RECEIVED

JUN 3 - 1991

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Parts 2, 22 and 25 of the Commission's Rules to Allocate Spectrum for the Mobile Satellite Service	)	RM-
	)	
In the Matter of the Applications of	)	
	)	
Ellipsat Corporation	)	File No. 11-DSS-P-91(6)
	)	
Motorola Satellite Communications, Inc.	)	File Nos. 9-DSS-P-91(87) CSS-91-010

PETITION OF AMERICAN MOBILE SATELLITE CORPORATION

Bruce D. Jacobs

Fisher, Wayland, Cooper
& Leader
1255 23rd Street, N.W.
Suite 800
Washington, D.C. 20037
(202) 659-3494

Lon C. Levin
Glenn S. Richards

Gurman, Kurtis, Blask &
Freedman, Chartered
1400 Sixteenth Street, N.W.
Suite 500
Washington, D.C. 20036
(202) 328-8200

Leslie A.L. Borden
Vice President and
General Counsel
American Mobile Satellite Corporation
1150 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 331-5858

Dated: June 3, 1991

Summary

In 1985, the Commission decided that there was sufficient spectrum available to license only one MSS system to serve the United States. That fact remains true today, as there is an increasingly severe worldwide shortage of L-band spectrum for MSS systems. To help reduce this shortage, the Commission should allocate a new ten megahertz frequency pair to MSS.

The new MSS uplink should come from the 1616.5-1626.5 MHz band, which currently is allocated to RDSS. It is clear from the bankruptcy of Geostar and the applications of Ellipsat and MSCI that RDSS is not a viable service. The Ellipsat and MSCI applications in reality are MSS applications; they seek to provide voice service and they do not conform to the RDSS rules. Rather than proceeding by waiver as requested by Ellipsat and MSCI, the Commission should simply reallocate the spectrum to MSS. An allocation of this spectrum to MSS will permit the offering of additional and much-needed voice and data communications in rural and remote areas, as well as the position location services that would have been provided by an RDSS system.

As the new MSS downlink band, AMSC proposes that the Commission allocate the 1515-1525 MHz band. Allocation of this spectrum to MSS would have minimal impact on existing users and would add greatly to the utility of the spectrum at 1616.5-1626.5 MHz. In the alternative, AMSC recommends that the Commission

allocate to MSS a ten megahertz downlink from one of the following bands: 2110-2130 MHz, 2160-2180 MHz, or 1850-1990 MHz.

In order to demonstrate the benefits and the efficiency with which the U.S. system could use the new allocation, AMSC is attaching to its Petition an exhibit that shows how AMSC would modify its proposed satellites at 62° W.L. and 139° W.L. to combine the new spectrum allocation with the existing MSS spectrum. (In order to preserve its rights in connection with the Commission's June 3 cut-off for applications to use the RDSS frequencies, AMSC also is submitting the modification proposal for its eastern and western satellites to the Commission as a formal application.)

AMSC's proposal demonstrates that assigning the spectrum to AMSC is the best way for the Commission to insure that the spectrum will be put to use efficiently, providing high-quality service. AMSC can add these frequencies to its eastern and western satellites at a cost of $1 million-$10 million per satellite. Depending on the amount of spectrum available after coordination, the additional frequencies could provide as much as 3600 additional channels of network capacity. In contrast, Ellipsat and MSCI would realize far less capacity from their systems, at a much higher cost. If required to operate within the established power limits, Ellipsat could serve no more than five customers at a time on its system. MSCI could serve only ten customers at a time in the United States on its system.

Moreover, contrary to MSCI's claims, AMSC will be able to provide service to hand-held radios.

In addition to their extremely limited capacity, there are serious technical problems with the Ellipsat and MSCI designs. These deficiencies include power levels that would cause severe harmful interference to such other users of the RDSS bands as fixed service operations, the proposed Glonass navigation system, and radio astronomy operations. The Ellipsat and MSCI system designs also raise serious questions about their reliability. For example, both systems appear to have a sufficient power supply to operate for only a portion of each day.

AMSC also is opposed to the applications of Ellipsat and MSCI because they are so speculative. In particular, MSCI proposes to spend over three billion dollars before providing service to a single customer and by MSCI's own admission, it does not have the necessary foreign approvals to go forward and the spectrum it is applying for is inadequate to meet its own market projections. Clearly, the Commission should not use what little additional spectrum is available to license so inefficient and speculative a system in these bands at this time.

TABLE OF CONTENTS

RECEIVED

JUN 3 - 1991

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Parts 2, 22 and 25 of the Commission's Rules to Allocate Spectrum for the Mobile Satellite Service	)	RM-
	)	
In the Matter of the Applications of	)	
	)	
Ellipsat Corporation	)	File No. 11-DSS-P-91(6)
	)	
Motorola Satellite Communications, Inc.	)	File Nos. 9-DSS-P-91(87) CSS-91-010

PETITION OF
AMERICAN MOBILE SATELLITE CORPORATION

American Mobile Satellite Corporation ("AMSC"), by its attorneys, hereby requests that the Commission: (i) allocate the frequencies at 1616.5-1626.5 MHz and 1515-1525 MHz to the Mobile Satellite Service ("MSS"); (ii) assign the frequencies to the United States MSS system; and (iii) dismiss or deny the above-referenced applications of Ellipsat Corporation ("Ellipsat") and Motorola Satellite Communications, Inc., ("MSCI").[1]

---

[1] AMSC has filed these requests in a single document because the issues raised in each of the matters are strongly related. Section 1.44 of the Commission's rules permits parties to combine more than one request into a single pleading if all of the requests are to be acted on by the Commission itself. AMSC expects that all the issues raised herein will be (continued...)

The common thread running through these requests is that, in light of the current international shortage of spectrum for MSS systems, this spectrum is best used for the development of the already-authorized U.S. MSS system. To demonstrate the practicality and benefits of integrating the bands into the planned U.S. MSS system, AMSC is attaching a specific proposal (Exhibit A) that describes how AMSC would use the frequencies.[2] The proposal demonstrates that AMSC can add the frequencies to its satellites at very little cost and use the spectrum to provide substantial additional capacity. AMSC urges the Commission to dismiss or deny the Ellipsat and MSCI applications because, as demonstrated below, these are extremely speculative

---

[1](...continued)
addressed by the Commission itself. To the extent that the Commission delegates any of these requests to its staff, AMSC requests a waiver of the rule. At a minimum, the request to deny the Ellipsat and MSCI applications should be considered timely filed.

[2] In a separate filing today, AMSC also is submitting this proposal as a formal application in order to preserve AMSC's rights in connection with the cut-off provisions of the Commission's recent Public Notice. Report No. DS-1068, DA 91-407 (April 1, 1991). In its Public Notice, the Commission accepted for filing the applications of Ellipsat and MSCI and established a deadline for the filing of competing applications to use the frequencies proposed by these applicants.

and technically-deficient applications.[3] As discussed below, the Ellipsat and MSCI systems must operate with such limited power that they have virtually no capacity or, if they operate at their proposed power levels, they will violate international standards and interfere with a large number of existing and planned users of the band.

Background

The MSS Proceeding. From the Commission's initial decision to allocate spectrum to a Mobile Satellite Service to meet the need for high-quality mobile communications in rural and remote areas, the Commission has held the view that the service will require at least 20 MHz of spectrum for a U.S. system to be economically viable and provide a full range of services. See Notice of Proposed Rulemaking ("NPRM"), in Gen. Docket No. 84-1234, 50 Fed. Reg. 8149, paras. 9-11 (February 28, 1985).[4] Based

---

[3] As the licensee of the U.S. MSS system, a proponent of the reallocation of the RDSS bands to MSS, and an applicant for the 1616.5-1626.5 MHz band, AMSC has standing as an interested party. For a discussion of the impact of the recent Court of Appeals decision in Aeronautical Radio, Inc. v. FCC, 928 F.2d 428 (D.C. Cir. 1991) on AMSC's license, see Comments of AMSC, Gen. Docket No. 84-1234, pp. 11-15 (April 11, 1991); Reply Comments of AMSC, Gen. Docket No. 84-1234, pp. 11-16 (April 23, 1991).

[4] Twenty megahertz is a small amount of spectrum relative to what the Commission allocates to other satellite and mobile services. Fixed Satellite Service and Direct Broadcast Satellite Service systems each operate with several hundred megahertz of spectrum. Terrestrial-based mobile communications services similarly have been allocated hundreds

(continued...)

on this estimate and the Commission's understanding of the difficulty of identifying spectrum for a U.S. system, the Commission concluded that it should license only one MSS system. Id., para. 23; Second Report and Order in Gen. Docket No. 84-1234, 2 FCC Rcd 485, paras. 4-8; recon. denied, Memorandum, Opinion and Order in Gen. Docket No. 84-1234, 4 FCC Rcd 6029.[5] The Commission also cited the high cost and risk of building an

---

[4] (...continued) of megahertz of spectrum by the Commission. Even the smallest rural cellular system has more than 24 MHz of spectrum.

In part because of the shortage of spectrum for the service, MSS technology is very spectrum efficient. The typical voice channel in AMSC's system will require no more than 6 kHz; current cellular systems use 30 kHz channel spacing.

The Commission anticipated that the geosynchronous MSS system would provide a broad range of services, including voice and data communications in rural and remote areas, aeronautical mobile communications and position location services. NPRM, para. 46 and Appendix E. The system being built by AMSC will be capable of providing all of these services.

[5] There are a number of reasons for the Commission to adopt a policy of licensing an MSS system for the U.S., rather than relying on foreign systems for service. Perhaps the most important is the need to retain U.S. ownership of vital communications facilities such as the MSS system. The U.S. MSS system is expected to be used to provide sensitive communications to, among others, local, state and federal government agencies. A separate U.S. system is also an efficient way to provide service to the large American market. By licensing a separate system, the Commission is best able to insure that the U.S. market gets its fair share of the limited available spectrum.

MSS system as a factor in its decision to license only one system. NPRM, para. 23.[6]

Subsequent events have confirmed the virtue of the Commission's decision to license one MSS operator. The shortage of MSS spectrum has become even more severe since the Commission made its initial decision. Most significantly, the International Maritime Satellite Organization ("Inmarsat") has begun an aggressive expansion effort that includes the construction of a spectrum inefficient third-generation system for which it is attempting to coordinate access to the entire MSS band at 1530-

---

[6] Other factors included the relative ease with which the Commission could coordinate internationally on behalf of a single MSS system and the improved efficiency of a single system operator providing priority access to aviation safety communications. Memorandum Opinion, Order and Authorization in Gen. Docket No. 84-1234, 4 FCC Rcd 6041, para. 49 (1989).

The Commission's current allocation to MSS requires the system operator to provide priority access to aviation safety communications throughout the 1545-1559/1646.5-1660.5 MHz band. This requirement has the effect of restricting AMSC's ability to guarantee priority access in these bands to land mobile and maritime mobile safety communications, such as rural ambulances and the Coast Guard. These land mobile and maritime mobile safety users are expected to comprise a large share of AMSC's market.

While the Commission licensed only one MSS operator, at the same time it recognized that substantial competition would be provided by other services. Second Report and Order, 2 FCC Rcd 485, para. 34; Memorandum Opinion and Order, 4 FCC Rcd 6029, paras. 43-46. In addition, the Commission took the precaution of regulating the MSS operator as a streamlined common carrier and of requiring the system operator to provide non-discriminatory access to resellers. Second Report and Order, 2 FCC Rcd 485, para. 34.

1559 MHz and 1626.5-1660.5 MHz.[7] In addition, Canada, Mexico and the Soviet Union have plans to build MSS systems that will severely restrict the U.S. system's access to the MSS band, and numerous other foreign MSS systems are in some degree of planning. All told, there are at least 35 MSS satellites vying to use the existing MSS bands in or near North America. Various estimates have been made of the size of the additional allocation required for MSS, ranging from 44.8 MHz to 175.4 MHz.[8]

In order to ameliorate the international spectrum shortage, AMSC and others have been exploring the possibilities for additional MSS allocations to be made by the 1992 World Administrative Radio Conference. Among the most prominent of the bands that have been identified by the Commission for additional MSS allocations are the bands currently assigned to the Radiodetermination Satellite Service ("RDSS") at 1610-1626.5 MHz (Earth-to-space) and 2483.5-2500 MHz (space-to-Earth).[9] Both Canada and Inmarsat suggested a reallocation of a ten megahertz

---

7/ See AMSC Petition to Deny, File No. CSS-91-001-LA (November 13, 1990).

8/ Document JIWP 92/110-E, CCIR Joint Interim Working Party WARC-92 (March 12, 1991); Third Interim Report of Ad Hoc Group C of IWG-2, Mobile Satellite Services, Section 2.1 (February 14, 1991).

9/ See Second Notice of Inquiry, Gen. Docket No. 89-554, para. 70 (October 1, 1990).

portion of the RDSS uplink at 1616.5-1626.5 MHz to MSS that would be paired with a new downlink band.[10]

There also is support for an allocation to MSS of a downlink band immediately below 1530 MHz. The 1435-1530 MHz band is predominantly used in the United States for aeronautical telemetry. The Commission has proposed that the U.S. should support an allocation to MSS at the 1992 WARC of the 1525-1530 MHz band.[11] This downlink band could be used to match the current uplink allocation at 1626.5-1631.5 MHz.[12] The allocation of the 1515-1525 MHz band to MSS is particularly attractive because these frequencies can be implemented easily and inexpensively with existing MSS allocations. An MSS allocation in the 1515-1530 MHz band would have little impact on aeronautical telemetry operations, since some geographic and time

---

10/ See Report of the CITEL, 1992 World Administrative Radio Conference Interim Working Group, at Section 2.2.4.a.2 (May 10, 1991); Mobile Satellite Services at L-band, prepared by Inmarsat, Doc. JIWP 92/17-E at 1 (February 20, 1991). As discussed below, the principal problem with the current RDSS downlink band is that RDSS or MSS operation in the band would have extremely limited capacity as a result of meeting the power limits that have been established in order to avoid interference to other services using the band.

11/ Second Notice of Inquiry, Gen. Docket No. 89-554, para. 68 (October 1, 1990).

12/ An MSS allocation at 1525-1530 MHz is also supported by the administrations that are members of CITEL, which consist of countries in the Western Hemisphere, and members of CEPT, which represents European countries. See Report of the CITEL, 1992 World Administrative Radio Conference Interim Working Group, Section 2.2.4.a.2 (May 10, 1991); WARC-92, Revised Provisional View of the CEPT, Annex D (March 6, 1991).

sharing between MSS and aeronautical telemetry is possible and other telemetry systems could operate in the remaining 80 MHz (1435-1515 MHz) or in the aeronautical telemetry band at 2310-2390 MHz. Brazil, Canada and Inmarsat support MSS allocations in the 1515-1525 MHz band.[13] Based on the records of the International Frequency Registration Board, the 1515-1525 MHz band is used in Canada and Mexico by at most a few fixed systems. If necessary, a U.S. MSS system could be coordinated to operate without interference with these foreign systems.

It is unlikely that the WARC will allocate to MSS more than ten megahertz of paired spectrum that can be used in the near future in the United States. There are other proposals for new MSS allocations, such as 1850-1990 MHz, 2110-2130 MHz, 2160-2180 MHz and 2410-2450 MHz, but there are significant numbers of existing systems using these bands in North America, making it more likely that these additional bands would be used for the development of MSS systems elsewhere in the world, at least in the near future.

AMSC has made substantial progress in its efforts to construct and launch the U.S. MSS system. With a strong ownership in place, including subsidiaries of such communications industry leaders as Hughes Aircraft Company, McCaw Cellular

---

[13] See Report of the CITEL, 1992 World Administrative Radio Conference Interim Working Group, at Section 2.2.4.a.2 (May 10, 1991); Mobile Satellite Services at L-band, prepared by Inmarsat, Doc. JIWP 92/17-E at 1 (February 20, 1991).

Communications, Inc., and Mobile Telecommunications Technologies Corp., AMSC has begun construction of the first of its satellites and has an agreement with Telesat Mobile, Inc., the Canadian MSS licensee, to develop similar satellites and ground segment facilities, and to provide backup and restoration to each other's system. AMSC also has contracted with Comsat to develop the ground segment specifications for the U.S. MSS system, and this work is due to be completed in September, 1991. AMSC is awaiting Commission authorization to begin offering an interim service using limited capacity on the Marecs-B satellite. AMSC is also planning the design of a second generation satellite that will provide additional frequency reuse. (See Exhibit B, attached hereto.) Despite this progress, however, the development of the U.S. MSS system still faces significant uncertainty and risk, among the most critical of which is the amount of available spectrum.

The RDSS Proceeding. The efforts to establish the Radiodetermination Satellite Service began at approximately the same time as the efforts to establish MSS.[14/] Indeed, Geostar received its RDSS license in 1986, fully three years before AMSC received its license.[15/] Nonetheless, there has been far less

---

[14/] See Petition for Rulemaking of Geostar Corporation, RM-4426 (March 31, 1983); Applications of Geostar Corporation, File Nos. 2191/2192/2193/2194-DSS-P/LA-84 (March 31, 1983).

[15/] Memorandum Opinion, Order and Authorization, 60 RR 2d 1725 (1986).

progress towards the launch of an RDSS system than is the case with MSS.

One of the principal problems faced by RDSS has been that other, existing uses of its frequencies severely limited their utility. Internationally and domestically, the RDSS downlink band is widely used for fixed services, typically point-to-point microwave systems, and is part of the Industrial, Scientific and Medical ("ISM") allocation (2400-2500 MHz), which includes millions of microwave ovens. As a result, the 1987 Mobile Services WARC adopted a severe limit on the power of RDSS downlinks and required RDSS systems to accept any interference generated by fixed service systems or by ISM equipment.[16]

Parts of the uplink band are similarly problematic. Radio astronomy operates sensitive radio observatories in the United States and abroad in the 1610.6-1613.8 MHz band. The Soviet Union and the International Civil Aviation Organization are developing a global navigation satellite system called "Glonass," that will operate worldwide in the 1610-1616.5 MHz band. Internationally, the entire uplink band is also allocated to fixed services, although there are no fixed service operations in the band in the United States. To protect existing and planned uses of the uplink band, the 1987 WARC adopted a power limit for the uplink band and a coordination requirement for airborne and

---

[16] RR Article 28, Nos. 2556-2559; RR Article 8, No. 752.

terrestrial RDSS terminals operating within 400 km and 100 km, respectively, of countries using the band for terrestrial services.[17/] To protect radio astronomy further, the Commission imposed a requirement that RDSS terminals in the vicinity of a radio astronomy facility restrict their operations to brief intervals timed to avoid interference with radio astronomy observations.[18/]

In addition to the technical limits on RDSS systems, the Commission established other restrictions, in part to preserve the opportunity for several RDSS systems to share the same frequencies.[19/] These include required use of psuedo-random-noise codes; use of random access time division multiplex techniques and limitation of communications to short bursts by relegating non-RDSS services provided by RDSS systems to ancillary status. As a result of all these limits, however, RDSS systems have very

---

17/ RR Article 28, No. 2548a; RR Article 11, No. 1107.2.

18/ Report and Order, Gen. Docket Nos. 84-689 and 84-690, 58 RR 2d 1416 (1985) at Appendix D.

19/ The requirement of multiple entry in licensing RDSS systems has always been an integral part of the Commission's RDSS policies. See Notice of Proposed Rulemaking in Gen. Docket Nos. 84-689 and 84-690, 49 Fed. Reg. 36512, paras. 33-34 (September 18, 1984); Second Report and Order, 104 FCC 2d 650, 660 (1986); Memorandum Opinion, Order and Authorization, File No. 1705-DSS-MP/ML-87, paras. 17-18 (August 28, 1987); Memorandum Opinion and Order, File Nos. 1145-DSS-MP/ML-89, et al, DA 91-528, paras. 12-13 (April 30, 1991).

little potential capacity.[20] Moreover, the requirement to operate in short bursts with random access to facilitate multiple entry means that voice service cannot be provided. <u>RDSS Second Report and Order</u>, 104 FCC 2d 650, Appendix B (1986). The Commission also limits RDSS systems to the provision of position location service and communications services that are "ancillary" to the provision of position location services.[21]

Four entities, including Geostar, filed applications to provide RDSS and all were granted. Soon thereafter all but Geostar had relinquished their authorizations. Geostar persisted in its efforts, spending at least $125 million in the process, but ultimately was required to file for bankruptcy $48 million in debt.[22]

At this point, with Geostar's bankruptcy, the only remaining applicants for the RDSS spectrum are Ellipsat and MSCI, both of which propose to use the RDSS spectrum to provide Mobile

---

[20] <u>See</u> Comments of AMSC, Gen. Docket No. 89-554, Technical Appendix, p. 11 (April 12, 1991).

[21] Radiodetermination is defined as the determination of position, or the obtaining of information relating to position, by means of the propagation properties of radio waves. Radionavigation is radiodetermination used for purposes of navigation, including obstruction warning, and radiolocation is radiodetermination for purposes other than those of radio navigation. <u>See</u> Section 2.1 of the Commission's rules.

[22] <u>See</u> "Geostar Shut Down as GRP Cites FCC, Customs Service Decision"; Mobile Satellite Reports, May 17, 1991, at 1.

Satellite Service and neither of which conforms to the Commission's RDSS rules.

The Application of Ellipsat Corporation. On November 2, 1990, Ellipsat Corporation filed an application to construct Ellipso I, an elliptical orbit satellite system consisting of six small satellites, based on Amateur Satellite technology, each of which is expected to have a three-year useful life. Ellipsat proposes to operate in the 1610-1626.5/2483.5-2500 MHz bands, providing domestic mobile voice service and a form of position location service. Ellipsat claims that customers of existing cellular telephone systems will be able to access its satellites by adding a piece of equipment to their existing mobile radios at a cost of only three hundred dollars. With its Ellipso I service, Ellipsat estimates that it can serve 25,000 customers.

Ellipsat claims that the cost to construct, launch, and operate its system for one year is under $27 million, including preoperational expenses and ground segment. Ellipsat provides a balance sheet showing assets of $20,000 and letters from two venture capital companies, Venture First Associates and ITR Group, Inc., stating that if the Ellipsat system is authorized and certain other conditions are met, they might be able to put together financing.

Application of Motorola Satellite Corporation, Inc. On December 3, 1990, Motorola Satellite Corporation, Inc. ("MSCI") filed an application for what it calls the Iridium system, a constellation of 77 low-earth orbit satellites. MSCI's application is for authority to provide two-way mobile voice and data communications and position location service throughout the world. MSCI claims that its system will be uniquely capable of providing mobile service to small, hand-held units and of avoiding the delays inherent in communications using geosynchronous satellites.[23/] MSCI proposes to operate both its uplinks and downlinks in the 1610-1626.5 MHz band, but states that additional L-band spectrum will be required by the end of the decade to meet projected demand for the service. Id. p. 2. Motorola also is requesting 400 MHz of spectrum in the 22/32 GHz bands for inter-satellite crosslinks and in the 20/30 GHz for feeder links.

MSCI estimates that it will serve several million subscribers, the large majority of which will be located in foreign countries. Id. p. 34. MSCI concedes that it must obtain separate grants of authority from foreign administrations and an allocation at the 1992 WARC, but it requests that the Commission grant its application now in order to improve its chances of securing these other actions. Id. pp. 105-108.

MSCI estimates the cost of construction, launch and operation of the MSCI system to be more than $3.7 billion through 1997, the first year of proposed service. Id. p. 115. MSCI

[23/] Application of MSCI, p. 14.

states that it is willing to finance this cost with funds provided by Motorola Inc., its parent corporation. Id. p. 115-116. Press reports, however, indicate that Motorola's business plan is to rely on joint venture partners to finance the construction and operation of its proposed system. See The Associated Press, June 26, 1990, The Los Angeles Times, April 2, 1991, at D1, Col. 4. Companies in Great Britain, Australia, Hong Kong and Japan have been mentioned as potential partners. Id.

Discussion

I. The Commission Should Allocate the 1616.5-1626.5 MHz and 1515-1525 MHz Bands to Mobile Satellite Service

A. The Spectrum is Needed for Mobile Satellite Service

As should be clear from the above background information, the Commission's policy of licensing a viable MSS system to provide service to the United States is in serious jeopardy due to the shortage of L-band spectrum. A large number of foreign systems have submitted notices to the International Frequency Registration Board seeking to use the spectrum that the Commission has assigned to AMSC. The 1992 WARC presents an opportunity to alleviate the current congestion, but the conference is likely to allocate only a small amount of additional spectrum that could be used in the United States in the near future.

AMSC therefore urges the Commission to make the best use possible of the RDSS bands by reallocating the RDSS uplink band to MSS and pairing the band with ten megahertz below 1530 MHz. As demonstrated by the proposal contained in Exhibit A, AMSC is prepared to integrate these new bands into its system as soon as they become available. As a result, AMSC is optimistic that the U.S. system can gain access to a significant portion of the new MSS allocation. This, plus the allocation of additional MSS spectrum at the WARC that might be useful outside North America, should provide relief from the immediate spectrum shortage.

B. <u>AMSC Can Use The Additional Spectrum Efficiently</u>

The proposal in Exhibit A demonstrates the practicality and the benefits of allocating this additional spectrum to MSS and assigning it to the U.S. system. Because the bands are contiguous to an existing MSS allocation, the U.S. MSS system can add this band to its satellites at a cost of as little as $1 million per satellite and no more than $10 million per satellite. The cost of adding these frequencies to the mobile equipment also would be insignificant.

This additional capacity presents an opportunity for AMSC to provide non-preemptible service to public safety users such as rural ambulance services, law enforcement agencies, and disaster relief services. Currently, AMSC must provide priority and preemptive access for aeronautical safety services in the 1545-

1559/1646.5-1660.5 MHz bands, and thus is unable to guarantee non-preemptible service to land mobile and maritime mobile safety customers. Additional spectrum will help to solve this problem.

AMSC also will provide high-quality position location service. Using receivers adapted for the Global Positioning Service, AMSC's customers will be able to secure instant position location information that is accurate to within fifty meters. As discussed in the Technical Appendix this is superior to the Ellipsat and MSCI service, though MSCI also proposes to offer GPS.

AMSC can offer service using higher power than Ellipsat or MSCI. This is because AMSC will not operate in the 2483.5-2500 MHz band, in the 1610-1616.5 MHz band, or outside the United States, where fixed services are located.

AMSC's use of the spectrum will result in much more capacity being available to the U.S. public than would result from its assignment to either Ellipsat or MSCI. As much as 3600 channels will be added to AMSC's system. As demonstrated in the attached Technical Appendix, the Ellipsat and MSCI systems would have much less capacity than claimed. Ellipsat's modified Amateur Satellite would be able to serve no more than five users at a time and Motorola would have no more than ten channels in the United States.

MSCI claims that its proposed system is uniquely spectrum efficient, offering substantial frequency reuse and capacity when compared with geostationary MSS systems. These claims are without merit. AMSC has demonstrated that geostationary MSS systems are as efficient as low-Earth orbit systems.[24] For example, AMSC has shown that geostationary MSS systems can flexibly provide capacity in accordance with demand, whereas low-Earth orbit systems are severely constrained in this regard. Thus, AMSC can serve many more customers dispersed non-uniformly across the country than could a low-Earth orbit system using the same amount of spectrum. Id.

In addition, AMSC expects that the next generation of MSS systems will provide even greater spectrum efficiency. The system design presented in Exhibit B includes satellite antennas that are 45 feet in diameter, having footprints on the Earth that are smaller than the footprints of MSCI's proposed system. The additional power of this next generation system will permit AMSC to offer service to hand-held units.

C. There is No Point to Preserving an RDSS Allocation

The bankruptcy of Geostar and the filing of MSS applications by Ellipsat and MSCI demonstrate conclusively that the market will not support a satellite system that is devoted principally to position location services. Simply put, it is extremely difficult to finance a multi-million dollar satellite system that

---

[24] Reply Comments of AMSC, Gen. Docket No. 89-554, Technical Appendix, p. 7, Exhibit 6 (January 8, 1991).

cannot generate significant revenue from providing data and voice communications.

It is clear that Ellipsat and MSCI do not conform to the Commission's RDSS rules. See Technical Appendix, pp. 21-26.

AMSC opposes the use of waiver requests. Ellipsat and MSCI have done nothing to demonstrate that there are circumstances unique to their applications which require a waiver.[25] Instead, the Commission should proceed by reallocating the spectrum to MSS and maximize the utility of the spectrum by assigning it to AMSC.

D. The 1515-1525 MHz Band is an Appropriate MSS Downlink

As discussed earlier, there are significant problems with the 2483.5-2500 MHz band that require the Commission to allocate a different downlink band to MSS to match with the 1616.5-1626.5 MHz band. These problems include PFD limits that protect existing fixed users. In addition, there is a serious problem with microwave ovens and other ISM devices operating throughout the 2400-2500 MHz band.[26]

---

[25] The proponent of a waiver request has a heavy burden to overcome. It must "plead with particularity the facts and circumstance which warrant such action." Rio Grande Radio v. FCC, 406 F.2d 6664, 666 (D.C. Cir. 1968). See also Station WHTR, 47 RR 2d 1130 (1980).

[26] See Comments in Gen. Docket No. 89-554 of Fusion Systems Corporation, International Microwave Power Institute, Dow Chemical, Amana, Omnipoint Data Communications, Raytheon, James River Corporation, CEM Corporation, Carolyn Dodson, Inc., Enersyst Development Center, Inc., Schwan's, Cober Electronics, APV, and University of Washington.

For this reason, AMSC recommends that the Commission allocate a new downlink to be paired with the 1616.5-1626.5 MHz band, the 1515-1525 MHz band being the most suitable of the candidate bands. This allocation would have a minimal impact on aeronautical telemetry users who could operate in the remaining 80 MHz below 1515 MHz or in the aeronautical telemetry band at 2310-2390 MHz. Internationally, AMSC will be able to coordinate, if necessary, with fixed systems operating in Canada and Mexico to ensure that there will not be interference.

In addition, because the allocation would be contiguous to existing MSS allocation, it could be added to the AMSC satellites and mobile earth stations at a minimal cost. As noted above, when paired with the 1616.5-1626.5 MHz band, these additional frequencies will yield up to 3600 channels in one satellite beam and even more channels among multiple spot beams, permitting AMSC to provide a wider variety of services, including position location service, and making AMSC's services more attractive to providers of land mobile distress and safety services.

If the Commission is unwilling to reallocate the 1515-1525 MHz band to MSS, then AMSC recommends that the Commission consider a 10 megahertz section of either the 1850-1990 MHz, 2110-2130 MHz or 2160-2180 MHz bands. All of these bands have been proposed for MSS allocations by the Commission in the WARC proceeding. However, these bands are not as desireable as the 1515-1525 MHz band because they are not proximate to the existing allocations and thus will be more costly to implement. In addition, it appears that reaccomodation of existing users in the 1515-1525 MHz band will be less problematic than in these other proposed bands because of the volume of users and the types of equipment in use.

II. The Applications of Ellipsat and MSCI Should Be Dismissed or Denied

A. The Applications Are Technically Deficient

As discussed in detail in the attached Technical Appendix, there are serious technical problems with the Ellipsat and Motorola applications. These problems include the violation of existing domestic and international limits on the power of RDSS systems operating in these bands. As a result of this excess power and other design elements, the Ellipsat and Motorola systems would cause severe harmful interference to existing users of the bands in which they propose to operate. In addition, there is strong evidence that the proposed systems would be extremely unreliable, although the applicants must provide further information before a thorough analysis of this issue can be completed. MSCI's system, with its proposal to orbit 77 satellites through the polar region, also creates a problem of potential space collisions, with the attendant risk of creating hazardous space debris. To make matters worse, Iridium satellites have an expected lifetime of only five years; thus, over time there will be many more than 77 Iridium satellites posing collision hazards.

1. <u>Excess power and harmful interference</u>

The most obvious problem with the Ellipsat and MSCI applications is their violation of the rules of the Commission and the International Telecommunication Union prescribing certain power limits on RDSS systems operating in the 1610-1626.5 MHz and 2483.5-2500 MHz bands. Both Ellipsat and MSCI violate these limits substantially. As a result, Motorola and Ellipsat would interfere with a large number of fixed services systems, radio astronomy observatories, and the planned Glonass navigation system, all of which operate in at least portions of the 1610-1626.5 MHz band. In addition, Ellipsat would interfere with fixed, mobile and radiolocation systems in the 2483.5-2500 MHz band and MSCI, which proposes to operate feeder links in the 20/30 GHz bands, would interfere with Fixed Satellite Service systems.[27/]

These power and interference problems do not appear to be remediable. If the power of the proposed systems is reduced to the acceptable levels, they will have dramatically less capacity. For instance, the MSCI system would have roughly one tenth of a percent of its stated capacity if it were to operate at the

---

[27/] In addition, as shown in the Technical Appendix, the Ellipsat and MSCI systems would preclude the licensing of other similar systems and would significantly reduce the ability for true RDSS systems to operate in these bands. Technical Appendix, pp. 21-26. Thus, they are totally inconsistent with the Commission's efforts to provide for multiple entry.

required power level compatibility with radio astronomy and radionavigation satellite systems.

A geostationary satellite system providing service in North America would not have these same interference problems as long as its operations are limited to the upper ten megahertz of the 1610-1626.5 MHz band. This is because all radio astronomy and radionavigation facilities operate or plan to operate in the lower part of the band and there are no fixed service operations in the upper portion of the band in North America.

2. Reliability

The Ellipsat and MSCI applications also present serious reliability problems. Based on the available information, it appears that users of the systems would experience frequent and prolonged outages. For instance, it appears that neither system design can provide enough battery power to permit operation at night when the solar arrays are not illuminated. At a minimum, these problems would preclude the use of the systems for safety communications. Although it is clear that a substantial reliability problem exists for the two systems, further information is required in order to understand the full severity of the problem. See Space Station Filing Requirements, 93 FCC 2d 1260, 1265 Appendix B, Section II.9 (1983).

3. Space Debris

In a previous filing, AMSC has demonstrated that a substantial risk exists that MSCI's proposed system will cause collisions in or below the orbital sphere at 765 km altitude that could destroy any of the critical strategic communications satellites, military surveillance satellites, search and rescue satellites, weather observation satellites, scientific satellites or Earth resources satellites that operate in the same or lower orbital spheres. See Reply of AMSC, Gen. Docket No. 89-554, Technical Appendix, at 4-6, Exhibit 5 (January 8, 1991). The earlier filing is incorporated herein by reference. MSCI has responded in only the most perfunctory fashion to these concerns.[28] This is not a silly issue that is the concern of some "fringe" element that is opposed to technological progress. Quite to the contrary, it has been recognized as a problem by, among others the Office of Technology Assessment. As such, it clearly merits a more thoughtful reply.

---

[28] See Supplemental Comments of Motorola, Gen. Docket No. 89-554, p. 6 (March 27, 1991). In partial recognition of the potential for collision, Motorola has proposed a space traffic control system that will prevent collision between Motorola satellites. However, this space traffic control center is totally inadequate because it ignores all of the many other objects that also orbit the Earth in this sphere.

B. The Applications Are Speculative

AMSC is not opposed to competition. Indeed, AMSC expects to face competition in many areas of the domestic market from terrestrial mobile radio systems such as rural cellular and from other satellite systems, such as the Qualcomm Ku-band system and VSAT systems. In the international market and some parts of the domestic market, AMSC will face competition from Inmarsat and other foreign systems. Thus, AMSC is not opposed to the Ellipsat and MSCI applications because they present possible competition. Rather, AMSC opposes the applications because they are unrealistic proposals and, thus, a grant of either application would result in the warehousing of spectrum that AMSC needs and could put to good use in the near future.

As discussed above, the Ellipsat and MSCI applications have serious technical deficiencies that call into question their legitimacy. Equally important, however, their business plans are based on speculative and unreasonable assumptions. Ellipsat, for instance has been able to demonstrate no committed financial resources other than a balance sheet of $20,000. MSCI presents a similarly speculative application; one that is all the more troubling because of its excellent corporate reputation. Despite that reputation, however, the Commission cannot grant MSCI's application without first assuring itself that the technology is adequately developed, the approach being taken is a practical one, and the alternative uses of the spectrum would not better serve the public interest. AMSC has shown that the technology being proposed by MSCI is ill-conceived and that the approach being proposed by MSCI faces a number of extremely high obstacles (including the need to raise an enormous amount of money from legally qualified entities and the need to secure foreign approvals). AMSC is confident that when the Commission compares Ellipsat's or MSCI's proposed system to that of AMSC, the Commission will be convinced that AMSC's proposal has the best technology, is far and away the most practical to implement, and makes the best use of spectrum to serve U.S. customers.

Conclusion

Therefore, based on the foregoing, AMSC respectfully requests that the Commission grant the requested relief.

Respectfully submitted,

AMERICAN MOBILE SATELLITE CORPORATION

By: ______________________
Bruce D. Jacobs

Fisher, Wayland, Cooper
& Leader
1255 23rd Street, N.W.
Suite 800
Washington, D.C. 20037
(202) 659-3494

By: ______________________
Lon C. Levin
Glenn S. Richards

Gurman, Kurtis, Blask &
Freedman, Chartered
1400 Sixteenth Street, N.W.
Suite 500
Washington, D.C. 20036
(202) 328-8200

Its Attorneys

Leslie A.L. Borden
Vice President and
General Counsel
American Mobile Satellite
Corporation
1150 Connecticut Avenue, N.W.
4th Floor
Washington, D.C. 20036
(202) 331-5858

Dated: June 3, 1991

EXHIBIT A

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

In the Matter of the Application of AMSC SUBSIDIARY CORPORATION For Modification of Space Station Authorization to Construct and Operate Its Satellite Located at 62° W.L. to Add the 1515-1525 MHz (downlink) Band and the 1616.5-1626.5 MHz (uplink) Band	)	File No.

APPLICATION

AMSC Subsidiary Corporation ("AMSC") hereby submits this application for modification of its mobile satellite authorization.[1] Specifically, AMSC requests authority to construct and operate its satellite located at 62° W.L. to add the 1515-1525 MHz (downlink) band and the 1616.5-1626.5 MHz (uplink) band.[2] Grant of this application is necessary for the

---

1/ AMSC Subsidiary Corporation is a wholly owned subsidiary of American Mobile Satellite Corporation. See Order and Authorization, File No. 13-DSS-AL-91(3), DA 91-33 (March 22, 1991). AMSC is authorized to construct, launch and operate three satellites in the 1545-1559 MHz/1646.5-1660.5 MHz bands. Memorandum Opinion, Order and Authorization, 4 FCC Rcd 6041 (1989), rev'd in part Aeronautical Radio, Inc. v. FCC, 928 F.2d 428 (D.C. Cir. 1991). For a discussion of the status of AMSC's license, see Comments and Reply Comments of AMSC in response to the Commission Public Notice soliciting comments on the remand. AMSC Comments (April 11, 1991); AMSC Reply Comments (April 23, 1991), Gen. Docket No. 84-1234.

AMSC has two amendments pending before the Commission that request, in part, authority to construct and operate each satellite in the 1530-1545/1626.5-1646.5 MHz bands. See Request for Modification and Supplemental Information of AMSC, File Nos, 7/8/9-DSS-MP/ML-90 (December 4, 1989); Application of AMSC for Authority to Operate in the 1530-1545 MHz and 1626.5-1646.5 MHz bands (January 25, 1990).

2/ AMSC is concurrently filing an application requesting authority to construct and operate its satellite located at 139° W.L. to add the 1515-1525 MHz (downlink) band and the (continued...)

development of a U.S domestic MSS system. Concurrent with this application, AMSC is filing a Petition requesting that the Commission allocate the 1515-1525 MHz and 1616.5-1626.5 MHz bands to the Mobile Satellite Service.[3]

AMSC submits the following information in support of this application:

A. The name and address of the applicant is:

AMSC Subsidiary Corporation
1150 Connecticut Avenue, N.W.
Fourth Floor
Washington, D.C. 20036
(202) 331-5858

B. Correspondence concerning this application should be addressed to:

Michael Ward
Senior Scientist
American Mobile Satellite Corporation
1150 Connecticut Avenue, N.W.
Fourth Floor
Washington, D.C. 20036
(202) 331-5858

2/ (...continued)
1616.5-1626.5 MHz (uplink) band. AMSC's central satellite, located at 101° W.L., is already under construction and AMSC does not expect that this proceeding will be completed in time to add the additional frequencies to the central satellite.

3/ The RF plan for the modified satellite system includes the bands 1525-1530 MHz for illustrative purposes only. The Commission has proposed that these bands be reallocated to MSS at the 1992 WARC as a companion downlink to the already allocated 1626.5-1631.5 MHz MSS uplink band. The domestic allocation of the 1525-1530 MHz band is not a subject of the AMSC Petition filed concurrently with this application. AMSC does plan, however, to request that the 1525-1530 MHz band be added to its system in the event that these bands are allocated domestically.

with a copy to applicant's counsel:

Lon C. Levin
Glenn S. Richards
Gurman, Kurtis, Blask & Freedman
1400 16th Street, N.W.
Suite 500
Washington, D.C. 20036
(202) 328-8200

C. Proposed Modification

By this application, AMSC requests authority to construct and operate the AMSC satellite located at 62° W.L. to add the bands 1616.5-1626.5 MHz (Earth-to-space) and 1515-1525 MHz (space-to-Earth).

If the 1515-1525 MHz band cannot be reallocated to MSS, AMSC requests that the Commission allocate a 10 MHz MSS downlink band in a portion of the 2110-2130 MHz, 2160-2180 MHz, or 1850-1990 MHz bands, in that order of preference. The 1515-1525 MHz is preferred because it will be nearly $10 million less expensive to incorporate into AMSC's satellite than the other options. This added cost is in part due to the fact that the satellite would need an additional transmitter if a band in the 2.1 GHz, or 1.8-1.9 GHz range is used.

D. General description of overall system facilities, operations and services

A complete description of AMSC's mobile satellite system, including facilities, operations and services, is contained in the AMSC system proposal that was filed on February 1, 1988, and the amendments thereto (the "System Proposal"). The AMSC System

Proposal is incorporated by reference into this application. Technical changes required as a result of adding these bands are discussed below.[4]

E. General Technical Information

1. Radio Frequency Plan

Attachment 1 provides the modified radio frequency plan, including frequencies, bandwidth, polarizations, emission designators, power into antennas, satellite antenna gain contours and power flux density levels within each coverage area.

2. Number of Satellites

There is no change from the System Proposal.

3. Space Segment

Figure 1 is a diagram of the proposed satellite design modified to incorporate the 1616.5-1626.5 MHz band and the 1515-1525 MHz bands. Figure 2 is a diagram of the satellite design modified to incorporate the 1616.5-1626.5 MHz band and the 2110-2120 MHz bands.

The satellite is expected to have a useful life of 12 years.

4/ AMSC notes that no changes are shown for adding a 10 MHz portion of the 1850-1990 MHz band because the changes would be the same as adding 10 MHz from the 2.1 GHz band.

Figure 1- Satellite Payload Block Diagram for a 1515-1525 MHz Matching Downlink

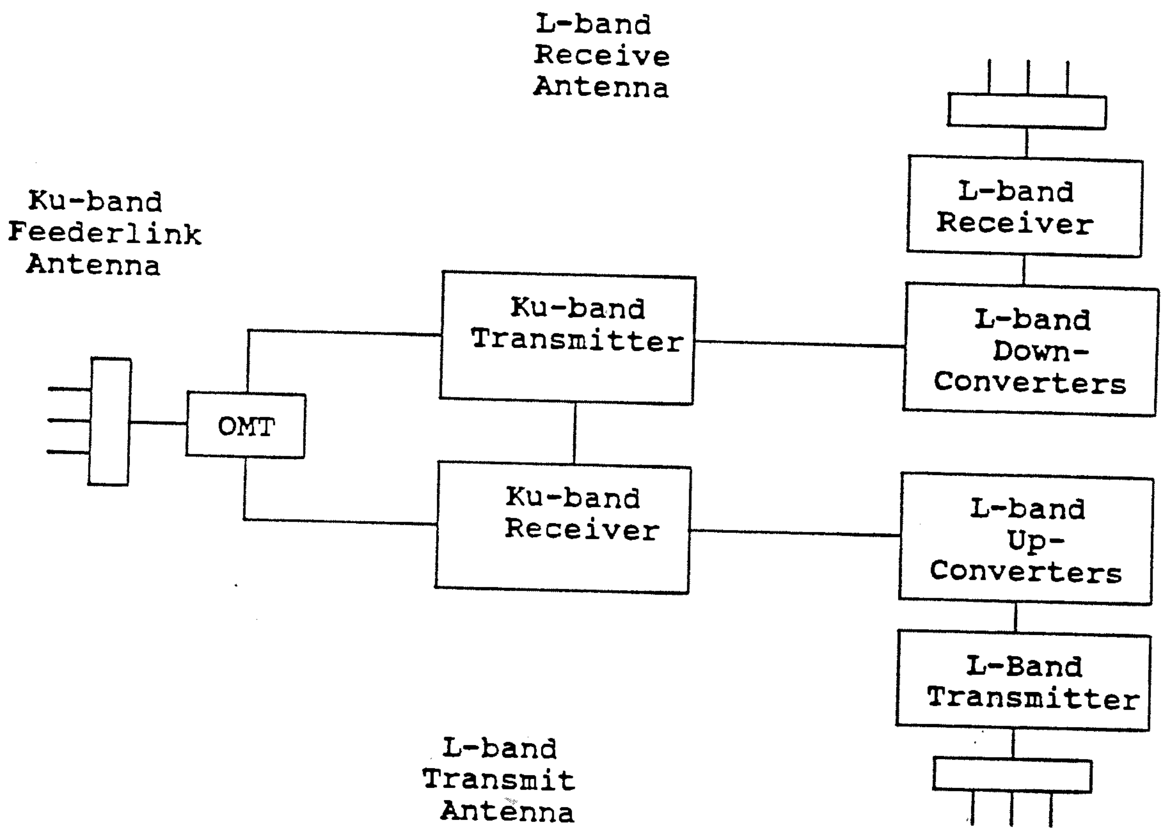
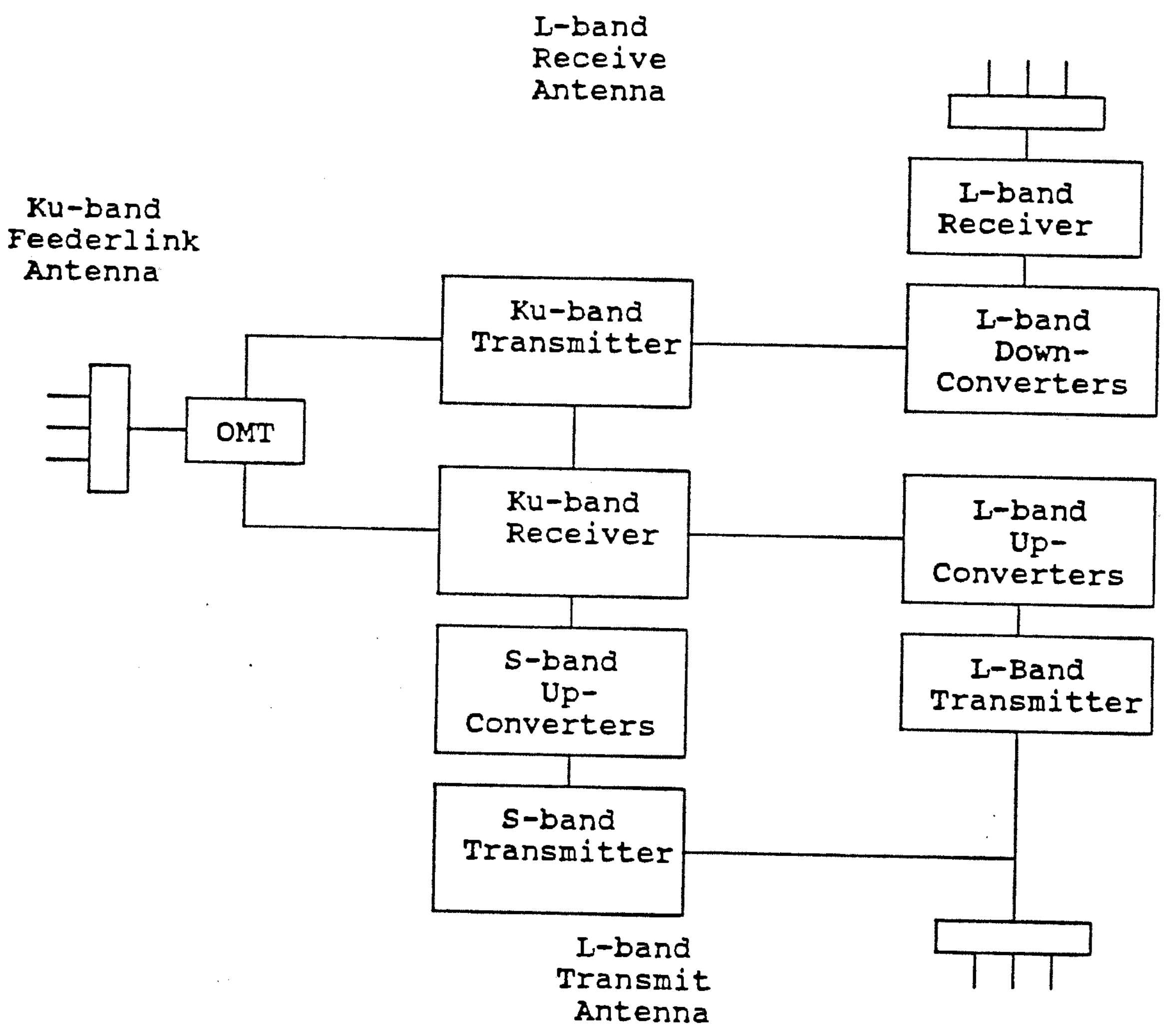


Figure 2- Satellite Payload Block Diagram for an S-band Matching Downlink



4. Space station coverage contours

There is no change to the predicted space station coverage contours for L-band coverage. Attachment 2 contains the coverage patterns for the S-band transmitters.

5. Physical Characteristic of the Space Station

There is no change from the System Proposal.

6. Emission limitations

There is no change from the System Proposal.

F. Description of Proposed Services

The modification of AMSC's satellite will not result in changes in the services that it offers except that AMSC expects to be able to provide land mobile safety services that will not be subject to preemption by aeronautical or maritime safety services.

AMSC will provide a highly accurate position location service through the use of the Global Positioning Satellite System ("GPS"). A GPS receiver will be integrated into the terminal design and available as an option to users.

Grant of this application will allow AMSC to provide approximately 3000 more channels of high-quality voice service. The Commission's MSS orders have established that there is a substantial demand for the new service. Further studies in preparation for the 1992 WARC have confirmed the substantial size of MSS demand. For example, the Joint Interim Working Party of the CCIR estimates that there is a minimum requirement of 88.8 MHz and a likely requirement of 164.1 MHz.[5]

To the extent that the Commission does not reallocate the requested frequencies to MSS pursuant to AMSC's concurrent Petition, but is willing to authorize expanded use of the frequencies through the grant of waivers, AMSC hereby seeks a waiver of Section 25.392 and Section 2.106 of the Commission's rules, as necessary, to permit use of the bands for MSS, including mobile data and voice services as proposed in this application. The preferred course, however, is for the Commission to proceed by rulemaking.

AMSC does not anticipate any change from its outstanding proposal with respect to the areas and entities to be served.

Attachment 3 provides for the 2.1 GHz band a description of transmission characteristics and performance objectives for each type of service, link noise budgets, typical or baseline earth station parameters, modulation parameters and overall link performance. With respect to the 1515-1525 MHz band, these characteristics do not change from the original system proposal.

5/ See Document JIWP92/110-E, March 12, 1991.

G. Compatibility

The Commission requires RDSS applicants proposing to operate in the 1610-1626.5 MHz band to meet certain requirements that are intended to permit their operation without interference with other users of the band and to permit sharing of the band by additional RDSS systems. See Section 25.392(f) of the Commission's Rules. By proposing to operate in only the 10 MHz between 1616.5 MHz and 1626.5 MHz, AMSC has eliminated any possibility that it will cause interference to existing users of the band. As to the Commission's interest in preserving the opportunity for sharing of the spectrum by several RDSS systems, as discussed in AMSC's Petition, such a requirement unnecessarily would reduce the capacity of the U.S. MSS system if an RDSS system actually was operating in the band, and AMSC therefore is opposed to the requirement. Nonetheless, because AMSC's system is essentially a "bent pipe," AMSC is capable if necessary of meeting the Commission's requirements for permitting sharing of the band by RDSS systems.

H. System reliability, redundancy and link availability

In general, there is no change from AMSC's System Proposal. Each modified satellite will be fully capable of providing back-up to the other modified satellite. In addition, AMSC's central satellite and the Canadian MSS satellite will share a significant amount of spectrum with the modified satellites. AMSC expects that MSS mobile terminals will be designed to tune to all of the bands authorized by the Commission.

I. Launch vehicle and arrangements for launch

There is no change from AMSC's System Proposal.

J. Arrangement for TT&C

There is no change from AMSC's System Proposal.

K. Orbital Locations

There is no change from AMSC's System Proposal.

L. Milestones

AMSC's milestones are set forth in AMSC Authorization Order, 4 FCC Rcd 6041 at para. 135 (1989).

M. Estimated Costs

AMSC estimates that to add the 1616.5-1626.5 MHz band and the 1515-1525 MHz band will cost $1 million. If frequencies from either the 2.1 GHz band or the 1850-1990 MHz band are added, the cost is approximately $10 million.

N. Financial Qualifications

By its subject application, AMSC proposes to incorporate the subject frequencies into the MSS system for which it holds the Commission authorization. At the time that the Commission granted the authorization for the U.S. MSS system, it concluded that AMSC's parent, American Mobile Satellite Corporation ("AMSC Parent") had the requisite financial qualifications to hold the authorization for that system. Memorandum Opinion, Order and Authorization, 4 FCC Rcd 6041, 6058 (1989). In this application, AMSC demonstrates its ability to finance the incremental cost to incorporate the additional frequencies proposed herein into its MSS system through construction, launch and the first year of operation.

As stated in this application and the concurrently-filed application to modify its authorization for the 139° W.L. satellite, AMSC estimates that those costs for both satellites will total no more than $20 million. AMSC proposes to meet these additional expenses through the sale of additional equity in AMSC Parent to the existing shareholders of that Parent, as it has done in the past to meet the costs of developing its MSS system. AMSC Parent has agreed to then provide these funds to AMSC to finance the subject proposal. To the extent that certain shareholders may elect not to make their pro rata contributions for additional equity to meet these costs, the remaining shareholders will make up the difference.[6]

6/ Each shareholder's percentage interest in American Mobile Satellite Corporation will be adjusted to reflect its total capital contributions to date. The Commission specifically anticipated that such shifts in ownership would occur. Second Report and Order, 2 FCC Rcd 485, 491 (1987).

To demonstrate the availability to AMSC of sufficient funds to meet these $20 million in costs, appended hereto as Attachment 4 is a letter from one of the shareholders of its Parent, McCaw Space Technologies, Inc. ("McCaw"). Therein, McCaw indicates its willingness, if necessary, to purchase sufficient additional equity in AMSC Parent up to the full $20 million to meet the costs of the subject proposal. Attached to the letter is the current balance sheet of the parent corporation of McCaw, McCaw Cellular Communications, Inc., demonstrating that sufficient current assets exist to meet this commitment to AMSC Parent. In light of the foregoing, AMSC respectfully submits that it has demonstrated that it is prepared to proceed with the implementation of its proposed system immediately upon Commission grant of the subject application.

O. Legal Qualifications

The legal qualifications of the applicant are a matter of record before the Commission.[7] A current Common Carrier and Satellite Licensee Qualification Report (FCC Form 430) for AMSC Subsidiary Corporation was filed with the Commission on April 29, 1991, and is incorporated into this application by reference.

7/ See AMSC Authorization Order.

P. Public Interest Considerations

As discussed in AMSC's Petition, a grant of this application will provide AMSC with additional spectrum for the development of the U.S. MSS system. There is a severe international shortage of MSS spectrum. The additional frequencies proposed in this application can be readily and inexpensively added to AMSC's planned satellites, permitting AMSC to provide a spectrum efficient and highly reliable service.

Q. Waiver of Claim to Spectrum

AMSC waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application.

R. Conclusion

For the above-stated reasons, AMSC respectfully requests that the Commission expeditiously grant this application.

Respectfully submitted,
AMSC SUBSIDIARY CORPORATION

By: [signature]
Brian B. Pemberton
President

Lon C. Levin
Glenn S. Richards
Gurman, Kurtis, Blask & Freedman
1400-16th Street, N.W.
Suite 500
Washington, D.C. 20036

Counsel to AMSC Subsidiary Corporation

June 3, 1991

ATTACHMENT 1

TABLE 1-1 SATELLITE RF CHARACTERISTICS
For L-Band Downlink Allocation

	L to K_u Band	K_u to L Band
Frequency		
Receive	1616.5 to 1660.5 MHz	14000 to 14500 MHz
Transmit	11700 to 12200 MHz	1515 to 1559 MHz
Polarization		
Transmit	Linear Horizontal	RHCP
Receive	RHCP	Linear vertical
Transponder bandwidth	44 MHz	44 MHz
Peak G/T	3 dB-K (peak nominal)	-3.9 dB-K(EOC)
System temperature	633° K	780° K
Emission limitations (% authorized bandwidth)		
50 to 100%	>25 dB attenuation in any 4 KHz	>25 dB attenuation in any 4 KHz
100 to 250%	>35 dB attenuation in any 4 KHz	>35 dB attenuation in any 4 KHz
>250%	>60 dB attenuation in any 4 KHz	>60 dB attenuation in any 4 KHz
Transponder gain (0 dB attenuation step)	157 dB	163.8 dB
Receive sat. flux density total peak	-105.8 dBW/M^2	-126.23 dBW/M^2
Transmit EIRP max./carrier		35.5 dBw/5 KHz
Total EIRP max./beam	40 dBW	57.1[1] dBw
Transmitter RF power	40 Watts	640 Watts
Transmitter redundancy	2 for 1	29 for 19

1/ Assuming 50% of <u>all</u> system traffic in a single beam.

TABLE 1-2 SATELLITE RF CHARACTERISTICS
For S-Band Downlink Allocation

	L to K_u Band	K_u to L Band	K_u to S Band
Frequency			
Receive	1616.5 to 1660.5 MHz	14000 to 14500 MHz	14000 to 14500 MHz
Transmit	11700 to 12200 MHz	1530 to 1559 MHz	2110 to 2120 MHz[2]
Polarization			
Transmit	Linear Horizontal	RHCP	RHCP
Receive	RHCP	Linear vertical	Linear vertical
:ransponder)andwidth	44 MHz	29 MHz	10 MHz
'eak G/T	3 dB-K (peak nominal)	-3.9 dB-K(EOC)	-3.9 dB-K(EOC)
ystem emperature	633° K	780° K	780° K
mission limitations (% authorized bandwidth)			
50 to 100%	>25 dB attenuation in any 4 KHz	>25 dB attenuation in any 4 KHz	>25 dB attenuation in any 4 KHz
100 to 250%	>35 dB attenuation in any 4 KHz	>35 dB attenuation in any 4 KHz	>35 dB attenuation in any 4 KHz
>250%	>60 dB attenuation in any 4 KHz	>60 dB attenuation in any 4 KHz	>60 dB attenuation in any 4 KHz
ransponder ain) dB attenuation step)	157 dB	163.8 dB	163.8 dB
eceive sat. lux density otal peak	-105.8 dBW/M[2]	-126.23 dBW/M[2]	-126.23 dBW/M[2]
ransmit EIRP ax./carrier		35.5 dBw/5 KHz	35.5 dBw/5 KHz
otal EIRP ax./beam	40 dBW	57.1[3] dBw	56 dBw
ansmitter power	40 Watts	640 Watts	398 Watts
ansmitter dundancy	2 for 1	29 for 19	10 for 8

2/ This band is cited for illustrative purposes only.

3/ Assuming 50% of <u>all</u> system traffic in a single beam.

TABLE 1-3 FORWARD (L-BAND TRANSMIT) FREQUENCY PLAN FOR S-BAND DOWNLINK ALLOCATION

Frequency Range: 1530-1559 MHz
Polarization: Right Hand Circular

Sub-band Letter	Frequency MHz
a	1532.5
b	1535.0
c	1537.5
d	1540.0
e	1542.5
f	1545.0
g	1547.5
h	1550.0
i	1552.5
j	1555.0
k	1557.5

TABLE 1-4 FORWARD (S-BAND TRANSMIT) FREQUENCY PLAN

Frequency Range: 2110 - 2120.0
Polarization: Right Hand Circular

Sub-band Letter	Frequency MHz
l	2112.5
m	2115.0
n	2117.5

TABLE 1-5 FORWARD (L-BAND TRANSMIT) FREQUENCY PLAN
FOR L-BAND DOWNLINK ALLOCATION

Frequency Range: 1515-1559 MHz
Polarization: Right Hand Circular

Sub-band letter	Frequency MHz
a	1517.5
b	1520.0
c	1522.5
d	1525.0
e	1527.5
f	1530.5
g	1532.5
h	1535.0
i	1537.5
j	1540.0
k	1542.5
l	1545.0
m	1547.5
n	1550.0
o	1552.5
p	1555.0
q	1557.5

TABLE 1-6 FORWARD (L-BAND RECEIVE) FREQUENCY PLAN <u>FOR ALL CASES</u>

Frequency Range: 1616.5-1660.5 MHz
Polarization: Right Hand Circular

Sub-band letter	Frequency MHz
a	1629.0
b	1631.5
c	1634.0
d	1636.5
e	1639.0
f	1641.5
g	1644.0
h	1646.5
i	1649.0
j	1651.5
k	1654.0
l	1656.5
m	1659.0
n	1619.0
o	1621.5
p	1624.0
q	1626.5

TABLE 1-7 Ku-BAND RECEIVE FREQUENCY PLAN, 62°/139° W.L.

(Frequency Range of 14000-14200 MHz)
(Polarization is horizontal)

Band Number	Freq. MHz	BW MHz	Bank Number	Freq. MHz	BW MHz
1	14003.5	2.5	16	14099	5
2	14009	5	17	14105	5
3	14015	5	18	14111	5
4	14021	5	19	14117	5
5	14027	5	20	14123	5
6	14033	5	21	14129	5
7	14039	5	22	14135	5
8	14045	5	23	14141	5
9	14051	5	24	14147	5
10	14057	5	25	14153	5
11	14063	5	26	14159	5
12	14069	5	27	14165	5
13	14075	5	28	14171	5
14	14087	5	29	14177	5
15	14093	5	30	14183	5
			31	14193	10

TABLE 1-8 Ku-BAND RECEIVE FREQUENCY PLAN, 62°/139° W.L.

(Frequency Range of 11700-11900 MHz)
(Polarization is vertical linear)

Band Number	Freq. MHz	BW MHz	Bank Number	Freq. MHz	BW MHz
TLM1	11703	-			
TLM2	11704	-	16	11799	5
1	11709	5	17	11805	5
2	11715	5	18	11811	5
3	11721	5	19	11817	5
4	11727	5	20	11823	5
5	11733	5	21	11829	5
6	11739	5	22	11835	5
7	11745	5	23	11841	5
8	11751	5	24	11847	5
9	11757	5	25	11853	5
10	11763	5	26	11859	5
11	11769	5	27	11865	5
12	11775	5	28	11871	5
13	11781	5	29	11877	5
14	11787	5	30	11883	5
15	11793	5	31	11893	10

TABLE 1-9 MOBILE EARTH TERMINAL CHARACTERISTICS

CONFIGURATION	1	2	3	4	5
ANTENNA TYPE	DIR	DIR	OMNI	OMNI	OMNI
COMM TYPE (NOTE)	CS	PS	CS	CS	PS
INFO. RATE (KBPS)	4.8	9.6	4.8	2.4	2.4
SYMBOL RATE (KSPS)	2.4	9.6	2.4	2.4	2.4
MODULATION	8PSK	QPSK	8PSK	QPSK	QPSK
MIN Es/No (DB)	12.5	8.0	12.5	6.0	8.0
MET G/T (DB/K)	-12	-12	-22	-22	-22

NOTE: CS = Circuit switched voice or data, BER = .001
PS = Packet switched data, BER = .00001

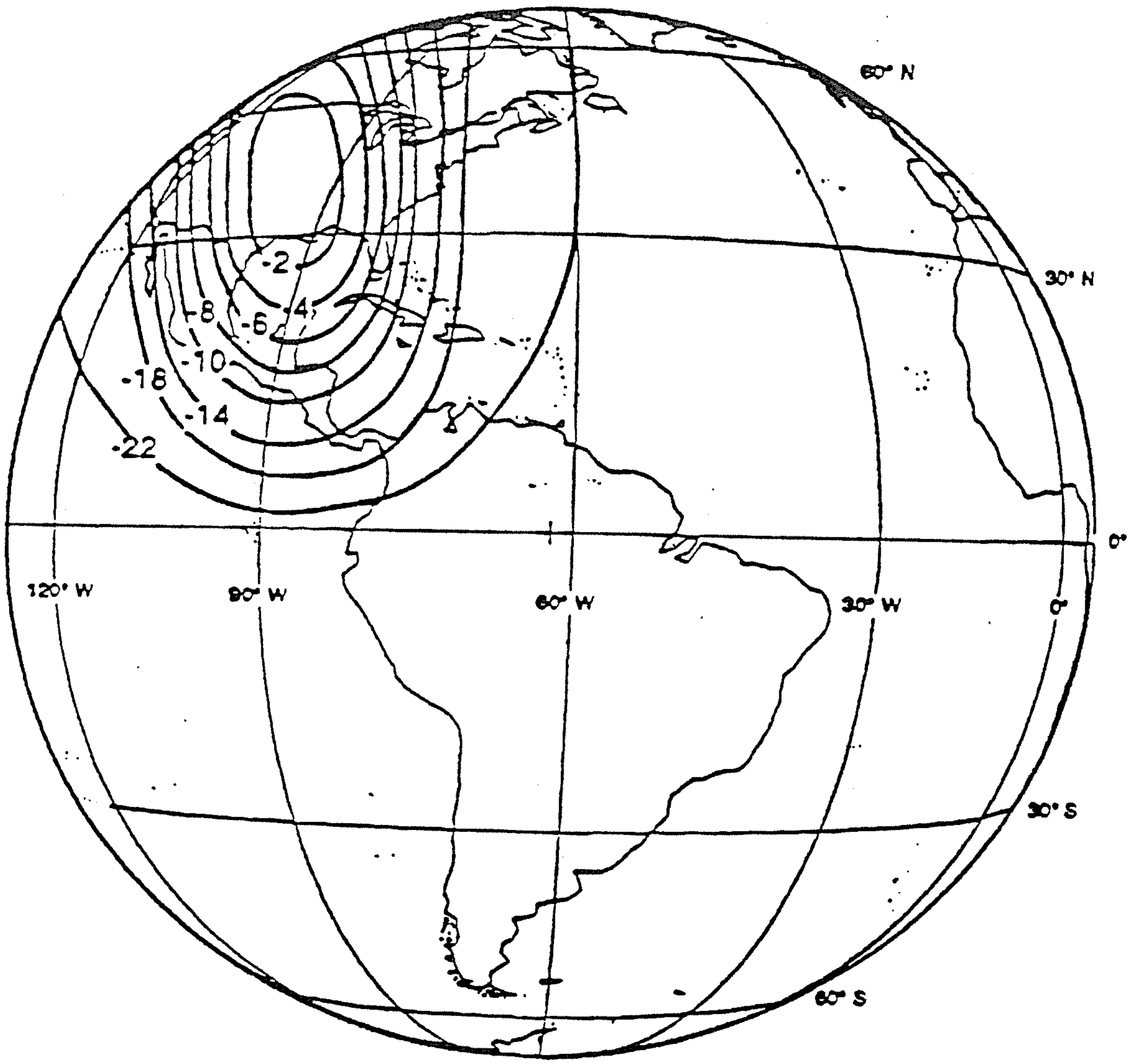
TABLE 1-10 MOBILE EARTH TERMINAL CHARACTERISTICS CONTINUED

CONFIGURATION	6	7	8	9
ANTENNA TYPE	FIXED	FIXED	FIXED	OMNI
COMM TYPE (NOTE)	CS	PS	PS	CS
INFO. RATE (KBPS)	4.8	9.6	2.4	4.8
SYMBOL RATE (KSPS)	2.4	9.6	2.4	2.4
MODULATION	8PSK	QPSK	QPSK	QPSK
MIN Es/No (DB)	11	7	7	12.5
G/T (DB/K)	-9	-9	-9	-16

TABLE 1-11 FEEDER LINK EARTH STATION CHARACTERISTICS

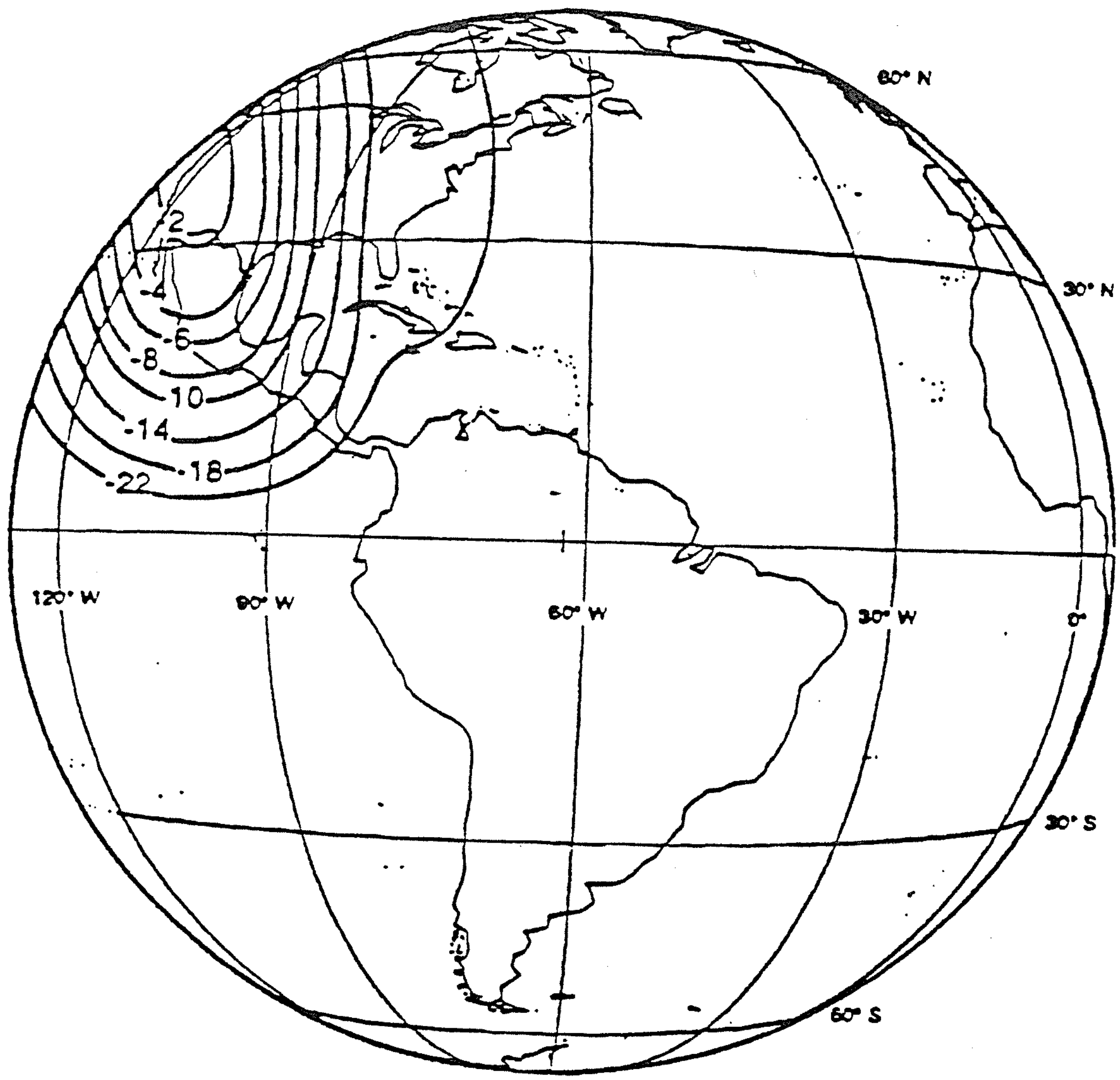
Designator	A	B	C
Antenna Diameter (m)	3.5	4.6	6.1
Transmit Gain @ 13 GHz (dBi)	51.5	53.7	56.0
Receive Gain @ 11 GHz (dBi)	50.0	52.3	54.8
Receive G/T, T = 225K (dB/K)	26.5	28.8	31.3

ATTACHMENT 2



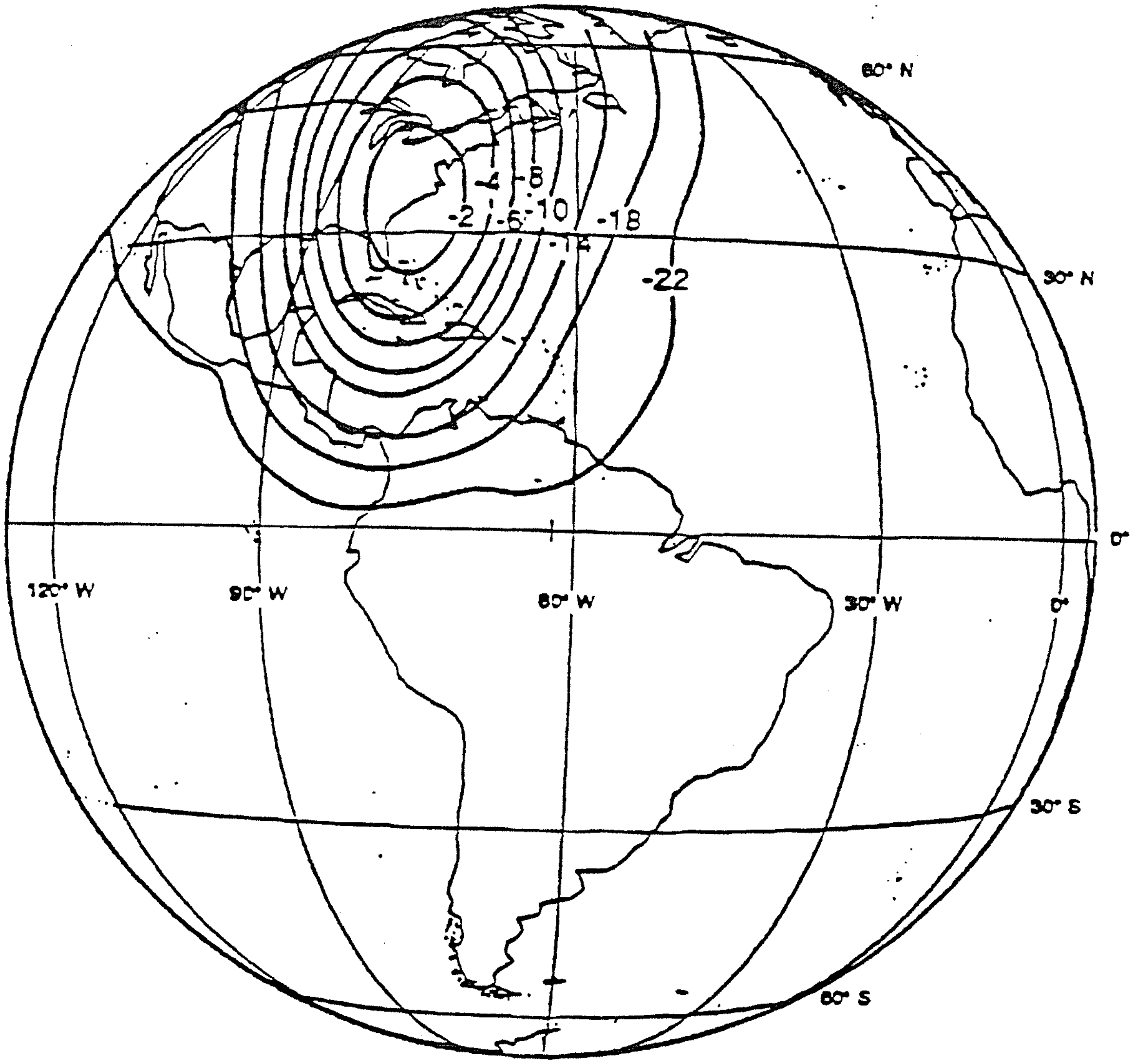
Central Beam

S-Band Transmitting Gain Contours, 62° W Satellite



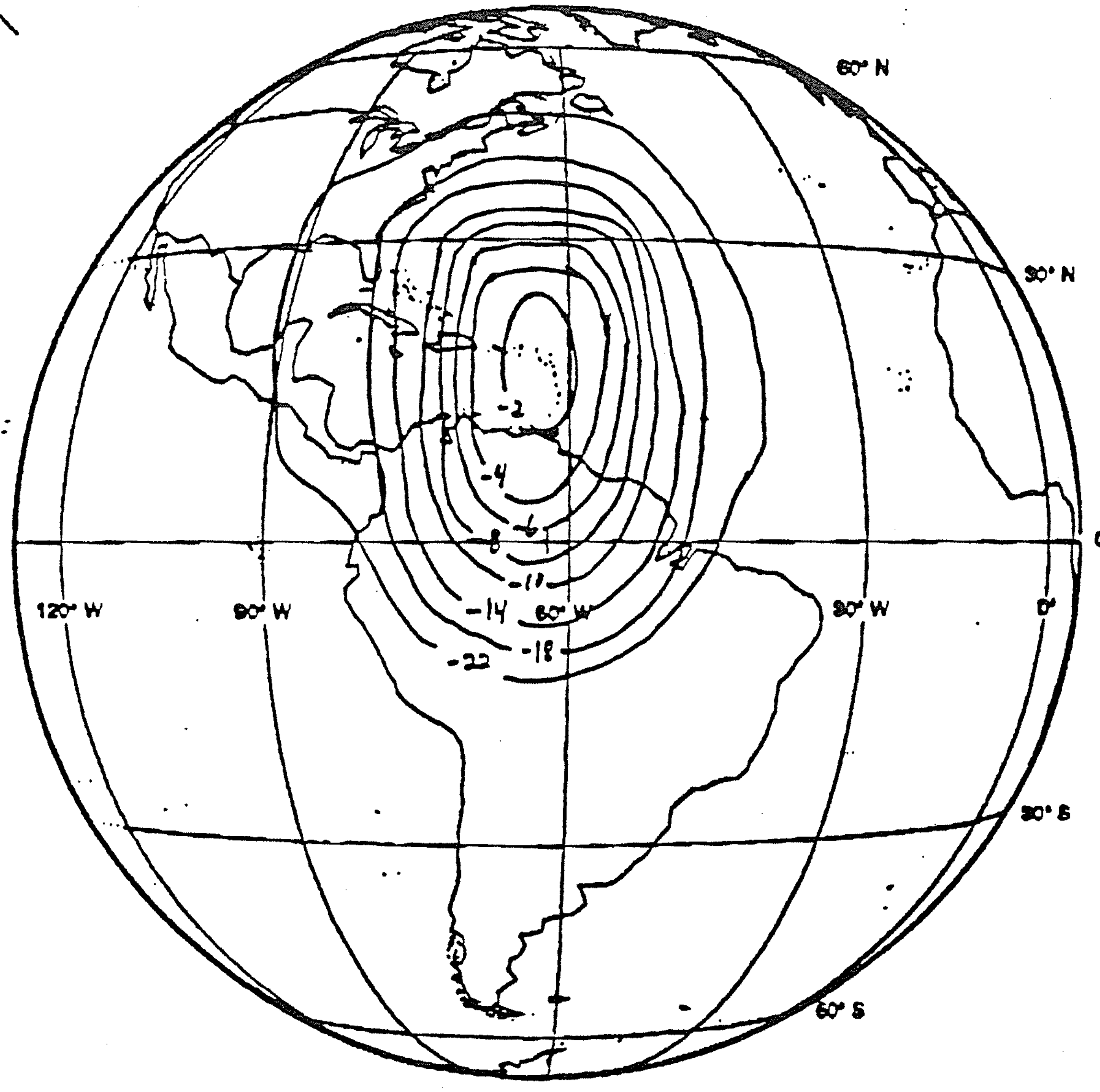
Mountain Beam

S-Band Transmitting Gain Contours, 62° W Satellite



East Beam

S-Band Transmitting Gain Contours, 62° W Satellite



Puerto Rico Beam

S-Band Transmitting Gain Contours, 62° W Satellite

ATTACHMENT 3

CONFIGURATION:	1A			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	DIRECTIONAL			
FES:	3.5 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	40.0	24.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-123.0	-138.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-12	3	26.5
CNR thermal (DB)	23.3	15.4	20.6	18.7
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	20.5	13.8	18.2	16.4
CNR total (DB)		13.0		14.2
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	1.5	2.3	2.7	3.3

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	1B			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	DIRECTIONAL			
FES:	4.6 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	40.0	24.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-123.0	-138.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-12	3	28.8
CNR thermal (DB)	23.3	15.4	20.6	21.0
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	20.5	13.8	18.2	17.6
CNR total (DB)		13.0		14.9
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	1.5	2.3	3.4	5.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	1C			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	DIRECTIONAL			
FES:	6.1 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	40.0	24.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-123.0	-138.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-12	3	31.3
CNR thermal (DB)	23.3	15.4	20.6	23.5
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	20.5	13.8	18.2	18.6
CNR total (DB)		13.0		15.4
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	1.5	2.3	3.9	7.2

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	2A			
LINK TYPE, SYMBOL RATE	PS, 9.6 KSPS			
MET:	DIRECTIONAL			
FES:	3.5 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	41.2	25.7	12.4	4.4
FLUX DENSITY (DBW/M*M)	-121.8	-137.3	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	9600	9600	9600	9600
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-12	3	26.5
CNR thermal (DB)	18.5	10.6	14.6	12.7
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	17.4	10.0	13.9	12.0
CNR total (DB)		9.3		9.8
Es/No min (dB)	8	8	8	8
CNR min (DB)	7	7	7	7
MARGIN (DB)	2.3	2.9	2.8	2.6

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 2B
LINK TYPE, SYMBOL RATE PS, 9.6 KSPS
MET: DIRECTIONAL
FES: 4.6 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	41.2	25.7	12.4	4.4
FLUX DENSITY (DBW/M*M)	-121.8	-137.3	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	9600	9600	9600	9600
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-12	3	28.8
CNR thermal (DB)	18.5	10.6	14.6	15.0
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	17.4	10.0	13.9	13.9
CNR total (DB)		9.3		10.9
Es/No min (dB)	8	8	8	8
CNR min (DB)	7	7	7	7
MARGIN (DB)	2.3	2.9	3.9	4.3

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 2C
LINK TYPE, SYMBOL RATE PS, 9.6 KSPS
MET: DIRECTIONAL
FES: 6.1 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	41.2	25.7	12.4	4.4
FLUX DENSITY (DBW/M*M)	-121.8	-137.3	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	9600	9600	9600	9600
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-12	3	31.3
CNR thermal (DB)	18.5	10.6	14.6	17.5
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	17.4	10.0	13.9	15.6
CNR total (DB)		9.3		11.7
Es/No min (dB)	8	8	8	8
CNR min (DB)	7	7	7	7
MARGIN (DB)	2.3	2.9	4.7	6.4

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 3A
LINK TYPE, SYMBOL RATE CS, 2.4 KSPS
MET: OMNI-DIRECTIONAL
FES: 3.5 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.65	10.8
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.7	-205.1
EIRP (DBW)	51.0	35.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-112.0	-127.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	26.5
CNR thermal (DB)	34.3	16.4	20.4	19.6
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	23.3	14.5	18.1	16.9
CNR total (DB)		14.0		14.5
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	2.5	3.7	3.0	3.9

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 3B
LINK TYPE, SYMBOL RATE CS, 2.4 KSPS
MET: OMNI-DIRECTIONAL
FES: 4.6 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	51.0	35.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-112.0	-127.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	28.8
CNR thermal (DB)	34.3	16.4	20.6	21.0
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	23.3	14.5	18.2	17.6
CNR total (DB)		14.0		14.9
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	2.5	3.7	3.4	5.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 3C
LINK TYPE, SYMBOL RATE CS, 2.4 KSPS
MET: OMNI-DIRECTIONAL
FES: 6.1 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	51.0	35.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-112.0	-127.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	31.3
CNR thermal (DB)	34.3	16.4	20.6	23.5
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	23.3	14.5	18.2	18.6
CNR total (DB)		14.0		15.4
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	2.5	3.7	3.9	7.2

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 4A
LINK TYPE, SYMBOL RATE CS, 2.4 KSPS
MET: OMNI-DIRECTIONAL
FES: 3.5 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	43.0	27.5	4.0	-4.0
FLUX DENSITY (DBW/M*M)	-120.0	-135.5	-159.0	-167.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	26.5
CNR thermal (DB)	26.3	8.4	12.2	10.3
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	21.8	8.0	11.8	9.9
CNR total (DB)		7.9		7.7
Es/No min (dB)	6	6	6	6
CNR min (DB)	5	5	5	5
MARGIN (DB)	2.9	3.1	2.7	2.4

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	4B			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	OMNI-DIRECTIONAL			
FES:	4.6 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	43.0	27.5	4.0	-4.0
FLUX DENSITY (DBW/M*M)	-120.0	-135.5	-159.0	-167.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	28.8
CNR thermal (DB)	26.3	8.4	12.2	12.6
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	21.8	8.0	11.8	11.9
CNR total (DB)		7.9		8.8
Es/No min (dB)	6	6	6	6
CNR min (DB)	5	5	5	5
MARGIN (DB)	2.9	3.1	3.8	4.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 4C
LINK TYPE, SYMBOL RATE CS, 2.4 KSPS
MET: OMNI-DIRECTIONAL
FES: 6.1 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	43.0	27.5	4.0	-4.0
FLUX DENSITY (DBW/M*M)	-120.0	-135.5	-159.0	-167.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	31.3
CNR thermal (DB)	26.3	8.4	12.2	15.1
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	21.8	8.0	11.8	14.0
CNR total (DB)		7.9		9.7
Es/No min (dB)	6	6	6	6
CNR min (DB)	5	5	5	5
MARGIN (DB)	2.9	3.1	4.7	6.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 5A
LINK TYPE, SYMBOL RATE PS, 2.4 KSPS
MET: OMNI-DIRECTIONAL
FES: 3.5 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	45.0	29.5	7.0	-1.0
FLUX DENSITY (DBW/M*M)	-118.0	-133.5	-156.0	-164.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	26.5
CNR thermal (DB)	28.3	10.4	15.2	13.3
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	22.4	9.8	14.4	12.5
CNR total (DB)		9.6		10.3
Es/No min (dB)	8	8	8	8
CNR min (DB)	7	7	7	7
MARGIN (DB)	2.6	3.0	3.3	3.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	5B			
LINK TYPE, SYMBOL RATE	PS, 2.4 KSPS			
MET:	OMNI-DIRECTIONAL			
FES:	4.6 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	45.0	29.5	5.0	-3.0
FLUX DENSITY (DBW/M*M)	-118.0	-133.5	-158.0	-166.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	28.8
CNR thermal (DB)	28.3	10.4	13.2	13.6
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	22.4	9.8	12.7	12.8
CNR total (DB)		9.6		9.7
Es/No min (dB)	8	8	8	8
CNR min (DB)	7	7	7	7
MARGIN (DB)	2.6	3.0	2.7	2.9

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	5C			
LINK TYPE, SYMBOL RATE	PS, 2.4 KSPS			
MET:	OMNI-DIRECTIONAL			
FES:	6.1 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	45.0	29.5	5.0	-3.0
FLUX DENSITY (DBW/M*M)	-118.0	-133.5	-158.0	-166.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-22	3	31.3
CNR thermal (DB)	28.3	10.4	13.2	16.1
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	22.4	9.8	12.7	14.7
CNR total (DB)		9.6		10.6
Es/No min (dB)	8	8	8	8
CNR min (DB)	7	7	7	7
MARGIN (DB)	2.6	3.0	3.6	4.9

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 6B
LINK TYPE, SYMBOL RATE CS, 2.4 KSPS
MET: STATIONARY
FES: 4.6 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	13	1.55	1.65	10.8
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-206.7	-188.2	-188.7	-205.1
EIRP (DBW)	36.0	20.5	11.0	3.0
FLUX DENSITY (DBW/M*M)	-127.0	-142.5	-152.0	-160.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	28.8
CNR thermal (DB)	20.1	17.1	19.0	20.5
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	18.5	14.9	17.3	17.4
CNR total (DB)		13.4		14.3
Es/No min (dB)	11	11	11	11
CNR min (DB)	10	10	10	10
MARGIN (DB)	3.4	5.7	4.3	6.2

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	6A			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	STATIONARY			
FES:	3.5 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	13	1.55	1.65	10.8
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-206.7	-188.2	-188.7	-205.1
EIRP (DBW)	35.0	19.5	10.5	2.5
FLUX DENSITY (DBW/M*M)	-128.0	-143.5	-152.5	-160.5
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	26.5
CNR thermal (DB)	19.1	16.1	18.5	17.7
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	17.8	14.3	16.9	15.8
CNR total (DB)		12.7		13.3
Es/No min (dB)	11	11	11	11
CNR min (DB)	10	10	10	10
MARGIN (DB)	2.7	4.6	3.3	3.9

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	6C			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	STATIONARY			
FES:	6.1 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	13	1.55	1.65	10.8
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-206.7	-188.2	-188.7	-205.1
EIRP (DBW)	36.0	20.5	8.0	0.0
FLUX DENSITY (DBW/M*M)	-127.0	-142.5	-155.0	-163.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	31.3
CNR thermal (DB)	20.1	17.1	16.0	20.0
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	18.5	14.9	15.1	17.1
CNR total (DB)		13.4		13.0
Es/No min (dB)	11	11	11	11
CNR min (DB)	10	10	10	10
MARGIN (DB)	3.4	5.7	3.0	5.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	7A			
LINK TYPE, SYMBOL RATE	PS, 9.6 KSPS			
MET:	STATIONARY			
FES:	3.5 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	37.5	22.0	11.0	3.0
FLUX DENSITY (DBW/M*M)	-125.5	-141.0	-152.0	-160.0
SYMBOL BANDWIDTH (HZ)	9600	9600	9600	9600
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	26.5
CNR thermal (DB)	14.8	9.9	13.2	11.3
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	14.3	9.4	12.6	10.8
CNR total (DB)		8.2		8.6
Es/No min (dB)	7	7	7	7
CNR min (DB)	6	6	6	6
MARGIN (DB)	2.2	2.9	2.6	2.3

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	7B			
LINK TYPE, SYMBOL RATE	PS, 9.6 KSPS			
MET:	STATIONARY			
FES:	4.6 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	37.5	22.0	9.0	1.0
FLUX DENSITY (DBW/M*M)	-125.5	-141.0	-154.0	-162.0
SYMBOL BANDWIDTH (HZ)	9600	9600	9600	9600
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	28.8
CNR thermal (DB)	14.8	9.9	11.2	11.6
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	14.3	9.4	10.8	11.0
CNR total (DB)		8.2		7.9
Es/No min (dB)	7	7	7	7
CNR min (DB)	6	6	6	6
MARGIN (DB)	2.2	2.9	1.9	2.0

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 7C

LINK TYPE, SYMBOL RATE PS, 9.6 KSPS

MET: STATIONARY

FES: 6.1 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	37.5	22.0	9.0	1.0
FLUX DENSITY (DBW/M*M)	-125.5	-141.0	-154.0	-162.0
SYMBOL BANDWIDTH (HZ)	9600	9600	9600	9600
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	31.3
CNR thermal (DB)	14.8	9.9	11.2	14.1
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	14.3	9.4	10.8	13.2
CNR total (DB)		8.2		8.8
Es/No min (dB)	7	7	7	7
CNR min (DB)	6	6	6	6
MARGIN (DB)	2.2	2.9	2.8	3.8

NOTES: 1. 20 DEGREE EL

2. NOISE BANDWIDTH= 1.25X SYMBOL RATE

3. EDGE OF COVERAGE

CONFIGURATION:	8A			
LINK TYPE, SYMBOL RATE	PS, 2.4 KSPS			
MET:	STATIONARY			
FES:	3.5 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	34.0	18.5	5.0	-3.0
FLUX DENSITY (DBW/M*M)	-129.0	-144.5	-158.0	-166.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	26.5
CNR thermal (DB)	17.3	12.4	13.2	11.3
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	16.4	11.5	12.7	10.8
CNR total (DB)		10.3		8.6
Es/No min (dB)	7	7	7	7
CNR min (DB)	6	6	6	6
MARGIN (DB)	4.3	5.8	2.6	2.3

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION: 8C
LINK TYPE, SYMBOL RATE PS, 2.4 KSPS
MET: STATIONARY
FES: 6.1 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	34.0	18.5	5.0	-3.0
FLUX DENSITY (DBW/M*M)	-129.0	-144.5	-158.0	-166.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	31.3
CNR thermal (DB)	17.3	12.4	13.2	16.1
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	16.4	11.5	12.7	14.7
CNR total (DB)		10.3		10.6
Es/No min (dB)	7	7	7	7
CNR min (DB)	6	6	6	6
MARGIN (DB)	4.3	5.8	4.6	6.1

CONFIGURATION: 8B
LINK TYPE, SYMBOL RATE PS, 2.4 KSPS
MET: STATIONARY
FES: 4.6 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	34.0	18.5	5.0	-3.0
FLUX DENSITY (DBW/M*M)	-129.0	-144.5	-158.0	-166.0
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-9	3	28.8
CNR thermal (DB)	17.3	12.4	13.2	13.6
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	16.4	11.5	12.7	12.8
CNR total (DB)		10.3		9.7
Es/No min (dB)	7	7	7	7
CNR min (DB)	6	6	6	6
MARGIN (DB)	4.3	5.8	3.7	4.0

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	9C			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	OMNI-DIRECTIONAL			
FES:	6.1 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	45.0	29.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-118.0	-133.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	54.8
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-16	3	31.3
CNR thermal (DB)	28.3	16.4	20.6	23.5
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	22.4	14.5	18.2	18.6
CNR total (DB)		13.8		15.4
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	2.3	3.6	3.9	7.2

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	9B
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS
MET:	OMNI-DIRECTIONAL
FES:	4.6 m

DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	45.0	29.5	12.4	4.4
FLUX DENSITY (DBW/M*M)	-118.0	-133.5	-150.6	-158.6
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	52.3
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-16	3	28.8
CNR thermal (DB)	28.3	16.4	20.6	21.0
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	22.4	14.5	18.2	17.6
CNR total (DB)		13.8		14.9
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	2.3	3.6	3.4	5.1

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

CONFIGURATION:	9A			
LINK TYPE, SYMBOL RATE	CS, 2.4 KSPS			
MET:	OMNI-DIRECTIONAL			
FES:	3.5 m			
DIRECTION	FORWARD UP	FORWARD DOWN	RETURN UP	RETURN DOWN
FREQUENCY (GHZ)	14.25	2.11	1.62	11.95
SAT GAIN (DB-M*M)	x	147.5	x	155
PATH LOSS (DB)	-207.5	-190.9	-188.6	-205.9
EIRP (DBW)	45.0	29.5	12.9	4.9
FLUX DENSITY (DBW/M*M)	-118.0	-133.5	-150.1	-158.1
SYMBOL BANDWIDTH (HZ)	2400	2400	2400	2400
RCV ANT GAIN (DBI)	x	x	x	50
RCV TEMPERATURE (K)	x	x	x	225
G/T (DB/K)	-3	-16	3	26.5
CNR thermal (DB)	28.3	16.4	21.1	19.2
C/INTERMOD (DB)	40	22	50	22
C/INTERFER external (DB)	25	25	25	25
C/INTERFER internal (DB)	30	25	25	50
CNR link (DB)	22.4	14.5	18.5	16.7
CNR total (DB)		13.8		14.5
Es/No min (dB)	12.5	12.5	12.5	12.5
CNR min (DB)	11.5	11.5	11.5	11.5
MARGIN (DB)	2.3	3.6	3.0	3.7

NOTES: 1. 20 DEGREE EL
2. NOISE BANDWIDTH= 1.25X SYMBOL RATE
3. EDGE OF COVERAGE

ATTACHMENT 4

McCAW CELLULAR
COMMUNICATIONS, INC.

Andrew A. Quartner
Senior Vice President — Law

June 3, 1991

Mr. Brian B. Pemberton
President
American Mobile Satellite Corporation
1150 Connecticut Avenue, NW
Fourth Floor
Washington, D.C. 20036

Dear Brian:

It is my understanding that, on June 3, 1991, AMSC Subsidiary Corporation ("AMSC") is filing an application with the Federal Communications Commission ("FCC") for authority to utilize certain additional frequencies in its authorized Mobile Satellite Service system. It is my further understanding that the additional cost to so incorporate these frequencies into the AMSC system will be up to $20 million.

This is to confirm that, as a principal of American Mobile Satellite Corporation, the parent of AMSC, McCaw Space Technologies, Inc. ("McCaw SpaceTech") will purchase from American Mobile Satellite Corporation additional equity in an amount up to the full $20 million, if necessary, to finance these additional costs upon grant of the application by the FCC. Attached hereto is the current balance sheet of McCaw SpaceTech's parent corporation, McCaw Cellular Communications, Inc. ("McCaw") which demonstrates that McCaw has sufficient current assets with which to meet this commitment. McCaw has agreed to make those funds available to McCaw SpaceTech for this purpose.

Sincerely,

Andrew A. Quartner

Andrew A. Quartner
Senior Vice President

Enclosure

L\I0603L01

PART I. FINANCIAL INFORMATION

Item 1. Financial Statements

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
CONDENSED CONSOLIDATED BALANCE SHEETS
(In Thousands)

ASSETS	March 31, 1991 (Unaudited)	December 31, 1990
Current assets:		
Cash and cash equivalents	$ 309,377	$ 345,309
Marketable securities	112,451	65,691
Accounts receivable, net	159,865	155,250
Federal tax benefit receivable	47,825	47,825
Other current assets	39,353	36,855
Total current assets	668,871	650,930
Property and equipment, net	951,576	874,725
Licensing costs and other intangible assets, net	5,058,670	5,091,062
Investments	1,850,625	1,855,407
Other assets	221,599	242,041
Total assets	$ 8,751,341	$ 8,714,165

(Continued)

PART I. FINANCIAL INFORMATION

Item 1. Financial Statements

McCAW CELLULAR COMMUNICATIONS, INC. AND SUBSIDIARY COMPANIES
CONDENSED CONSOLIDATED BALANCE SHEETS (CONTINUED)
(In Thousands)

LIABILITIES AND STOCKHOLDERS' INVESTMENT	March 31, 1991 (Unaudited)	December 31, 1990
Current liabilities:		
Current potion of long-term debt	$ 39,608	$ 37,452
Accounts payable and accrued expenses	258,443	292,395
Unearned revenues and customer deposits	38,721	32,113
Total current liabilities	336,772	361,960
Long-term debt, less current portion	5,369,367	5,224,777
Other noncurrent liabilities	184,239	180,369
Total liabilities	5,890,378	5,767,106
Redeemable preferred stock of a subsidiary	935,923	902,348
Stockholders' investment:		
Common stock	1,815	1,792
Additional paid-in capital	2,211,834	2,156,722
Deficit	(288,609)	(113,803)
Total stockholders' investment	1,925,040	2,044,711
Total liabilities and stockholders' investment	$ 8,751,341	$ 8,714,165

See notes to condensed consolidated financial statements.

PART I. FINANCIAL INFORMATION
Item 1. Financial Statements

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
CONDENSED CONSOLIDATED STATEMENTS OF OPERATIONS

(In Thousands, Except Per Share Amounts)
(Unaudited)

	Three Months Ended March 31, 1991	1990
Net revenues	$ 293,378	$ 187,556
Expenses:		
Operating	199,043	146,536
Corporate	4,876	4,776
Depreciation and amortization	88,674	52,761
	292,593	204,073
Income (loss) from operations	785	(16,517)
Other income (expense):		
Interest expense	(152,031)	(77,904)
Gain (loss) on assets sold	(534)	1,155,283
Interest income	6,864	20,956
Equity in income of unconsolidated investees	2,635	3,583
Nonrecurring benefit (charges)	5,632	(16,621)
	(137,434)	1,085,297
Income (loss) before income tax benefit (expense), minority interest and extraordinary item	(136,649)	1,068,780
Income tax benefit (expense)	3,575	(402,871)
Income (loss) before minority interest and extraordinary item	(133,074)	665,909
Minority interest:		
Income of consolidated subsidiaries	(2,430)	(4,962)
Provision for preferred stock dividend of a subsidiary	(33,575)	–
Income (loss) before extraordinary item	(169,079)	660,947
Extraordinary item: Income tax benefit	–	190,919
Net income (loss)	$ (169,079)	$ 851,866
Weighted average common shares outstanding:		
Primary	179,574	171,544
Fully diluted	N/A	182,021
Income (loss) per common share:		
Primary:		
Income (loss) before extraordinary item	$ (0.97)	$ 3.82
Extraordinary item: Income tax benefit	–	1.11
Net income (loss)	$ (0.97)	$ 4.93
Fully diluted:		
Income (loss) before extraordinary item	N/A	$ 3.64
Extraordinary item: Income tax benefit	N/A	1.05
Net income (loss)	N/A	$ 4.69

See notes to condensed consolidated financial statements.

PART I. FINANCIAL INFORMATION

Item 1. Financial Statements

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS
(In Thousands)

(Unaudited)

	Three Months Ended March 31, 1991	1990
Net cash used in operating activities	$ (75,913)	$ (18,059)
Cash flows from investing activities:		
Purchase or acquisition of:		
LIN Broadcasting Corporation	–	(3,368,532)
Marketable securities	(47,121)	–
Property and equipment, net	(113,804)	(53,416)
Licensing costs	(1,733)	(83,344)
Other assets	(21,003)	(18,941)
Sale or redemption of:		
Southeast Cellular Systems	–	1,312,084
Marketable securities	499	309,427
Other assets	–	27,449
Distributions from investments	8,148	–
Other investing activities, net	13,445	(8,495)
Net cash used in investing activities	(161,569)	(1,883,768)
Cash flows from financing activities:		
Proceeds from long-term debt	210,703	2,290,217
Principal payments on long-term debt	(9,744)	(64,676)
Other financing activities, net	591	(4,055)
Increase in deferred financing costs	–	(62,490)
Net cash provided by financing activities	201,550	2,158,996
Net increase (decrease) in cash and cash equivalents	(35,932)	257,169
Cash and cash equivalents, beginning of period	345,309	461,806
Cash and cash equivalents, end of period	$ 309,377	$ 718,975

SUPPLEMENTAL DISCLOSURES OF CASH FLOW INFORMATION

Cash paid (received) for:		
Interest	$ 167,240	$ 71,782
Taxes, net	$ (4,902)	$ –

See notes to condensed consolidated financial statements.

PART I. FINANCIAL INFORMATION

Item 1. Financial Statements

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
NOTES TO CONDENSED CONSOLIDATED FINANCIAL STATEMENTS

March 31, 1991

1. Basis of presentation:

The condensed consolidated financial statements included herein have been prepared by McCaw Cellular Communications, Inc. and its majority-owned subsidiary companies (the Company), including LIN Broadcasting Corporation (together with its subsidiaries, LIN), without audit, pursuant to the rules and regulations of the Securities and Exchange Commission. Certain information and footnote disclosures normally included in financial statements prepared in accordance with generally accepted accounting principles have been condensed or omitted pursuant to such rules and regulations. These condensed consolidated financial statements should be read in conjunction with the audited consolidated financial statements and notes thereto included in the Form 10-K for the year ended December 31, 1990 of the Company and its majority-owned subsidiary LIN.

The financial information included herein reflects all adjustments (consisting of normal recurring adjustments) which are, in the opinion of management, necessary to a fair presentation of the results for interim periods. Certain reclassifications have been made to the financial statements for previous periods to conform with the current period's presentation. The results of operations for the three month period ended March 31, 1991 are not necessarily indicative of the results to be expected for the full year.

2. Pending transactions:

On April 10, 1991, the Company signed a definitive agreement with BellSouth Enterprises, Inc. (BellSouth) under which BellSouth will purchase the Company's cellular assets in Indiana, Wisconsin and Illinois in return for $360 million and BellSouth's interest in the nonwireline cellular system in Rochester, New York. In addition, as part of the transaction, the Company will release Graphic Scanning Corporation (Graphic) from a pending lawsuit and terminate the pending formation of a joint venture between the Company and Graphic to which the Company would have contributed the cellular assets which will be sold to BellSouth. The termination of the pending formation of the joint venture relieves the Company of a $50 million obligation to Graphic. Total pops to be sold to BellSouth in this transaction are approximately 2.7 million.

3. Exchange offer:

On April 5, 1991 the Company closed an offer to exchange shares of its Class A Common Stock for 12.95% Senior Subordinated Debentures due August 15, 1999. Through March 31, 1991 the Company exchanged 2.2 million shares of stock for $62.4 million principal amount of outstanding debentures which resulted in a gain, net of discount and deferred financing costs of $5.6 million. The gain is reflected in the accompanying condensed consolidated statements of operations as a nonrecurring benefit.

4. Net income (loss) per share:

Net income (loss) per share is based on the weighted average number of common and common equivalent shares outstanding. In periods where the Company has reported a net loss, only common shares outstanding are considered since the assumed conversion of options and convertible securities would be antidilutive. At March 31, 1990 the weighted average number of shares for the fully diluted calculation includes 10,478,000 shares from the assumed conversion of debentures. The fully diluted calculation at

PART I. FINANCIAL INFORMATION

Item 1. Financial Statements

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
NOTES TO CONDENSED CONSOLIDATED FINANCIAL STATEMENTS
(Continued)

4. Net income (loss) per share (continued):

March 31, 1990 reflects the addition to income of $8.5 million representing reduced interest expense on the assumed conversion of convertible subordinated debentures. The computation of net income (loss) per share also reflects the net accretion of the mandatory repurchase obligation of McCaw Cellular, Inc. (MCI) warrants. The accretion for the periods ending March 31, 1991 and 1990 was $5.7 million and $5.8 million, respectively.

5. Litigation:

In May 1990, a suit was filed in the United States District Court for the District of Columbia against the Company by the former owners of certain cellular properties and other cellular interests which the Company acquired in 1986 and 1987 and certain of which the Company sold in the Contel Transaction. The suit alleges that the Contel Transaction constituted a subsequent sale of substantially all of certain properties by the Company and thus a breach of an agreement that would require the Company to share with the former owners up to 25% of the gains from such sale.

The Company believes that the Plaintiffs are not entitled to the relief sought and intends to defend the lawsuit vigorously. The Company has filed a response to the complaint denying Plaintiff's allegations and asserting various affirmative defenses. The lawsuit is still in the early stages of discovery and accordingly, no provision is deemed necessary in the accompanying financial statements.

PART I. FINANCIAL INFORMATION

Item 2. Management's Discussion and Analysis of Financial Condition and Results of Operations

McCAW CELLULAR COMMUNICATIONS, INC. AND SUBSIDIARY COMPANIES MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

RESULTS OF OPERATIONS

The Company has undergone a substantial change in the properties that it owns and operates over the last year resulting in a lack of comparability in the periods discussed herein. Factors leading to such lack of comparability include:

(a) The sale by the Company on February 27, 1990 to Contel Cellular Inc. (Contel) of the Company's cellular interests in Kentucky, Alabama and Tennessee, constituting all of its interests in its southeast cellular systems and representing in the aggregate approximately 6.1 million 1989 pops (the Contel Transaction).

(b) The completion on March 5, 1990 of a tender offer pursuant to which the Company acquired an approximate 52% interest in LIN Broadcasting Corporation (LIN) which owns or has the right to acquire cellular interests representing approximately 26.1 million 1989 pops (including a 4.97% indirect interest in the nonwireline cellular licensee in Los Angeles, CA contributed to LIN by the Company upon the completion of the tender offer) and owns and operates seven network-affiliated television stations and specialty publishing (the LIN Acquisition). The Company's results of operations for the first quarter of 1990 include the results of LIN for the period March 5, 1990 through March 31, 1990.

(c) The acquisition on August 10, 1990 by LIN and its subsidiaries from Metromedia Company (Metromedia) of its 46% direct and indirect interests in Cellular Telephone Company (CTC), the New York City nonwireline licensee (the Metromedia Transaction) and 2.1% indirect minority interests in CTC held by third parties. LIN's ownership in CTC was increased from 45% to approximately 93% as a result of these transactions. In addition, LIN sold a 1.01% interest in Metrophone, the nonwireline licensee in Philadelphia to Metromedia. As a result of the sale, LIN's ownership interest declined to 49.99% and Metromedia obtained voting control of Metrophone. The acquisition of controlling interest in CTC and the disposition of controlling interest in Metrophone are reflected in LIN's financial statements as if the change in ownership control occurred January 1, 1990.

(d) In addition to (a), (b), and (c), the Company has been involved in the acquisition of interests in other cellular licenses and the construction and initial operation of cellular systems.

Primarily due to the factors described above, results of operations for the periods discussed herein are not necessarily indicative of the Company's future results. All references to the Company represent McCaw Cellular Communications, Inc. and its majority owned subsidiaries, including LIN.

Three months ended March 31, 1991 and 1990

Net revenues increased 56 percent to $293.4 million compared with $187.6 million for the first quarter of 1990. This increase primarily resulted from an increase in the Company's cellular subscriber base in existing markets and growth through acquisition. Exclusive of the net revenues of LIN and the reduction in net revenues as a result of the Contel Transaction, net revenues increased 29 percent over the first quarter of 1990.

Operating expenses were $199.0 million, an increase of $52.5 million or 36 percent from the first quarter of 1990. The increase in operating expenses resulted primarily from an increase in marketing and administrative costs incurred as a result of the increase in the Company's cellular subscriber base and growth through acquisition. Exclusive of the operating expenses of LIN and the effect of the Contel Transaction, operating expenses increased 12 percent over the first quarter of 1990. Operating expenses as a percentage of net revenue

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS
(Continued)

Three months ended March 31, 1991 and 1990 (continued)

decreased to 68 percent for the first quarter of 1991 compared to 78 percent for the first quarter of 1990. This trend is primarily due to the economies of scale resulting from growth in the Company's subscriber base. Exclusive of the effects of the LIN Acquisition and the Contel Transaction, operating expenses as a percentage of net revenues decreased to 72 percent for the first quarter of 1991 compared to 82 percent for the first quarter of 1990.

Depreciation and amortization increased from $52.8 million in the first quarter of 1990 to $88.7 million for the first quarter of 1991. Factors contributing to the increase in depreciation and amortization include: (i) the acquisition of LIN which resulted in additional depreciation and amortization due to the consolidation of LIN's results for the full 1991 first quarter, versus the period from March 5 to March 31 for the 1990 first quarter, (ii) the amortization of the excess of the purchase price over the fair value of the tangible assets acquired and liabilities assumed in the LIN Acquisition and (iii) increased depreciation and amortization of the Company's existing cellular and paging systems as a result of the improvement and expansion of those systems. In the future, depreciation and amortization will increase due to the construction and expansion of cellular systems (including the conversion from analog to digital cellular equipment).

Other income (expense) changed substantially from income of $1,085.3 million for the quarter ended March 31, 1990 to a net expense of $137.4 million for the first quarter of 1991. The first quarter of 1990 includes a gain on assets sold of $1,155.3 million resulting from the Contel Transaction. Interest expense was $152.0 million in the first quarter of 1991, a $74.1 million increase over 1990 due to increased levels of debt. As a result of the substantial debt incurred to fund the LIN Acquisition, the Metromedia Transaction and anticipated cash deficiencies, interest expense will continue to be substantial in the foreseeable future (see "Liquidity and Capital Resources"). A substantial portion of the Company's interest bearing investments were used to fund the LIN Acquisition, therefore interest income is substantially reduced from the first quarter of 1990 and is not anticipated to be significant in future periods.

On April 5, 1991 the Company closed an offer to exchange shares of its Class A Common Stock for 12.95% Senior Subordinated Debentures due August 15, 1999. Through March 31, 1991 the Company exchanged 2.2 million shares of stock for $62.4 million principal amount of outstanding debentures which resulted in a gain, net of discount and deferred financing costs of $5.6 million. The gain was recorded as a nonrecurring benefit. Concurrent with the LIN Acquisition in the first quarter of 1990, the Company replaced previous credit facilities with the Bank Credit Facility (as described below). Financing costs of $16.6 million associated with the replacement of the previous credit facilities were expensed as nonrecurring charges in the first quarter of 1990.

As a direct result of the gain recognized by the Contel Transaction, the Company recognized income tax expense of $402.9 million in the first quarter of 1990, partially offset by the tax benefit of prior years' operating loss carryforwards of $190.9 million. The tax paid in 1990 was under the Alternative Minimum Tax rules, and the Company is unable to carry back current year losses to offset the income in 1990. The tax benefit recognized in the first quarter of 1991 is the result of the reversal of certain deferred taxes, offset in part by state income tax expense.

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS
(Continued)

LIQUIDITY AND CAPITAL RESOURCES

The Company utilizes capital to make acquisitions of cellular and paging interests (which may include the acquisition of stock of publicly traded corporations), to complete the initial construction of and to operate and expand its cellular systems, to fund start-up operating losses for its cellular systems and to cover interest payments on its indebtedness. Moreover, as subscribers are added and usage increases, it will be necessary to make additional capital expenditures for the purchase of additional cell sites and operating equipment. The Company expects, in the next several years, to change equipment to accommodate the transition from analog to digital service. The conversion from analog to digital equipment will require significant expenditures but will expand the capacity of such systems dramatically. Interest expense will continue to be substantial in future periods.

The Company does not expect its operations to generate sufficient cash to meet its expenditure requirements for the next several years. In order to meet its substantial debt service obligations and to fund its other operating and capital requirements, the Company will have to borrow significant additional amounts under its Bank Credit Facility (described below), the primary source of liquidity for the Company. Under the Bank Credit Facility an aggregate of $3.0 billion is available of which $2.0 billion was outstanding on May 10, 1991. There are conditions which must be satisfied before the banks will be required to lend these additional amounts. If these conditions are not satisfied, the banks may conclude it is not in their best interest to lend additional amounts to the Company. If the Company were unable to borrow the required amounts from the banks, it may seek to issue additional debt through a private or public offering, sell equity or sell certain paging businesses, cellular interests or other assets. There can be no assurance that the Company will be able to obtain such additional financing or sell assets when needed, or if it is able to obtain such financing or sell assets, that the terms will be favorable to the Company. In addition, under certain circumstances, the Company may need the consent of British Telecom USA Holdings, Inc. to sell equity or cellular assets. Finally, the Company will be required by the terms of the Bank Credit Facility to apply the proceeds of asset sales under certain circumstances not reinvested in similar assets to the repayment of loans thereunder.

While the Company expects to have sufficient internally generated funds to repay its indebtedness at maturity, there can be no assurance that this will occur. The Company to date has obtained funds to meet its obligations through the issuance of indebtedness, the sale of equity and the sale of certain cellular interests or other assets.

Exclusive of the effect of significant acquisitions and dispositions, the Company's revenues and cash flows have historically grown at significant rates. While the Company expects its revenues and cash flows to continue to grow in the future, there can be no assurance that this will occur or that the rates of growth will equal the rates achieved by the Company in prior periods. Indeed, as absolute levels of revenues and cash flows increase, it is expected that the percentage rate of growth will decline.

Under the Bank Credit Facility, the Company must remain in compliance with a series of financial covenants which compare the levels of the Company's indebtedness to its cash flow as of the end of each quarter. Although the Company is currently in compliance with all bank covenants, because the ratios of indebtedness to cash flow required to be maintained by the Bank Credit Facility decrease each quarter through 1993, it is necessary for the Company either to reduce debt or to continue to increase cash flow in order to remain in compliance.

It is the Company's practice to carefully monitor the state of its business and future cash requirements in light of these financial covenants especially in light of the recession. From time to time, the Company may enter into transactions pursuant to which debt is extinguished, or assets are sold. The Company recently completed an

McCAW CELLULAR COMMUNICATIONS, INC.
AND SUBSIDIARY COMPANIES
MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS
(Continued)

exchange of Common Stock for certain of its outstanding debentures and entered into a definitive agreement to sell the Company's cellular assets in Indiana, Wisconsin and Illinois to BellSouth Enterprises, Inc. (BellSouth). The Company will continue to explore other such opportunities, which could include sales of assets or equity, joint ventures, reorganizations or further recapitalizations. There can be no assurance that any further such transactions will be undertaken, or, if undertaken, will be favorable to stockholders.

Bank Credit Facility

Under the Bank Credit Facility, interest is payable at the applicable margin above, at the Company's discretion the prevailing prime, LIBOR or CD rate. Interest is fixed for a period ranging from one month to twelve months, depending on availability of the interest basis selected, although if the Company selects a prime-based loan, the interest rate will fluctuate during the period as the prime rate fluctuates. The applicable margin for each loan will be determined on the basis of the Company's ratio of adjusted senior debt (as determined under the Bank Credit Facility) to cash flow (i.e., net income [excluding extraordinary items], plus depreciation, amortization, interest expense, reserves for deferred taxes and other non-cash items deducted in determining net income). For example, if the ratio was 12.0 to 1 or greater, the applicable margin for LIBOR, CD and prime loans would be 2-1/8%, 2-1/4% and 1-1/8%, respectively, while if the ratio was less than 4.5 to 1, such margins would be 7/8%, 1% and 0%, respectively. Beginning on March 31, 1994 and at the end of each fiscal quarter thereafter until the maturity date (which will be on or about March 31, 2000), the Company will be required to make payments amortizing the amount outstanding under the Bank Credit Facility on December 31, 1993. In addition, the Company will be required to apply cash proceeds from certain sales of assets, not reinvested in similar assets, and, after January 1, 1994, all excess cash flow, to the prepayment of loans.

The Bank Credit Facility contains covenants restricting certain activities by the Company and its restricted subsidiaries, including, without limitation, restrictions on (i) investments in unrestricted subsidiaries, (ii) the incurrence of debt, (iii) distributions and dividends to stockholders, (iv) mergers and sales of assets, (v) prepayments of subordinated indebtedness, (vi) the creation of liens, and (vii) the issuance of preferred stock. In addition, the Company and its subsidiaries are required to maintain compliance with certain financial covenants set forth in the Bank Credit Facility. The Company is required to maintain certain ratios of adjusted total and senior outstanding indebtedness to the number of pops owned. The Company is also required to maintain ratios of senior debt and combined debt to cash flow (both before and after marketing expenses) and cash flow before marketing expenses and cash flow after marketing expenses to senior debt service and total debt service, in each case in compliance with amounts specified in the Bank Credit Facility and to maintain the revenues, cash flow before marketing expenses and cash flow after marketing expenses for certain core properties at the levels specified in the Bank Credit Facility.

The Bank Credit Facility contains customary events of default, including (i) failure to make principal or interest payments when due, (ii) failure to comply with covenants, (iii) misrepresentations, (iv) defaults on other indebtedness, (v) material adverse change in the business, condition, operations, performance or properties of the Company, (vi) unpaid judgments, and (vii) standard ERISA and bankruptcy defaults. In addition, it shall be an event of default if the Designated Party (as defined in the McCaw Shareholders Agreement) fails to be entitled to appoint a majority of the Board of Directors of the Company or if the McCaw Family (as defined) fails to hold at least 20 million shares subject to such Shareholders Agreement.