## LIN's Credit Facilities

On August 10, 1990, LIN completed $2.1 billion in financings, the proceeds of which were used to finance the Metromedia Transaction, retire LIN's short-term credit facility and provide for LIN's general operating needs. In the first of two financings, LIN Cellular Network, Inc., a newly created subsidiary of LIN, borrowed $1.35 billion under a $1.75 billion facility. In the second financing, LIN Television Corporation, a newly created subsidiary of LIN, borrowed $350 million under a $350 million facility. Both facilities contain covenants and events of default similar to those described above for the Company's Bank Credit Facility and require amortization of payments intended to retire such facilities in full by 2000. LIN's portion of additional financing available under the $1.75 billion facility was $330 million as of May 10, 1991.

LIN's Credit Facilities prohibit the payment of dividends and distributions to LIN by its major operating subsidiaries, thereby effectively limiting the ability of LIN to transfer funds to the Company.

Funds available under the Bank Credit Facility can only be utilized by the Company and certain of its subsidiaries other than LIN. Proceeds from LIN's Credit Facilities are only available to LIN and its subsidiaries. For additional information regarding LIN's credit facilities, see LIN's current Report on Form 10-Q.

## LCH's Redeemable Preferred Stock

On August 10, 1990, LIN completed the Metromedia Transaction. In addition to the cash portion of the purchase price for the Metromedia interests, LIN's subsidiary, LCH Communications, Inc. ("LCH"), issued $850 million of newly issued Class A Redeemable Preferred Stock to Metromedia. The holder of LCH's Class A Redeemable Preferred Stock is entitled to appoint one member of the LCH Board of Directors and will be entitled to dividends if and when declared by the Board. LCH may redeem the Preferred Stock at any time at a price equal, at its option, to either:

(1) all of the issued and outstanding capital stock of LCH's subsidiary ("LIN-Penn"), which holds GuestInformant and LIN's ownership interest in the Philadelphia nonwireline cellular system, plus cash equal to 15% of the fair market value of all businesses (currently, only WOTV, LIN's broadcast business in Grand Rapids - Kalamazoo - Battle Creek, Michigan) then operated by LCH (the "Operating Business Portion"); or

(2) a cash amount equal to the greater of (a) the fair market value of the issued and outstanding capital stock of LIN-Penn plus the Operating Business Portion and (b) $850 million, plus, in each case, dividends which would have accrued on the Preferred Stock from the issuance date (to the extent not previously paid ) at the rate of 15.8% per year.

LCH is required to redeem the Preferred Stock in the year 2000 (if not redeemed prior to such time) at a price comparable to that described above. In certain circumstances, the holder of the Preferred Stock may require the corporate parent to LCH to purchase the Preferred Stock.

TELEPHONE 202-331-5858

FACSIMILE 202-331-5861

# AMERICAN MOBILE SATELLITE CORPORATION

## TECHNICAL CERTIFICATE

I hereby certify that I am the technically qualified person responsible for the preparation of this application; that I am familiar with Part 25 of the Commission Rules and Regulations; that I have either prepared or reviewed the technical information contained in this Application; and, that it is complete and accurate to the best of my knowledge and belief.

Michael Ward

Date: 3 - June - 91

1150 Connecticut Avenue, N.W.

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

| | | |
|---|---|---|
| In the Matter of the Application of<br><br>AMSC SUBSIDIARY CORPORATION<br><br>For Modification of Space Station Authorization to Construct and Operate Its Satellite Located at 139° W.L. to Add the 1515-1525 MHz (downlink) Band and the 1616.5-1626.5 MHz (uplink) Band | )<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>) | 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 139°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

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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 62° 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 139° 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.

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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

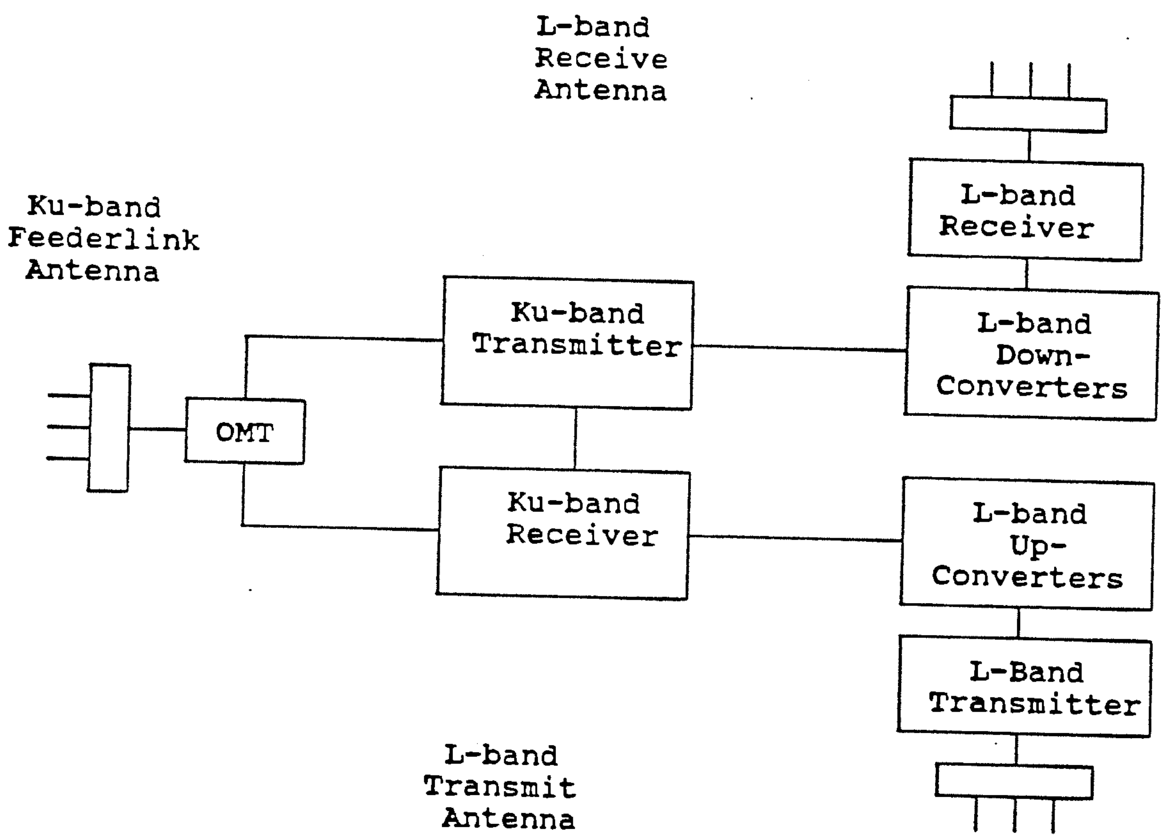
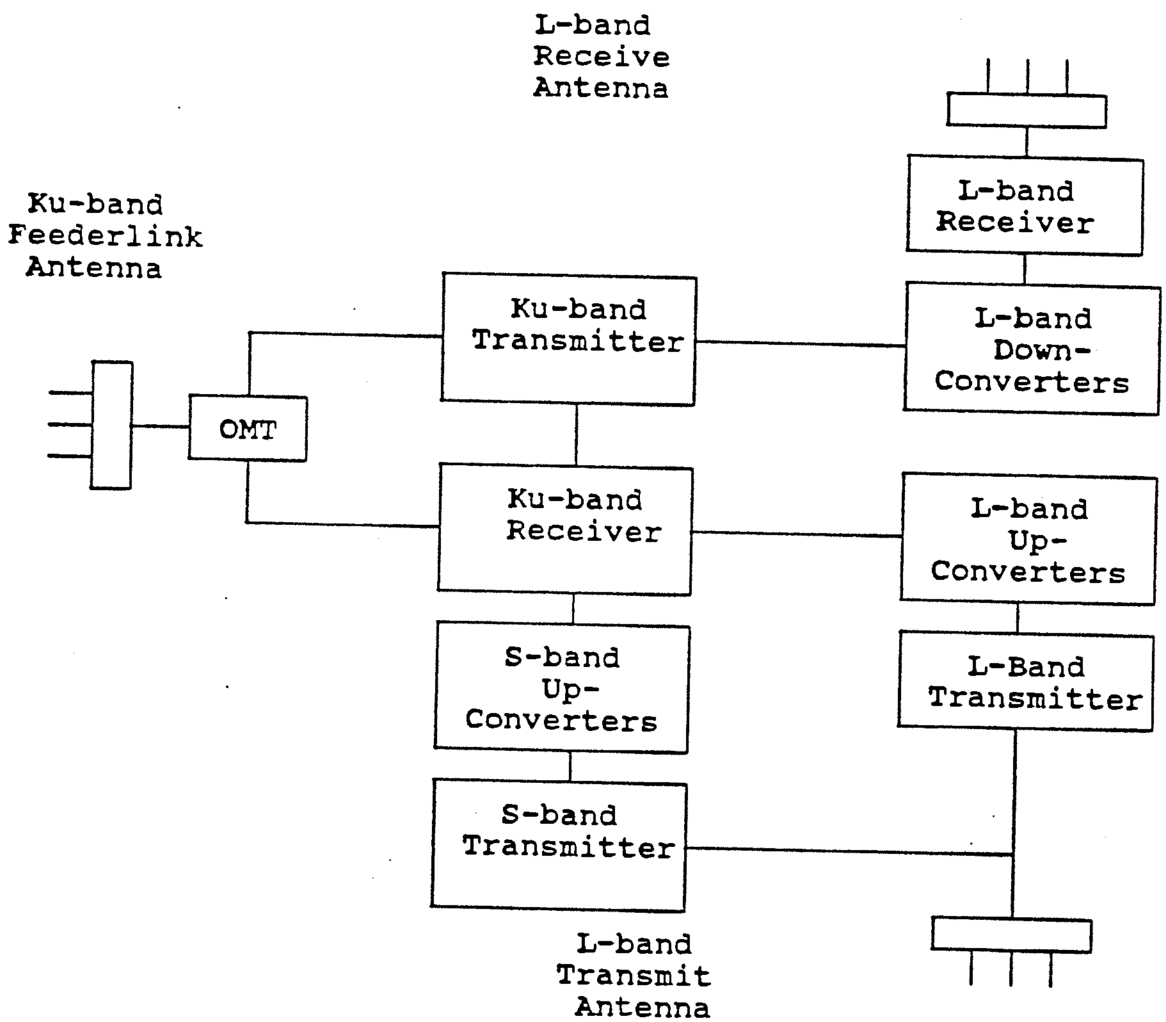


Figure 2- Satellite Payload Block Diagram for an S-band Matching Downlink



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.

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

G. <u>Compatibility</u>

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. <u>System reliability, redundancy and link availability</u>

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 62° 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.

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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.

ATTACHMENT 1

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

## 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 all system traffic in a single beam.

<u>TABLE 1-2 SATELLITE RF CHARACTERISTICS</u>
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 0 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 edundancy | 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 FOR ALL CASES

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

## 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

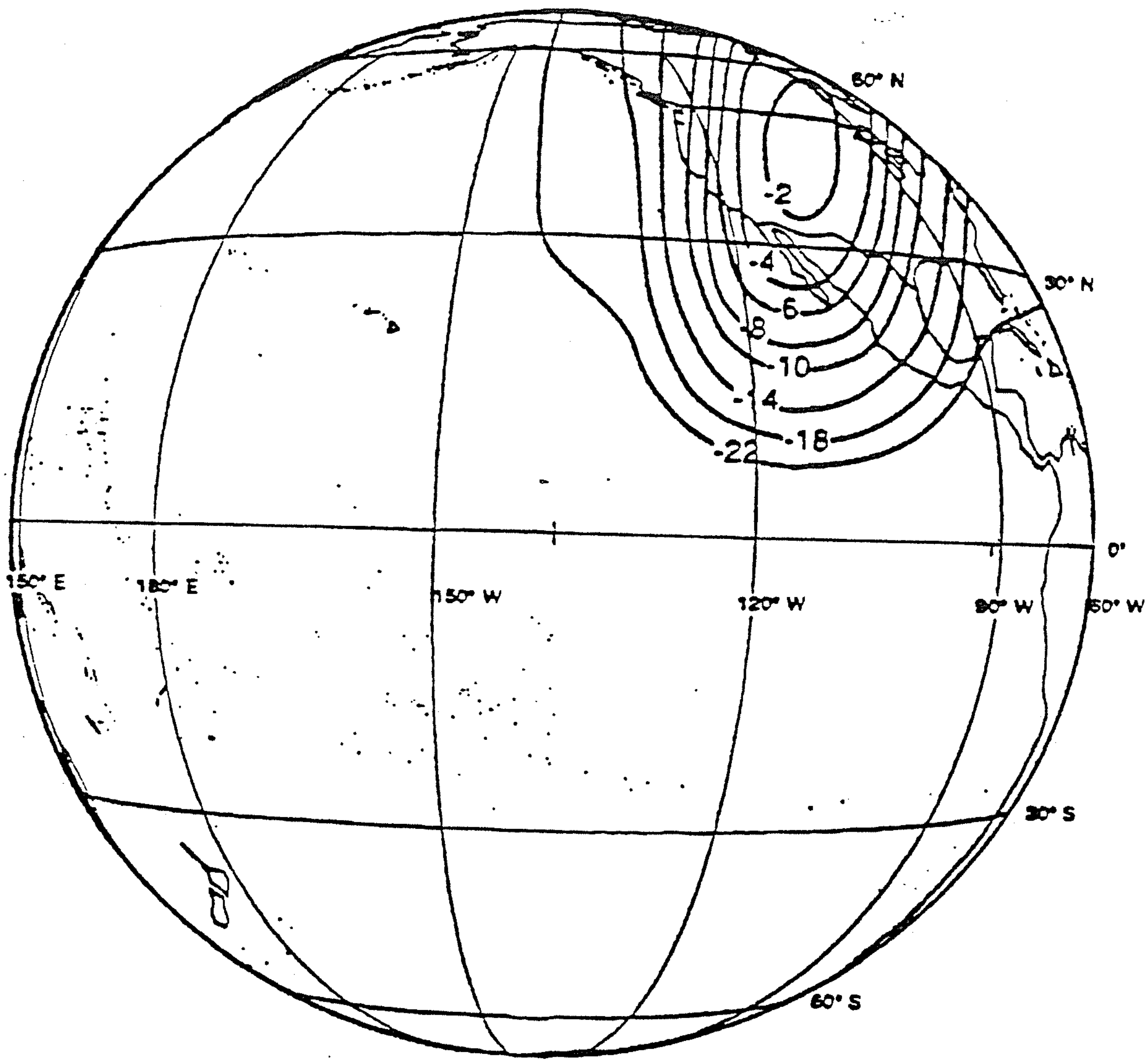
## TABLE 1-10 MOBILE EARTH TERMINAL CHARACTERISTICS CONTINUED

| 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

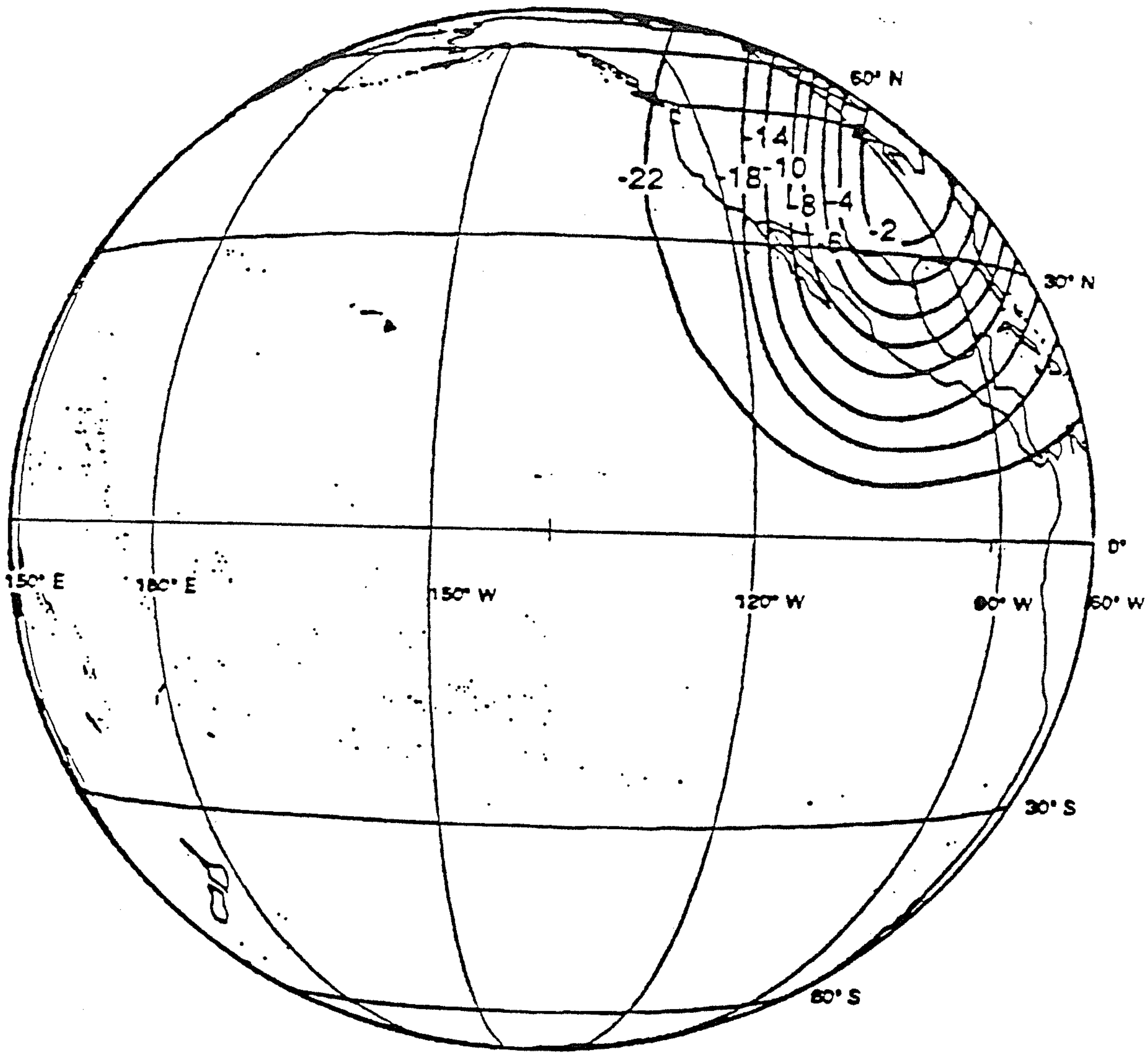
| Designator | A | B | C |
|---|---|---|---|
| Antenna Diameter (m) | 3.5 | 4.6 | 6.1 |
| Transmit Gain @ 13 GHz (dBi) | 51.5 | 53.7 | 56.0 |
| Receive Gain @ 11 GHz (dBi) | 50.0 | 52.3 | 54.8 |
| Receive G/T, T = 225K (dB/K) | 26.5 | 28.8 | 31.3 |

ATTACHMENT 2



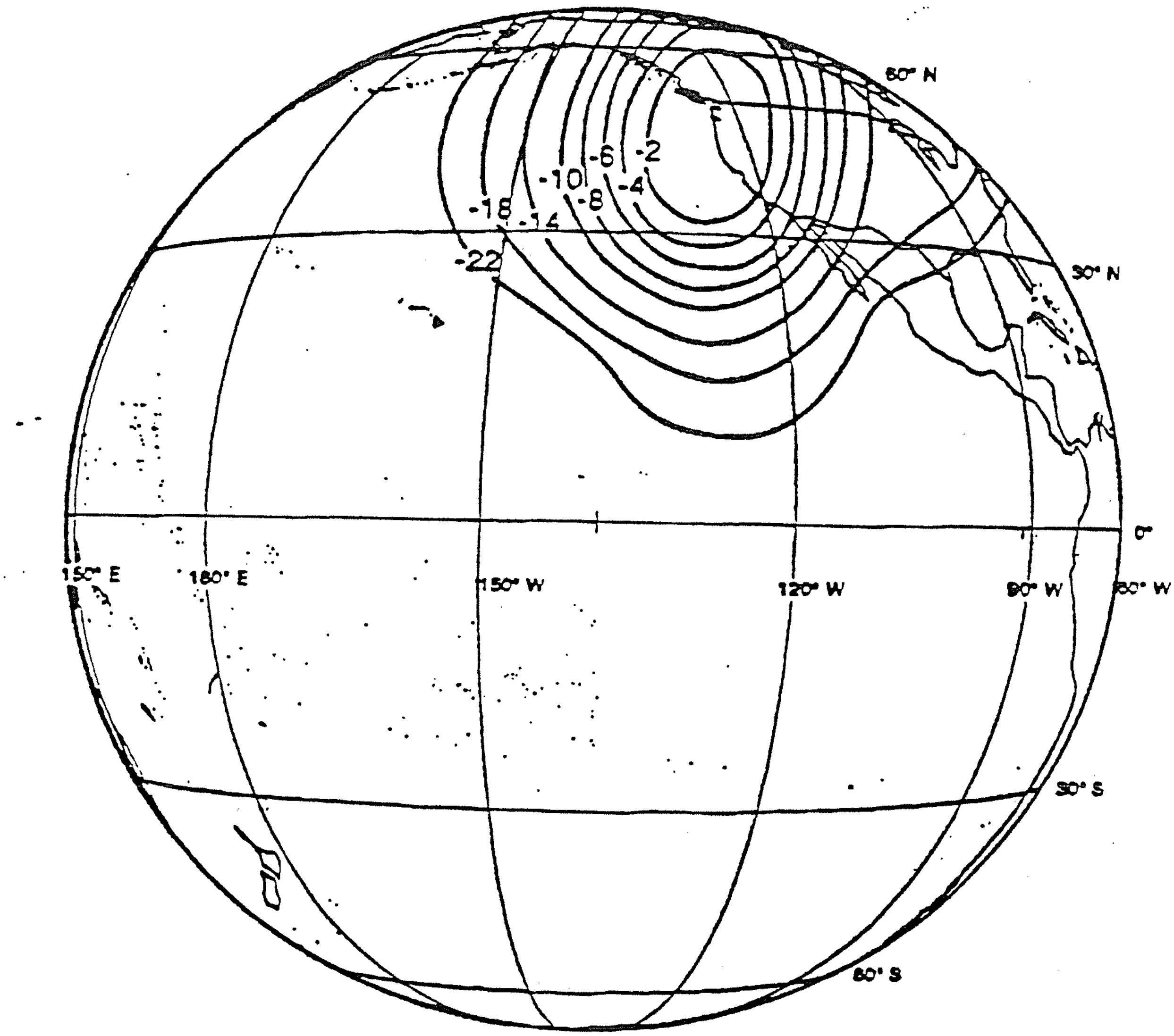

Mountain Beam

S-Band Transmitting Gain Contours, 139° W Satellite



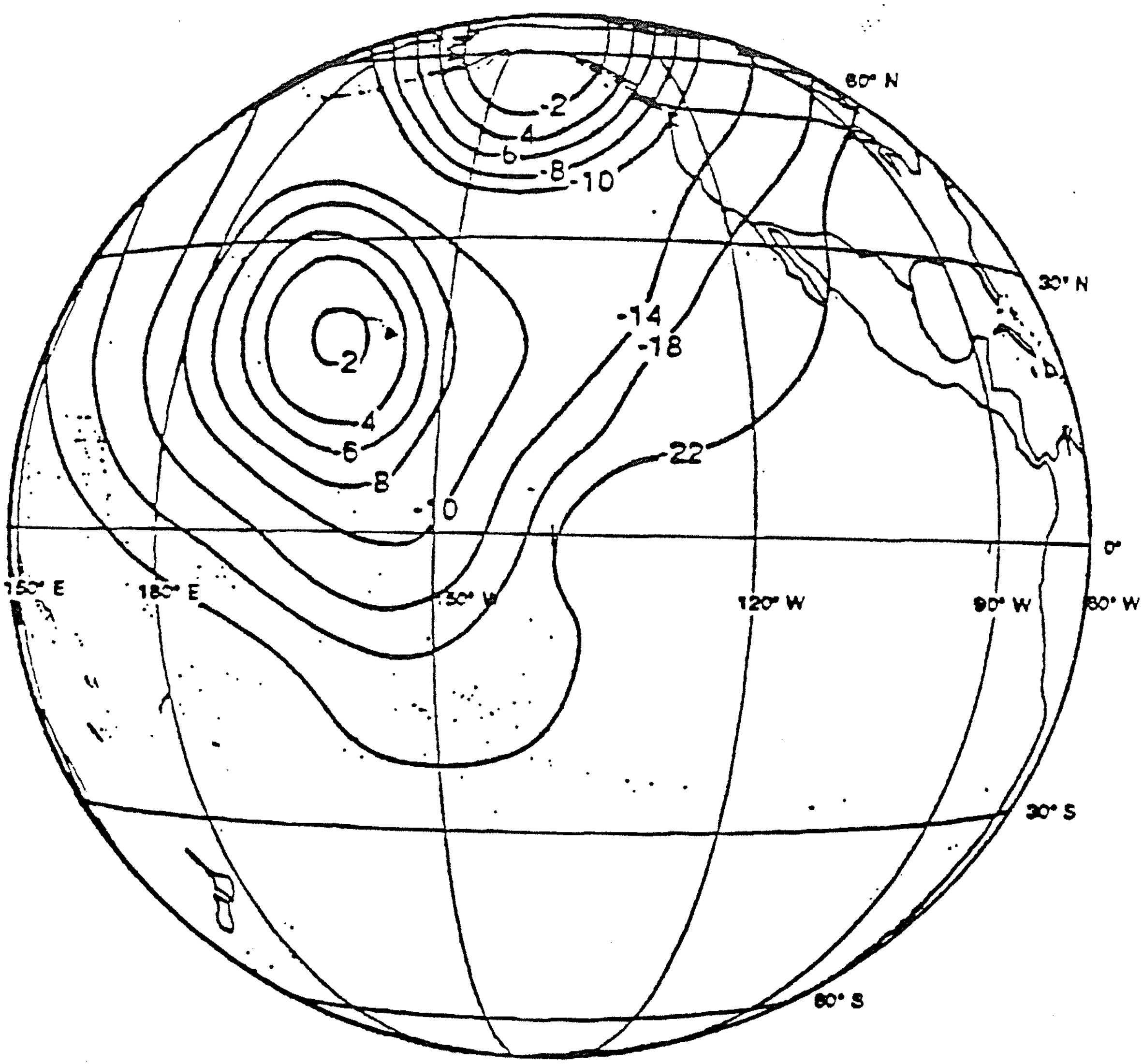

Central Beam

S-Band Transmitting Gain Contours, 139° W Satellite




West Beam

S-Band Transmitting Gain Contours, 139° W Satellite




Hawaii - Alaska Beam

**S-Band Transmitting Gain Contours, 139° 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 | 22 |
| C/INTERFER internal (DB) | 30 | 25 | 25 | 25 |
| CNR link (DB) | 20.5 | 13.8 | 18.2 | 50 |
| CNR total (DB) | | 13.0 | | 17.6 |
| Es/No min (dB) | 12.5 | 12.5 | 12.5 | 14.9 |
| CNR min (DB) | 11.5 | 11.5 | 11.5 | 12.5 |
| MARGIN (DB) | 1.5 | 2.3 | 3.4 | 11.5 |
| | | | | 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: | 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: 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: 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: | 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: | 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: | 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: | 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: 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: 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

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: | 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

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 | Three Months Ended March 31, 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

| | 1991 | 1990 |
|---|---|---|
| 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

# 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.

## LIN's Credit Facilities

On August 10, 1990, LIN completed $2.1 billion in financings, the proceeds of which were used to finance the Metromedia Transaction, retire LIN's short-term credit facility and provide for LIN's general operating needs. In the first of two financings, LIN Cellular Network, Inc., a newly created subsidiary of LIN, borrowed $1.35 billion under a $1.75 billion facility. In the second financing, LIN Television Corporation, a newly created subsidiary of LIN, borrowed $350 million under a $350 million facility. Both facilities contain covenants and events of default similar to those described above for the Company's Bank Credit Facility and require amortization of payments intended to retire such facilities in full by 2000. LIN's portion of additional financing available under the $1.75 billion facility was $330 million as of May 10, 1991.

LIN's Credit Facilities prohibit the payment of dividends and distributions to LIN by its major operating subsidiaries, thereby effectively limiting the ability of LIN to transfer funds to the Company.

Funds available under the Bank Credit Facility can only be utilized by the Company and certain of its subsidiaries other than LIN. Proceeds from LIN's Credit Facilities are only available to LIN and its subsidiaries. For additional information regarding LIN's credit facilities, see LIN's current Report on Form 10-Q.

## LCH's Redeemable Preferred Stock

On August 10, 1990, LIN completed the Metromedia Transaction. In addition to the cash portion of the purchase price for the Metromedia interests, LIN's subsidiary, LCH Communications, Inc. ("LCH"), issued $850 million of newly issued Class A Redeemable Preferred Stock to Metromedia. The holder of LCH's Class A Redeemable Preferred Stock is entitled to appoint one member of the LCH Board of Directors and will be entitled to dividends if and when declared by the Board. LCH may redeem the Preferred Stock at any time at a price equal, at its option, to either:

(1) all of the issued and outstanding capital stock of LCH's subsidiary ("LIN-Penn"), which holds GuestInformant and LIN's ownership interest in the Philadelphia nonwireline cellular system, plus cash equal to 15% of the fair market value of all businesses (currently, only WOTV, LIN's broadcast business in Grand Rapids - Kalamazoo - Battle Creek, Michigan) then operated by LCH (the "Operating Business Portion"); or

(2) a cash amount equal to the greater of (a) the fair market value of the issued and outstanding capital stock of LIN-Penn plus the Operating Business Portion and (b) $850 million, plus, in each case, dividends which would have accrued on the Preferred Stock from the issuance date (to the extent not previously paid ) at the rate of 15.8% per year.

LCH is required to redeem the Preferred Stock in the year 2000 (if not redeemed prior to such time) at a price comparable to that described above. In certain circumstances, the holder of the Preferred Stock may require the corporate parent to LCH to purchase the Preferred Stock.

TELEPHONE 202-331-5858

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AMERICAN MOBILE SATELLITE CORPORATION

## TECHNICAL CERTIFICATE

I hereby certify that I am the technically qualified person responsible for the preparation of this application; that I am familiar with Part 25 of the Commission Rules and Regulations; that I have either prepared or reviewed the technical information contained in this Application; and, that it is complete and accurate to the best of my knowledge and belief.

Michael Ward
Michael Ward

Date: 3-June-91

1150 Connecticut Avenue, N.W., Fourth Floor, Washington, D.C.

EXHIBIT B

EXHIBIT B

## AMSC's Next Generation Satellites

AMSC's next generation satellites will be larger, have more EIRP and provide more spot beams. One of the principal advantages of these satellites will be their ability to increase spectrum reuse. The use of spot beams also will provide more directional EIRP and G/T, enabling voice users to communicate via the satellite with compact hand-held units as is possible for data communications in the first generation system. These user terminals will have omnidirectional antennas with 600 milliwatt amplifiers, yielding a minimum EIRP of .5 dBW.

Given the risks associated with the development and launch of the MSS system, the prudent course has been to take a relatively conservative approach to the design of the satellites to establish a firm business base before launching the satellites described here. The Commission's milestones have been another factor in the consideration of satellite technology. In addition, AMSC has been concerned that any delays in satellite construction and launch could make it more difficult to coordinate spectrum as the competition for spectrum increases.

### A. Antenna Contours

Figures 1 and 2 are diagrams of the coverage pattern of the next generation satellite. As can be seen the US and Canada would be covered by approximately 45-50 spot beams, depending on the satellite orbital location. Figure 3 would be a coverage pattern for a satellite positioned at 101° West. Each of the individual spot beams would have approximately a 45 dB of directional gain to allow the user to have a handheld type device for voice communications through the feederlink earth stations or with another mobile unit. The crossover gain between beams is approximately 4 dB less. Frequency reuse would be permitted between beams that have two beam isolation between them. The patterns shown permit the development of 7 frequency sub-band patterns that would yield average frequency reuse factors of 7.

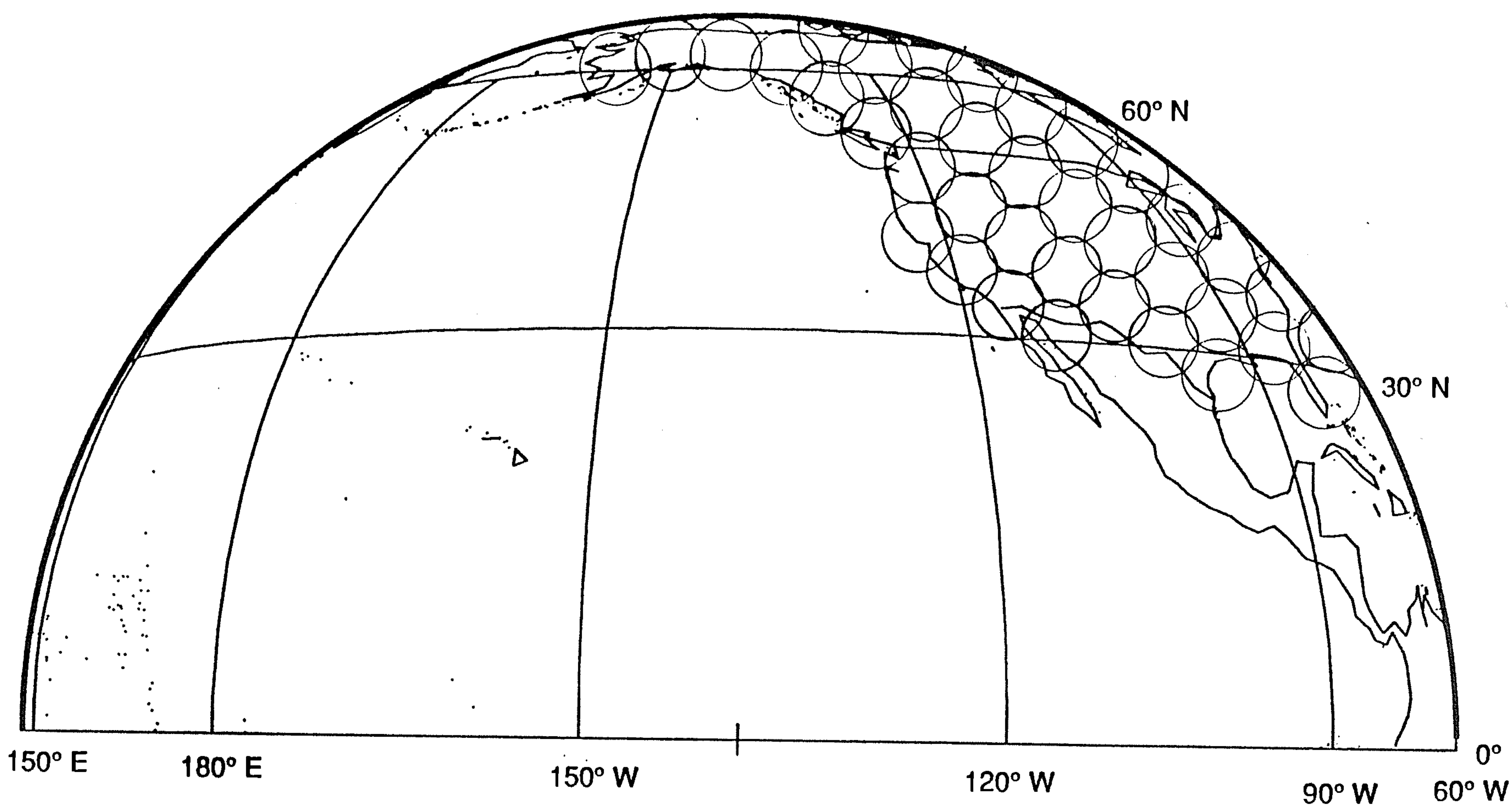



FIGURE 1 - 139° SATELLITE

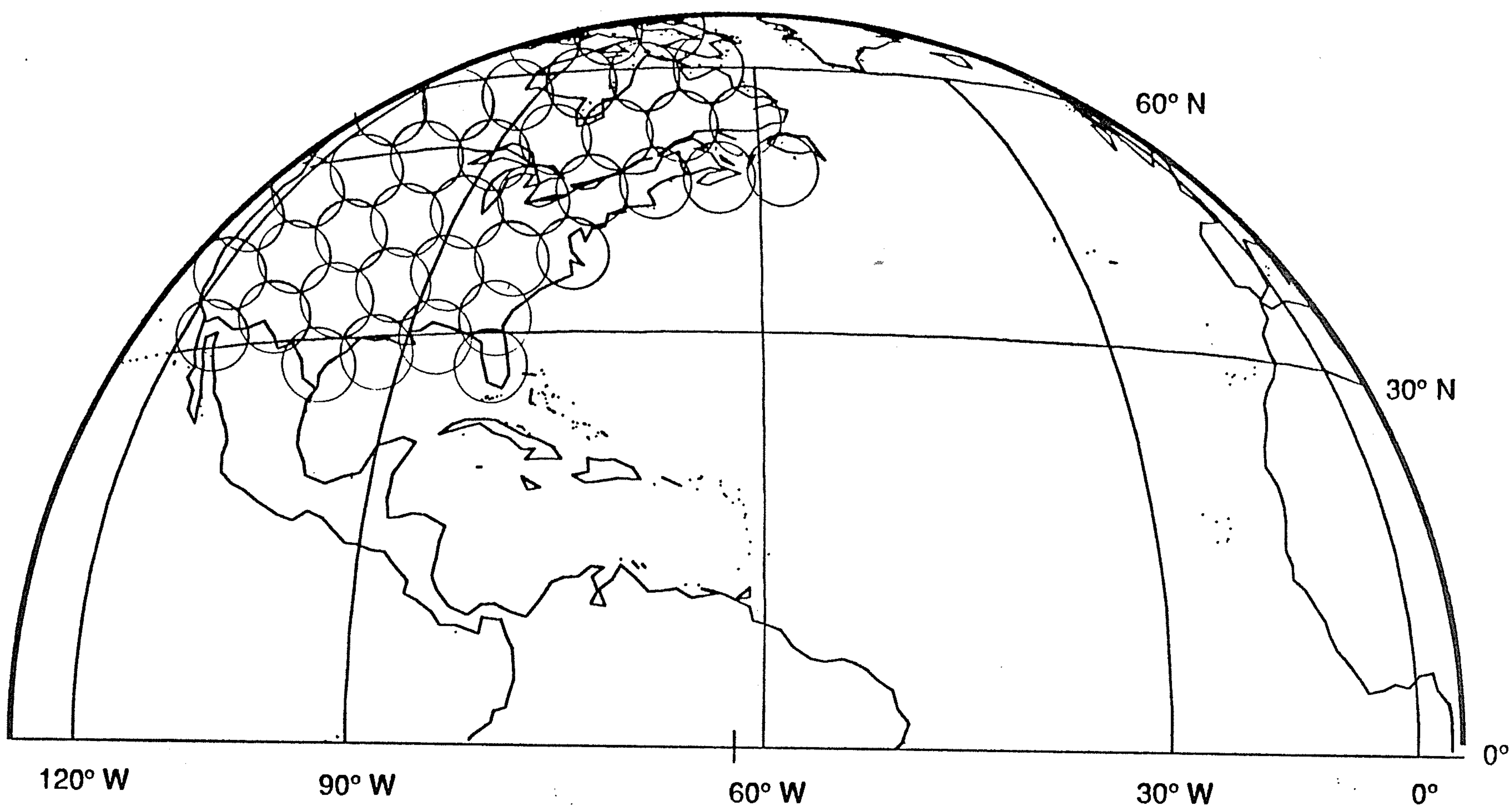



FIGURE 2 - 62° SATELLITE

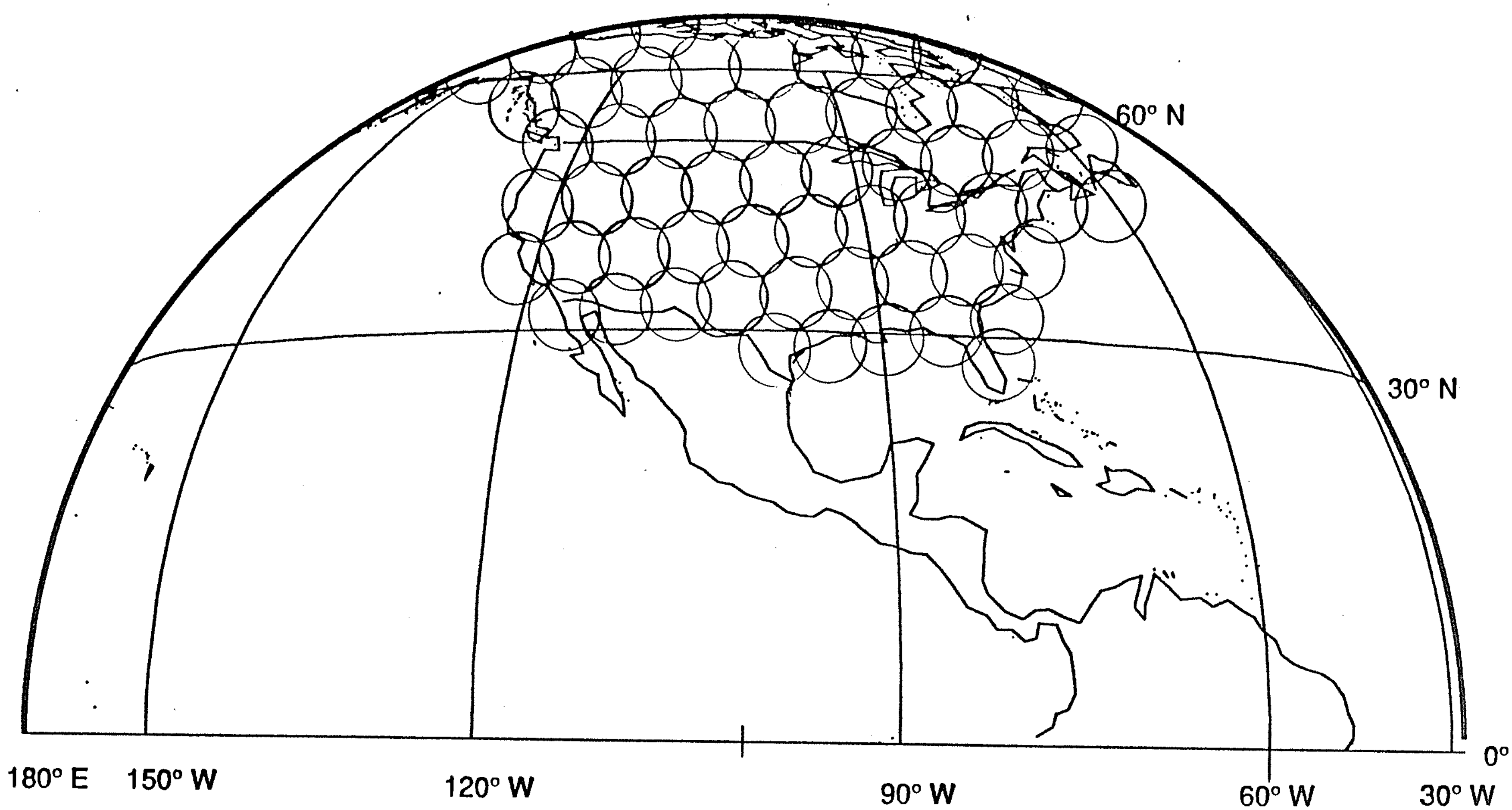


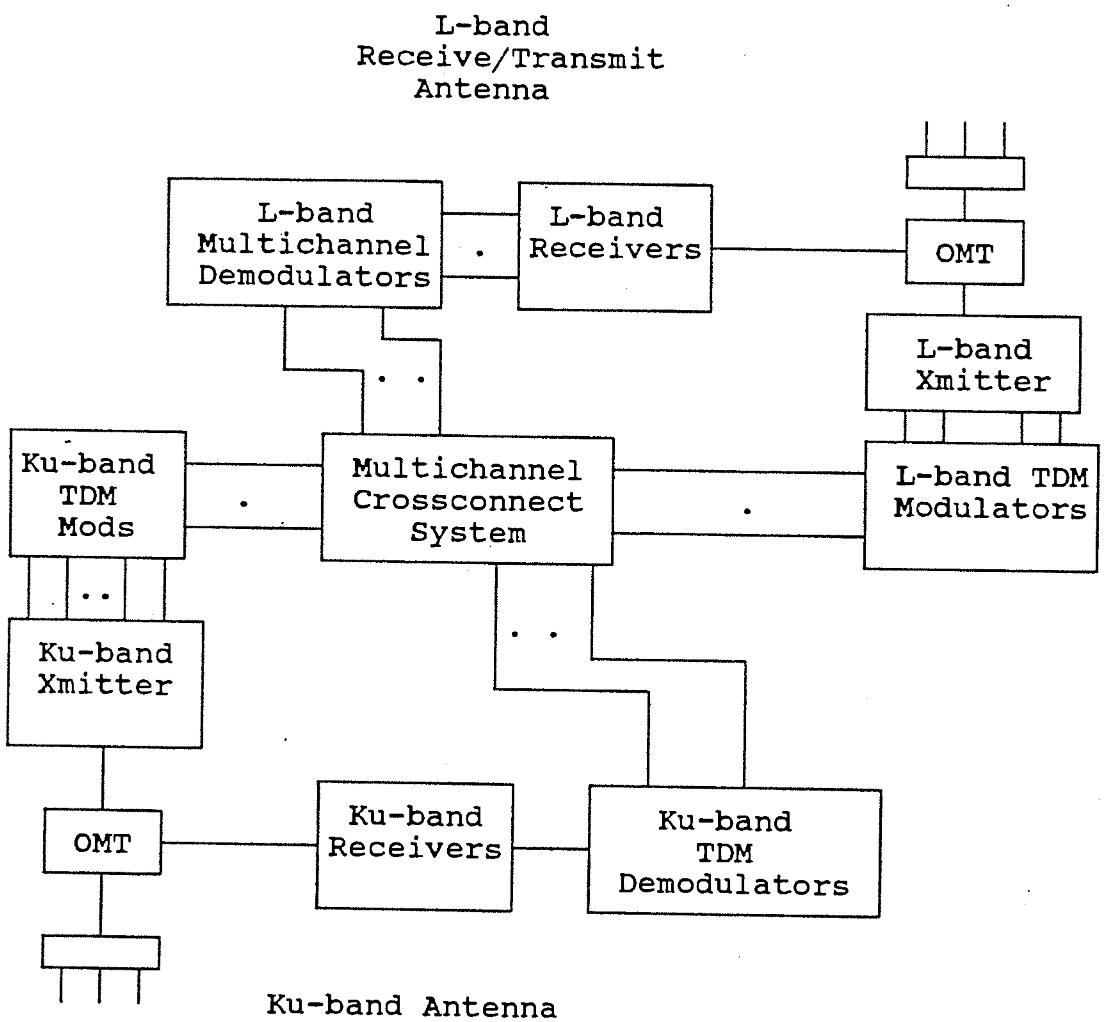

FIGURE 3 - 101° SATELLITE

B. Satellite Characteristics

To maximize flexibility, AMSC has concluded that the next generation satellite technology should use satellite processing to manage the spectrum and the capacity of the satellite. Figure 4 diagrams the important components of the advanced technology satellite. The processing capability of the satellite could also be used to facilitate L-band user-to-user communications. All carriers received by the satellite would be demodulated into a digital stream and fed into a multichannel, crossconnect system. The multichannel crossconnect system (MCCS) would operate like a Digital Access Crossconnect (DACS) used in terrestrial digital networks. It would remultiplex the received incoming digital channels onto particular TDM carriers that will be broadcast on the L- and Ku-band downlinks. It should be noted that the rate of the incoming digital streams would not be uniform so that the MCCS would need to do the appropriate rate conversions and insure that the frame integrity of the incoming digital channels are not lost in the process.

Mobile users would uplink on individual FDM channels to conserve on the required terminal battery power to permit the use of hand held devices. The satellite would receive each of the individual carriers and then combine each of the individual uplinks onto a higher rate TDM broadcast carrier for transmission in the space-to-earth direction. This technique of remodulation from a FDMA access scheme in the space-to-Earth direction and into a TDM

Figure 4 Advanced Technology Satellite Payload Design



format in the earth-to-space direction has been discussed in the available literature on satellite processing techniques. The technique employs the use of multicarrier demodulators. The technology is based on the use of SAW filter technology in the satellite. The SAW filter is designed to operate over a specified contiguous bandwidth. The filter introduces a differential delay between incoming FDMA signals, so that they can be serially demodulated by a digital demodulator. Once demodulated the incoming signals have been transformed into a serial digital stream that can be redirected to the feederlink bandwidth or to another L-band downlink. Since the satellite is using spot beams, enough satellite power can be generated to broadcast the higher data rate carriers to the hand held terminals with omnidirectional antennas. Through the MCSS on board the satellite, individual terminals will be able to communicate with each other directly.

The processing of the incoming Ku band feederlink carriers is more straightforward. Since switching and rate conversion will be done at the satellite, higher speed digital links can be configured as feederlink carriers to be processed at the satellite. Ideally, a high speed interface, such as T1, can be used to interface feederlink earth station baseband equipment with the earth station transmit equipment. The use of T1 would enable the network to employ the use of standard digital modem equipment for feederlink transmissions.

C. Frequency Plan

The frequency plan of the satellite would consist of two parts, one the mapping of the feederlink spectrum into the L-band and the other the interbeam reuse of the L-band frequency spectrum. Since there will exist satellite processing, the data rates of carriers on the L-band uplink and downlink will vary. There will be a uniform rate for access to and from the satellite on the feederlink portion of the network, however, these access rates will differ from those used in the L-band.

1. Feederlink Uplink

Since there is satellite processing, there is no reason to use a SCPC approach on the feederlink uplink. The approach considered is to use high capacity TDM carriers on the uplink and use the satellite processor to direct each channel to the appropriate downlink. This will minimize the numbers of modems that are required in the feederlink earth station. The use of a standard rate modem will enable the network to use existing satellite modems and standard interfaces to terrestrial networks and baseband equipment. The use of T1 rates has the advantage of standardization and provides a convenient interface with any switching equipment that may be required at the feederlink earth station. Although the experience of the cellular community is that the predominant connection is between the mobile and the PSTN and not another mobile, the commitment to provide on-board processing allows direct communications between mobiles without adversely impacting the design of the satellite.

2. Feederlink Downlink

The feederlink downlink can be designed to make best utilization of the available downlink spectrum. Since the earth station G/T on the downlink is not as limiting a factor as in the L-band, the best tradeoff between carrier size/satellite EIRP can be made. Ku-band satellite TWTAs have been designed with output powers on the order of 45 to 60 watts. 100 watt TWTAs have been considered for DBS applications. Thus, the size of the TDM carrier does not appear to be a limit on the downlink. Carrier sizes on the order of T1 rates can be easily accommodated by 3.5m feeder link earth stations. For arguendo let say that the 1.544 Mbps is the upper limit that is allowed to be transmitted. Then 5000 channels would require approximately 21 T1 carriers and about 41 MHz of feederlink spectrum. This is to be compared to the 200 MHz of spectrum that is currently required to support 2000 channels. Thus, very efficient use of feederlink spectrum can be obtained through the use of satellite processing. The use of T1 rates on both the uplink and downlink will also allow feederlinks to use standard off the shelf modem technology to provide access to and from the satellite.

### 3. Mobile Uplink

As stated previously, the mobile uplink would basically use an SCPC approach to limit the amount of power that is required to support the link. Each handheld terminal would be required to radiate 600 milliwatts. The omni-directional antenna itself would give approximately 3 dB of gain to give the terminal an EIRP of .5 dB, enough to support basic telephony at compressed voice rates of 4.8 Kbps or in band data up to the same rate. The access to the spectrum would be SCPC, each channel occupying approximately 6 KHz. Thus, 5000 channels can easily fit within the 10 MHz, assuming a frequency reuse factor of 5, which is within the design constraints of the system.

### 4. Mobile Downlink

The mobile downlink is designed with the handheld in mind. The practical capacity limit of the TDM downlink carrier is 7 channels or approximately 44.8 Kbps. Thus, to support 5000 channels approximately 40.3 MHz of spectrum is necessary,which matches the uplink spectrum requirement very well and, assuming a frequency reuse factor of 5, is well within the design constraints of the system.

## D. Transmission Characteristics

All carriers will be modulated using offset or $\pi/4$ QPSK. This modulation form has been shown to be the most robust in a fading environment. Table 1 is a link calculation for the network, assuming the data rates on the various links that were indicated in the previous sections.

Table 1 Link Calculation for Next Generation Satellite System

| | | | | |
|---|---|---|---|---|
| CONFIGURATION: | NEXT GENERATION SATELLITE SYSTEM | | | |
| 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) | 62.0 | 44.0 | 0.5 | 27.0 |
| FLUX DENSITY (DBW/M*M) | -101.0 | -119.0 | -162.5 | -136.0 |
| SYMBOL BANDWIDTH (HZ) | 1544000 | 22400 | 2400 | 1544000 |
| RCV ANT GAIN (DBI) | x | x | x | 54.8 |
| RCV TEMPERATURE (K) | x | x | x | 225 |
| G/T (DB/K) | -3 | -22 | 11 | 31.3 |
| CNR thermal (DB) | 17.2 | 15.2 | 16.7 | 19.0 |
| 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) | 16.4 | 13.7 | 15.6 | 16.6 |
| CNR total (DB) | | 13.7 | | 16.6 |
| 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) | 4.9 | 2.9 | 4.1 | 4.4 |

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

## E. Physical Characteristics Of the Satellite

The satellite itself would be based on a Hughes 601s design, which has a capability of supporting 4900 watts. The satellite dry weight is estimated to be 5000 Kg. The feature of most interest is the 25 meter boom that will be required to support the 15.6m reflector. Aside from the challenge of deploying the antenna in orbit, the design challenge of the new antenna assembly is to overcome the passive intermod problems so that only one reflector need to be deployed. The antenna will use an offset feed that will be mounted on the satellite body. The boom itself will be extended from the body of the spacecraft, where it will be stowed for the launch. The boom itself would consist of two parts, an offset and a parallel part. The reflector would use a wrap-rib design which has been flown on ATS-6. Proof of concept contracts have already been completed on these large pieces of hardware.

## F. System Reliability

Design methods will be used to insure that at least 2-for-1 redundancy is used on all critical elements of the satellite processing, and receivers. Transmitters will be designed with HPAs using at least 15-for-11 ring redundancy. It is estimated that the probability that the spacecraft will be fully operational for the first 7 years is 90%.

G. Launch Vehicles

The mass of the spacecraft and antenna will require the launch services of an Arianne 5 - class launch vehicle.

# TECHNICAL APPENDIX

TABLE OF CONTENTS

## TECHNICAL APPENDIX

### INTRODUCTION

This Technical Appendix analyzes the applications of Ellipsat Corporation ("Ellipsat") and Motorola Satellite Communications, Inc. ("Motorola"). Among the conclusions it reaches are the following:

- the proposed systems would cause widespread harmful interference to existing and planned systems in the proposed bands, including fixed services, the Glonass radionavigation system, and radio astronomy
- the proposed systems would violate the Commission's RDSS rules and prevent the operation of RDSS systems that sought to comply with the rules
- the proposed systems would prevent the use of their proposed frequencies by other MSS systems, except by dividing the spectrum
- the proposed systems appear to be very unreliable; for instance, the systems appear to have power systems that are inadequate to operate all channels during solar eclipse
- Ellipsat and Motorola have dramatically overestimated their systems' capacity; Ellipsat would have the capacity to serve no more than five users at a time and Iridium would have no more than ten channels

In addition, analysis of claims made by Ellipsat and Motorola shows that Ellipsat will not be able to offer a $300 unit to convert a cellular telephone to satellite use and Motorola will not be able to offer any meaningful advantages in transmission delay.

I. ELLIPSO AND IRIDIUM WOULD VIOLATE POWER LIMITS AND CAUSE HARMFUL INTERFERENCE TO EXISTING AND PLANNED SYSTEMS

In this section it is shown that the systems proposed by Ellipsat and Motorola violate limits on the power levels that may be radiated by RDSS systems and, consequentially, that the systems would cause harmful interference to other users of the bands in which they propose to operate.

A. Ellipso and Iridium Exceed Emission Power Limits

The International Telecommunication Union ("ITU") has established limits on the power density levels that may be radiated by systems in the Radiodetermination-Satellite Service ("RDSS") operating in the 1610-1626.5 MHz and 2483.5-2500 MHz bands in order to enable shared use of those bands.[1] Specifically, limits on the power flux density ("PFD") level generated at the Earth's surface by satellite transmissions provide blanket protection of terrestrial receivers, and limits on the equivalent isotropically radiated power ("EIRP") of earth stations (1) enable the application of the predetermined coordination distances specified in RR Article 11 (No. 1107.2), (2) bound the actual distance and frequency separations that may

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e WARC-MOB-87 adopted an EIRP density limit on RDSS uplink transmissions (RR Article 28, No. 2548A) and a power flux density ("PFD") limit on RDSS downlink transmissions (RR Article 28, No.s 2556-2559). Ellipso and Iridium claim to provide RDSS and, therefore, are subject to these power limits. As "multifunction" systems, the MSS operations in Ellipso and Iridium also would be subject to the RDSS power limits. CCIR Report 833 (Study Group 1).

be needed between the affected stations, and (3) provide a basis for Radio Astronomy Regions ("RAR") around radio astronomy observatories. Ellipso and Iridium substantially exceed the applicable limits within the U.S. and in the territory of other administrations, and have not made an attempt to explain or justify this excess power.[2] These violations of PFD and EIRP limits would lead inevitably to harmful interference to other services, as will be shown below. In addition, because they violate applicable PFD and EIRP limits, Ellipso and Iridium would be found to be non-conforming by the International Radio Frequency Board ("IFRB") upon submission of the requisite advance publication data. Thus, Ellipso and Iridium would not be entitled to protection from interference.

1. EIRP Limits

The calculations in Table 1 demonstrate that uplink EIRP density of Ellipso feeder link earth stations is over three-hundred and fifty times (25.6 dB) higher than the level that is

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[2] Neither Ellipsat nor Motorola have proposed new power limits or procedures intended to permit their respective systems to be accommodated in the bands they seek. Further, while Motorola claims it would develop appropriate sharing criteria in the International Radio Consultative Committee ("CCIR"), it has bypassed appropriate opportunities including the meeting of IWP 8/14 in Fall 1990, at which a number of administrations raised concerns as to how Iridium could share the 1610-1626.5 MHz band, and then successive meetings of IWP 8/15 in Spring 1991, the JIWP-WARC-92 in Spring 1991, and the meeting of Task Group 12-3 in Spring 1991. In any case, as shown below, Ellipsat's and Motorola's proposed systems are incompatible with other systems; therefore, no satisfactory sharing criteria can be developed.

permissible in the 1610-1626.5 MHz band. The calculations in Table 2 show that Iridium's satellite EIRP density also exceeds the permissible level for the 1610-1626.5 MHz band by twenty-six percent (1 dB).

The spectrum management impact of these violations is twofold. First, the predetermined coordination distances for RDSS stations (RR No. 1107.2) no longer would be effective in identifying potential cases of interference that would be mitigated in subsequent coordination. This is particularly critical with respect to Radionavigation-Satellite service operations in the 1610-1616.5 MHz band and Fixed service operations throughout the 1610-1626.5 MHz band that several administrations will wish to protect. New, larger coordination distances would be required. Thus, even if the frequency sharing were possible, the administrative burden associated with coordination would be increased substantially. In the case of the Iridium satellite violation, the EIRP violation likely would have to be treated as a PFD problem although Motorola has made no proposals along these lines.

Table 1 - Ellipso Uplink EIRP Density
In The 1610-1626.5 MHz Band

| Type of Earth Station | Mobile | Gateway |
|---|---|---|
| Antenna Input Power Per Channel (Note 1): | 3.3 | 20.0 dBW |
| Antenna Gain: | 5.0 | 27.1 dBi |
| Uplink EIRP: | 8.3 | 47.1 dBW/ch. |
| Signal Bandwidth (Note 2): | 1.13 | 1.13 MHz |
| EIRP Density: | -16.2 | 22.6 dBW/4 kHz |
| Radio Regulation EIRP Density Limit: | -3.0 | -3.0 dBW/4 kHz |
| Amount of Violation (Note 3): | - | 25.6 dB |

Note 1: Parameters are for Ellipso mobile earth stations ("mobile") and feeder link earth stations ("gateway") that transmit multiple, overlaid spread spectrum signals in the same channel in the 1610-1626.5 band. Ellipsat Application, Appendix B, p1, "Link Noise Budget."

Note 2: Bandwidth and chip rate parameters are not clearly stated in the Ellipsat application. The stated "spreading" figure of 1.28 Mcps is interpreted here as the chip rate, which would yield a 3 dB bandwidth of 1.13 MHz. Ellipsat Application, Appendix B, at 2.

Note 3: Ellipso mobile earth stations conform with the EIRP limit, but Ellipso gateway earth stations greatly exceed the limit.

Table 2 - Iridium Power Levels In The 1610-1626.5 MHz Band:
(1) Versus Power Flux Density Limit (Note 1)
(2) Versus EIRP Limit (Note 2)

| | | |
|---|---|---|
| | Satellite EIRP (10 degree elevation): | 31.7 dBW/ch |
| | Signal Bandwidth: | 280 kHz |
| | EIRP Density: | 13.2 dBW/4 kHz |
| | Length of Space-Earth Path: | 2293.5 km |
| (1) | Power Flux Density (10 degrees): | -125 dBW/m$^2$/4 kHz |
| (1) | Power Flux Density Limit (10 degrees): | -151 dBW/m$^2$/4 kHz |
| (1)* | Amount of Violation: | 26 dB |
| (2) | Coordination Distance (1610-1626.5 MHz): | 400 km |
| (2) | Additional Loss to Iridium Satellite: | 15.2 dB |
| (2) | Effective EIRP vs Coordination Trigger: | -2.0 dBW/4 kHz |
| (2) | Coordination EIRP (vs 400 km separation): | -3.0 dBW/4 kHz |
| (2)* | Amount by Which Threshold is Exceeded: | 1.0 dB |

Note 1: RR No. 2557 prescribes the PFD limit for the frequency range 1525 MHz to 2500 MHz. The parameters assumed for the Iridium system are taken from the "Supplemental Information to Iridium Application."

Note 2: Because the RDSS allocation in the 1610-1626.5 MHz band is for Earth-to-space transmission only, the power limit on RDSS is specified in the form of an earth station EIRP limit. On the basis of that limit, predetermined coordination distances of 100 km and 400 km were established for ground-based and airborne RDSS earth stations, respectively. The frequency sharing situation for airborne RDSS earth stations is similar to the situation for Iridium satellite transmissions, and so, it is possible to translate the RDSS aircraft earth station EIRP limit and 400 km coordination distance to an equivalent limit for Iridium satellites. Specifically, because free space loss levels approximate the basic transmission losses encountered on long slant paths, the EIRP limit would be relaxed in proportion to the square of the ratio of interference path lengths (Iridium path length/400 km).

Second, the RARs in the 1606.8-1613.8 MHz band would have to be enlarged substantially.[3] Specifically, even if Ellipso and Iridium were to adhere to the synchronized 200 millisecond transmission periods associated with RARs, the existing RARs would be inadequate because the RAR radius is based on lower-power emissions that conform with the EIRP limit. The problem is even worse, however, because neither Iridium nor Ellipso are designed to confine their transmissions to the 200 millisecond synchronized time slots as required under the RAR concept. As a result, RAR areas would have to be redefined as areas where RDSS and MSS operations are precluded, and the radius of RAR areas would have to be extended to well beyond the horizon. Ultimately, this would limit or preclude Ellipso feeder link operations in expansive RARs in the three lowest proposed channels, i.e, 30% of its channels. In the case of Iridium satellite transmissions, each RAR would extend through the Iridium orbit and would pertain to at least the twenty-four Iridium channels spanning 1606.8-1613.8 MHz and at least to all Iridium satellites visible to the protected radio astronomy

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[3] See Appendix D to Report and Order, Gen. Docket Nos. 84-689 and 84-690. Any RDSS earth station operating within an RAR must confine its transmissions to the first 200 milliseconds following one-second UTC time marks. Six RARs have been established in the U.S. and Puerto Rico, which are bounded by circles with radii of 25 km and 150 km for ground-based and airborne RDSS stations, respectively.

observatories.[4]

### 2. PFD Limits

Tables 2 and 3 present calculations of the PFD levels produced by Iridium and Ellipso, respectively, and compare those levels with the applicable PFD limits. For Iridium, it is shown that the PFD limit at 1610-1626.5 MHz is exceeded by 26 dB at an elevation angle of 10 degrees. Even greater violations occur at elevation angles less than 10 degrees. The calculations in Motorola's own application reveal that the PFD limit is exceeded at all elevation angles. Supplement, at Table A-2. For Ellipso, Table 3 shows that the PFD limit at 2483.5-2500 MHz is exceeded by about 7 dB at low elevation angles. The effect of these violations is to immerse terrestrial receivers in interfering signal fields that are much higher than the levels to which they are to be designed to withstand. As shown in later interference calculations, these PFD levels would severely interfere with other systems.

The problems caused by Ellipsat's and Motorola's PFD violations are exacerbated by the non-geostationary orbits proposed for Ellipso and Iridium. Specifically, transmitting Ellipso and Iridium satellites will frequently traverse the antenna mainbeams of terrestrial receiving stations. This

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[4] There is no need to further address Ellipso or Iridium sharing with radioastronomy. It is obvious that little if any use could be made of frequencies near 1606.8-1613.8 MHz by either Ellipso or Iridium.

onerous situation is not adequately addressed by the current PFD limits. The PFD limits in the ITU RR Article 28 were derived with respect to geostationary satellites, assuming that the mainbeams of terrestrial fixed systems could be directed sufficiently away from geostationary satellites in order to avoid receiving the entire PFD and the associated interference. In the absence of a stationary reference for the PFD (i.e., the geostationary orbit), designers of terrestrial systems will be unable to avoid receiving the full brunt of the PFD. This problem is compounded by the fact that Ellipsat and Motorola propose to operate multiple satellites, each of which would impose the full brunt of their PFD on terrestrial systems. Thus, even if Ellipso and Iridium were able to meet current PFD limits, there nonetheless would be a serious interference problem created by this operation.[5/]

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5/ See Comments of AMSC on Supplemental NOI for WARC-92 Technical Appendix, n. 12 (April 12, 1991). AMSC established that PFD limits developed for geostationary satellites, when applied to constellations of non-geostationary satellites, would provide inadequate protection of terrestrial systems. This has not been disputed by either Ellipsat or Motorola or by any operator of terrestrial systems.