting comment on service and licensing rules for the 24 GHz band. Although DirecTV raises concerns that it will not be able to share the 24 GHz spectrum with DEMS, the DEMS licensees and DirecTV have both submitted technical analyses indicating that sharing should be feasible.[113] Sharing by licensees of DEMS facilities and BSS "gateway" feederlinks of the kind proposed by DirecTV should be possible. Because the gateway facilities are few, not ubiquitously deployed, and need not be located near major population centers, it should be possible to design the facilities to minimize interference to fixed services operating on the same frequencies. Thus, the allocation of 24 GHz spectrum to DEMS licensees does not necessarily foreclose implementation of DirecTV's proposal. Although the DEMS licensees and DirecTV differ on the precise terms of the sharing and both FS and potential BSS operators may face system design constraints, these technical issues can be addressed in appropriate future proceedings.

E. Auction Requirement

58. BellSouth argues that under Section 309 (j) of the Act, the Commission should have assigned DEMS licensees the same amount of spectrum in the 24 GHz band that they were assigned at 18 GHz, and conducted a competitive bidding procedure for the additional 24 GHz spectrum.[114] Similarly, WebCel asserts that if DEMS operations at 24 GHz require additional spectrum, the Relocation Order should have addressed whether requiring DEMS licensees to compete for that spectrum in an auction is "warranted or mandated under Section 309(j)."[115] The DEMS licensees respond that they are incumbent licensees and applicants, not new entrants who may be required to obtain spectrum in an auction.[116]

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113 *See* DirecTV's "Technical Response to Teligent DEMS/BSS Interference Analysis and Proposed Solution," dated August 27, 1997, submitted with ex parte filing; letter dated from Antoinette Cook Bush and Jay L. Birnbaum to John P. Janka and James H. Barker re "Analysis of DEMS/BSS Interference in the 25.05-25.25 GHz Band" September 23, 1997.

114 BellSouth petition at 19. BellSouth does not indicate whether it believes that the 24 GHz spectrum should have been auctioned only for DEMS use or for other services as well.

115 WebCel petition at 18.

116 DEMS Licensee's joint opposition at 27.

59. The Commission modified the licenses previously granted to DEMS licensees pursuant to Section 316 of the Act. As discussed above,[117] it assigned DEMS licensees only enough spectrum in the 24 GHz band to permit them to replicate their operations in that band using similar facilities, transmission rates, and power to achieve the same capacity and reliability, given the different propagation characteristics in the two frequency bands. Because its actions were license modifications under authority of Section 316, and did not involve the grant of initial licenses, the Commission was not authorized under Section 309(j) of the Act to use auction procedures. Those auction procedures may only be used to select from among mutually exclusive applications for initial licenses.[118] Accordingly, petitioners' reliance on Section 309(j) of the Act is misplaced.

F. De Facto Monopoly

60. MWCA asserts that the Relocation Order reduces the number of available DEMS channels by 50 percent from 10 to five, resulting in a de facto monopoly over all available DEMS spectrum.[119] MWCA argues that the Commission should have considered this impact on competition in a rulemaking proceeding. The DEMS licensees counter that nothing in the Relocation Order changes the fundamental character of DEMS.[120] We agree. MWCA's assertion that there were ten channels available for commercial DEMS in the 18 GHz band is incorrect. In fact, there were only five transmit/receive DEMS channels available for assignment for commercial point-to-multipoint transmission at 18 GHz[121] and there are five at 24 GHz. The Commission's actions in the Relocation Order simply changed the frequency bands in which DEMS operators operate. Thus, there is no basis for MWCA's claim that the Relocation Order altered the competitive status quo.

IV. OTHER MATTERS

61. At the time of the Relocation Order, the only operations in the 24 GHz band in the United States were two radionavigation radar facilities operated by the Federal Aviation Administration.[122] The facilities, located near Washington, D.C. and Newark, New Jersey, were

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117 *See* Section III.C. *supra*.

118 At the time of the Relocation Order, Section 309 (j) of the Communications Act stated: "If mutually exclusive applications are accepted for filing for any *initial license or construction permit* which will involve a use of the electromagnetic spectrum . . . then the Commission shall have the authority . . . to grant such license or permit to a qualified applicant through the use of a system of competitive bidding . . . ." 47 U.S.C. § 309 (j) (emphasis added). Section 309 was recently amended to require, rather than authorize, the use of competitive bidding for certain initial licenses. Because auction procedures still apply only to initial licenses, that change in the statute does not affect our decision.

119 MWCA petition at 15.

120 DEMS licensees' opposition at 34.

121 *See* 47 C.F.R. § 101.505 (1996).

122 Relocation Order at ¶ 15.

scheduled to be decommissioned January 1, 1998 and January 1, 2000, respectively. The Relocation Order added U.S. Footnote US341 to the U.S. Table of Allocations to protect the FAA operation in these two areas until decommissioning.[123] Consistent with this schedule, the facility in Washington, D.C. has been decommissioned and the decommissioning date for the Newark, New Jersey station has been advanced. In order to accurately reflect the current status we amend US341 to state:

> Non-Government operations in the 24.25-24.45 GHz band must provide protection to the FAA radionavigation radar facility at the Newark International Airport, New Jersey, until the facility is decommissioned. The Newark radar facility is scheduled to be decommissioned by January 1, 1998. Protection will be afforded in accordance with criteria developed by the NTIA and FCC.

V. CONCLUSION

62. We have carefully and comprehensively considered the arguments presented by the Petitioners and find them to be unpersuasive. Consequently, we deny the petitions for reconsideration and partial reconsideration of the Relocation Order and the petitions for reconsideration and applications for review of the Modification Order. We affirm the Commission's decision relocating DEMS from the 18 GHz band to the 24 GHz band based upon the requests made by NTIA on behalf of the Department of Defense and the Commission's objective of maintaining DEMS on a uniform nationwide frequency band.

V. ORDERING CLAUSES

63. Accordingly, IT IS ORDERED that the Petitions for Reconsideration of WebCel Communications, Inc., DirecTV Enterprises, Inc. and BellSouth Corporation of the March 14, 1997 Relocation Order ARE DENIED.

64. IT IS FURTHER ORDERED that the Petition for Partial Reconsideration filed by the Millimeter Wave Carrier Association, Inc. IS DENIED.

65. IT IS FURTHER ORDERED that the Petitions for Reconsideration of DirecTV Enterprises, Inc. and Bellsouth Corporation of the June 24, 1997 Modification Order ARE DENIED.

66. IT IS FURTHER ORDERED that the Applications for Review of WebCel Communications, Inc., and Millimeter Wave Carrier Association, Inc., of the June 24, 1997 Modification Order ARE DENIED.

67. IT IS FURTHER ORDERED that the Joint Motion for Leave to File Surreply of Digital Services Corporation, Microwave Services Inc. and Teligent, L.L.C., ET Docket No. 97-99,

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[123] *See* Relocation Order at Appendix A: Final Rules, Part 2.

IS GRANTED and that WebCel Communications, Inc., Opposition to Joint Motion for Leave to File Surreply, ET Docket No. 97-99, IS DENIED.

68. IT IS FURTHER ORDERED that the Motion of WinStar Communications, Inc. to withdraw its Petition for Clarification and its Reply IS GRANTED.

69. IT IS FURTHER ORDERED that Teledesic Corporation's request to withdraw its Petition to Deny and Determine Status of Licenses, File No. 9607682 et. al., IS GRANTED.

70. IT IS FURTHER ORDERED that the Motions for Expedited Resolution filed by Millimeter Wave Carrier Association, Inc. and WebCel Communications, Inc., ET Docket No. 97-99, ARE DISMISSED.

71. IT IS FURTHER ORDERED that the U.S. Table of Allocations footnote US341 is amended as discussed above.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas
Secretary

APPENDIX A

BANDWIDTH REQUIRED AT 24 GHz VERSUS REQUIREMENT AT 18 GHZ

In order to provide equivalent performance at 24 GHz as at 18 GHz without significant increase in equipment or system cost, a number of methods can be combined with presently available equipment to minimize equipment changes to those required only by the change in frequency. The need to overcome the additional signal degradation due to increased rain attenuation at 24 GHz leads to a different operational strategy than that used in the 18-GHz band. The main operational differences in this strategy are twofold: 1) a change in modulation scheme to one which is more robust but consequently requires additional bandwidth; and 2) a change in channel sharing techniques which requires less total transmitter power but again requires additional bandwidth.

A. ADDITIONAL LOSSES AT THE HIGHER FREQUENCY BAND

The main difference between the 18 and 24 GHz bands lies in the propagation effects. There are three main causes of reduced performance at the higher frequency band as summarized below:

Increased rain attenuation (0.01%, rain climate K)	9.5 dB
Increased spreading loss, 20 log(f/f_o)	2.3 dB
Reduced amplifier output at higher band	1.0 dB
Total additional performances losses to be overcome	**12.8 dB**

The 9.5 dB rain attenuation differential is based on a typical cell radius of around 4.8 km and a service reliability of 99.99%. The 1.0 dB of reduced transmitter power is a result of operating the same power amplifier at the higher frequency. However, 2.3 dB of additional spreading loss can be counteracted by increasing antenna gain if the same antenna is used at the higher frequency band. This leaves a total of 10.5 dB which needs to be overcome. Increasing the transmitter power by this amount would overcome these additional losses, but would have required significant redesign of the existing DEMS equipment. Similarly, the DEMS cell size could be reduced, but that would significantly increase the number of cells required and therefore the cost of DEMS. Studies have shown that this performance could be recovered by reducing a typical cell radius from 4.81 to 2.84 km. This represents a reduction in area by a factor of 2.8, with a consequently similar increase in the number of cells.

B. EQUIPMENT CAPABILITIES

DEMS equipment intended for operation at 18 GHz is capable of operating with different modulation techniques. One of these, 16-phase trellis code modulation (16-TCM) with Rate 3/4 forward error correction (FEC), is very efficient in bandwidth utilization and is the one which

would have been used at 18 GHz. Also available is quadriphase shift key (QPSK) with Rate 1/2 FEC. This latter modulation technique requires about 7 dB lower carrier-to-noise (C/N) ratio; however, it requires three times the bandwidth of the 16-TCM technique.

DEMS equipment for implementation at 18 GHz would also allow sharing of the bandwidth resource among the users by allowing the nodal station to change the bit rate of the customer station on a demand basis. This capability, known as dynamic bandwidth allocation (DBA), is accomplished by having the remote (customer) station capability to transmit simultaneously two different signals, one with a current bit rate and a second with the new bit rate. When the line-up of the new signal is complete, the service is switched to the new signal and the old signal is turned off by the nodal station. While this technique is efficient in sharing bandwidth among users, the requirement to support two simultaneous signal forces the power of the individual signals to be on average approximately 4 dB lower than what the transmitter is capable of supporting.

The improvement in bandwidth efficiency which results from the application of DBA is estimated to be a factor of 2.59, based on an average of six trunks per remote, an offered load of 0.2 Erlangs per trunk, call blocking capability of 0.1%, and the overhead needed to effect control of the DEMS remote station.

C. STRATEGY FOR HIGHER-FREQUENCY OPERATION WITH MINIMAL SYSTEM IMPACT

Based on current equipment capabilities, there are three different ways of operating the DEMS service within existing cells at the higher frequency band, with different relative efficiencies, depending on the distance from the nodal station.

Close to the nodal station, the service can be operated in the same manner as the entire service would have been operated at 18 GHz. In this region, out to 2.84 km from the nodal station, the service would operate at 16-TCM with DBA. The relative bandwidth requirement within this region, compared to the 18-GHz requirement, is 1.0.

Beyond this distance, the first level of compensation is to eliminate the DBA and operate in a fixed bandwidth allocation (FBA) mode. This approach, which can be sustained out to 3.75 km from the nodal station, requires 2.59 times the bandwidth which would be required when operating at 18 GHz.

Finally, beyond 3.75 km, out to the cell radius of 4.81 km, the modulation technique is changed to QPSK (3.0 bandwidth factor) and FBA is used (2.59 bandwidth factor); the bandwidth requirement is 7.77 times that at 18 GHz.

When the bandwidth factors of the three modes of operation are weighted according to the relative area of the cell within which each mode is feasible, the relative bandwidth factor,

averaged over the entire cell, for operation at 24 GHz compared to 18 GHz is 4.07. The table below summarizes these results.

Cell Region	**Area (km^2)**	**Area Percent**	**Techniques**	**Bandwidth Factor**	**Weighted Bandwidth Factor**
To 2.84 km	25.3	34.8	DBA & 16-TCM	1.0	0.35
2.84-3.75 km	18.8	25.9	FBA & 16-TCM	2.59	0.67
3.75-4.81 km	28.5	39.2	FBA & QPSK	7.77	3.05

Total: 4.07