# FCC 312
**Main Form**

**FEDERAL COMMUNICATIONS C**

**APPLICATION FOR SATELLITE SPACE AND EARTI**

191-SAT-P/LA-97

FCC Use Only
File Number: FCC/MELLON SEP 25 1997
Call Sign: Received

## PAYOR AND FILING FEE INFORMATION

| a. Payor Name | | | b. Daytime Telephone Number |
|---|---|---|---|
| Haig Capital LLC | | | 6 1997 |
| c. Mailing Street Address or P.O. Box | | | d. FCC Account Number |
| 18 Corporate Woods Boulevard, Third Floor | | | 0061324691 Sat. Sys. Policy Branch International Bureau |
| e. City | f. State | g. Zip Code | h. Country Code (if not U.S.A.) |
| Albany | NY | 12211 | |

| i. Payment Type Code | j. Quantity | k. Fee Due for Payment Type Code in (i) | l. Total Amount Paid | FCC Use Only |
|---|---|---|---|---|
| BNY | 1 | $85,045.00 | $85,045.00 | 85,045.00 |

## APPLICANT INFORMATION

| 1. Legal Name of Applicant | 2. Voice Telephone Number |
|---|---|
| CAI Satellite Communications, Inc. ORIGINAL | 518 - 462-2632 |
| 3. Other Name Used for Doing Business (if any) | 4. Fax Telephone Number |
| | 518 - 462-3045 |

| 5. Mailing Street Address or P.O. Box | 6. City | |
|---|---|---|
| 18 Corporate Woods Boulevard, Third Floor | Albany | |
| ATTENTION: | 7. State / Country (if not U.S.A.) | 8. Zip Code |
| | NY | 12211 |

| 9. Name of Contact Representative (If other than applicant) | 10. Voice Telephone Number |
|---|---|
| James Troup | 202 - 775-7100 |
| 11. Firm or Company Name | 12. Fax Telephone Number |
| Arter & Hadden | 202 - 857-0172 |

| 13. Mailing Street Address or P.O. Box | 14. City | |
|---|---|---|
| 1801 K Street, N. W., Suite 400K | Washington | |
| ATTENTION: | 15. State / Country (if not U.S.A) | 16. Zip Code |
| | DC | 20006-1301 |

## CLASSIFICATION OF FILING

17. Place an "X" in the box next to the classification that applies to this filing for both questions a. and b. Mark only one box for 17a and only one box for 17b.

- [ ] a1. Earth Station
- [X] a2. Space Station
- [X] b1. Application for License of New Station
- [ ] b2. Application for Registration of New Domestic Receive-Only Station
- [ ] b3. Amendment to a Pending Application
- [ ] b4. Modification of License or Registration
- [ ] b5. Assignment of License or Registration
- [ ] b6. Transfer of Control of License or Registration
- [ ] b7. Notification of Minor Modification
- [ ] b8. Other (Please Specify):

| 18. If this filing is in reference to an existing station, enter: | 19. If this filing is an amendment to a pending application enter: | |
|---|---|---|
| Call sign of station: | (a) Date pending application was filed: | (b) File number of pending application: |

## TYPE OF SERVICE

20. NATURE OF SERVICE: This filing is for an authorization to provide or use the following type(s) of service(s): Place an "X" in the box(es) next to all that apply.

[X] a. Fixed Satellite [ ] b. Mobile Satellite [ ] c. Radiodetermination Satellite [ ] d. Earth Exploration Satellite [ ] e. Other (please specify) _____

21. STATUS: Place an "X" in the box next to the applicable status. Mark only one box.

[ ] a. Common Carrier [X] b. Non-Common Carrier

22. If earth station applicant, place an "X" in the box(es) next to all that apply. N/A

[ ] a. Using U.S. licensed satellites [ ] b. Using Non-U.S. licensed satellites

23. If applicant is providing INTERNATIONAL COMMON CARRIER service, see instructions regarding Sec. 214 filings. Mark only one box. Are these facilities: N/A

[ ] a. Connected to the Public Switched Network [ ] b. Not connected to the Public Switched Network

24. FREQUENCY BAND(S): Place an "X" in the box(es) next to all applicable frequency band(s).

[ ] a. C-Band (4/6 GHz)

[ ] b. Ku-Band (12/14 GHz) [X] c. Other (Please specify) V-band 40.5 - 41.5 GHz and 49.2 - 50.2 GHz

## TYPE OF STATION

25. CLASS OF STATION: Place an "X" in the box next to the class of station that applies. Mark only one box.

[ ] a. Fixed Earth Station [ ] b. Temporary-Fixed Earth Station [ ] c. 12/14 GHz VSAT Network [ ] d. Mobile Earth Station [X] e. Space Station [ ] f. Other (Specify) _____

If space station applicant, go to Question 27.

26. TYPE OF EARTH STATION FACILITY Mark only one box. N/A

[ ] a. Transmit/Receive [ ] b. Transmit-Only [ ] c. Receive-Only

## PURPOSE OF MODIFICATION OR AMENDMENT

27. The purpose of this proposed modification or amendment is to: Place an "X" in the box(es) next to all that apply. N/A

[ ] a -- authorization to add new emission designator and related service
[ ] b -- authorization to change emission designator and related service
[ ] c -- authorization to increase EIRP and EIRP density
[ ] d -- authorization to replace antenna
[ ] e -- authorization to add antenna
[ ] f -- authorization to relocate fixed station
[ ] g -- authorization to change assigned frequency(ies)
[ ] h -- authorization to add Points of Communication (satellites & countries)
[ ] i -- authorization to change Points of Communication (satellites & countries)
[ ] j -- authorization for facilities for which environmental assessment and radiation hazard reporting is required
[ ] k -- Other (Please Specify)

_____

## ENVIRONMENTAL POLICY

28. Would a Commission grant of any proposal in this application or amendment have a significant environmental impact as defined by 47 CFR 1.1307? [ ] YES [X] NO
If YES, submit the statement as required by Sections 1.1308 and 1.1311 of the Commission's rules, 47 C.F.R. §§ 1.1308 and 1.1311, as Exhibit A to this application.

A Radiation Hazard Study must accompany all applications as Exhibit B for new transmitting facilities, major modifications, or major amendments. Refer to OET Bulletin 65.

## ALIEN OWNERSHIP

| | | |
|---|---|---|
| 29. Is the applicant a foreign government or the representative of any foreign government? | ☐ YES | ☒ NO |
| 30. Is the applicant an alien or the representative of an alien? | ☐ YES | ☒ NO |
| 31. Is the applicant a corporation organized under the laws of any foreign government? | ☐ YES | ☒ NO |
| 32. Is the applicant a corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country? | ☐ YES | ☒ NO |
| 33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country? | ☐ YES | ☒ NO |
| 34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as Exhibit C an identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote. | | |

## BASIC QUALIFICATIONS

| | | |
|---|---|---|
| 35. Does the applicant request any waivers or exemptions from any of the Commission's Rules? If Yes, attach as Exhibit D, copies of the requests for waivers or exceptions with supporting documents. | ☒ YES | ☐ NO |
| 36. Has the applicant or any party to this application had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as Exhibit E, an explanation of the circumstances. | ☐ YES | ☒ NO |
| 37. Has the applicant, or any party to this application, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? | ☐ YES | ☒ NO |
| 38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement or any other means or unfair methods of competition? | ☐ YES | ☒ NO |
| 39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceeding two items? | ☐ YES | ☒ NO |
| 40. By checking Yes, the undersigned certifies, that neither the applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application" for these purposes. | ☒ YES | ☐ NO |

41. Description. (Summarize the nature of the application and the services to be provided).

See Exhibit K.

## CERTIFICATION

The Applicant 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. The applicant certifies that grant of this application would not cause the applicant to be in violation of the spectrum aggregation limit in 47 CFR Part 20. All statements made in exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that all statements made in this application and in all attached exhibits are true, complete and correct to the best of his or her knowledge and belief, and are made in good faith.

42. Applicant is a (an): (Place an "X" in the box next to applicable response.)

☐ a. Individual ☐ b. Unincorporated Association ☐ c. Partnership ☒ d. Corporation ☐ e. Governmental Entity ☐ f. Other (Please specify) _____

| 43. Typed Name of Person Signing | 44. Title of Person Signing |
|---|---|
| Timothy J. Santora | President |

| 45. Signature | 46. Date |
|---|---|
| T. Santora | 9-19-97 |

**WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION (U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).**

## Request For Waiver of Financial Qualifications

Section 25.140(b) of the Commission's Rules requires that each applicant for a space station authorization in the domestic FSS demonstrate that it has the current financial ability to meet the estimated costs for the construction and launch of the proposed space station, and the estimated costs for operation of the proposed space station for one year after launch. *See* 47 C.F.R. §25.140(c)(1)-(2). However, because the Commission has yet to adopt service rules for satellite systems operating in the V-band, the financial qualifications for such systems may be substantially changed.

CAI intends to finance the construction, launch and first-year operation of its satellite system through the issuance of equity and debt securities. However, as discussed below, due to the nature of CAI's proposal and because no specific rules for V-band systems have been adopted, CAI respectfully requests that the Commission waive its existing financial qualification requirements applicable to domestic FSS licensees, and if necessary any subsequently adopted requirements specific to V-band applicants. Such a waiver is justified. The Commission has routinely applied its financial qualifications to applicants in a particular satellite service based upon the "entry opportunities" in the particular service.[1] Specifically, the Commission has concluded that the existence of entry opportunities in the service being licensed is an important factor, and that "[w]here grant to one applicant will not prevent another from going forward, the

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[1] *See e.g.*, Morning Star Satellite Company, L.L.C., File Nos. 190 through 193-SAT-P/LA-95, para. 12 (released May 9, 1997), *see* also In re EarthWatch Incorporated, File Nos. 21/22-DSS-P-93; 43-DSS-LA 94(2); 52-SAT-AMEND-95, DA 95-1707, para. 11 (released August 1, 1995) ("EarthWatch"); Norris Satellite Communications, Inc., 7 FCC Rcd 4289 (1992) ("Norris").

required financial demonstration has been rather liberal."[2] For example, in each of the "*Order[s] and Authorization[s]*" granted to the licensees in the first processing round of Ka-Band satellite applicants, the Commission determined that there were sufficient orbitals slots to accommodate the applicants in the first processing round as well as subsequent applicants, and therefore, it was "not necessary to rule on the applicants' financial qualifications."[3]

For the reasons stated above, Commission grant of CAI's waiver request is appropriate, and complies with the Commission's public interest considerations as articulated in the Authorizations from the first processing round of Ka-band applicants, *Norris* and other Commission precedent. Therefore, CAI respectfully requests that the Commission waive its financial qualifications requirements with respect to the instant application.

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2 *See EarthWatch*, para. 11.

3 *Morningstar* at 13.

## General Description of Overall System

CAI proposes a satellite communications system consisting of a single V-band satellite and associated earth stations capable of sending and receiving high speed broadband digital communications from feeder link earth stations and ground terminals within the continental United States. Individual ground terminals will have the capability of sending data back through the CAI satellite to other ground terminals and/or the principal CAI earth station.

CAI does not plan to enter the business of designing, manufacturing, or distributing the ground terminals used to communicate with the CAI satellite. CAI anticipates that it will work closely with equipment and satellite manufacturers to ensure that the products that they develop are compatible with the CAI system.

## 1.0 Application Proposal.

CAI requests authority to launch and operate a single GSO satellite in the fixed-satellite service (FSS) utilizing the V-band. Requests for earth stations, including TT&C stations, will be submitted subsequently.

CAI's system will be capable of providing a high-quality two-way video, voice and data distribution service intended to serve business and residential customers throughout the continental United States (CONUS). The system will employ a single satellite designed to operate over a period of twelve years operating in the CONUS orbital arc at 93° WL, 95° WL or 103° WL. CAI has selected these orbital locations because their business plan requires full CONUS capability and because it desires to gain economies of scale from co-locating its V-band satellite with the Ka-band satellite system proposed by CAI's affiliate, CAI Data Systems, Inc. Such colocation would enable a single subscriber dish to communicate with both the V-band and Ka-band satellite systems. In its Ka-band space station license application filed on July 2, 1997, CAI Data Systems, Inc. proposed to locate that space station at the 93° WL or 103° WL orbital position both of which became available when AT&T Corp. withdrew its Ka-band application.[4] CAI Data Systems, Inc., also requested, in the alternative, to locate its space station at the 95° WL orbital location should NetSat 28 Company, L.L.C. (NetSat 28) forfeit its Ka-band authorization as a result of the proceeding initiated in *MobileMedia Corporation, et al.*, Order to Show Cause, Hearing Designation Order, and Notice of Opportunity for Hearing for Forfeiture, WT Docket No. 97-115, FCC 97-124, released April 8, 1997.

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[4] In the Matter of Assignment of Orbital Locations to Space Stations in the Ka-Band, Order, DA 97-967, released May 9, 1997 at fn. 3.

## 2.0 Public Interest Considerations.

Grant of CAI's application will provide numerous public interest benefits by utilizing a new and innovative satellite technology capable of providing consumers with interactive multimedia services; and will provide business customers with next generation high bandwidth services. Applicant's system will employ a single V-band satellite to provide a ubiquitous broadband wireless communications infrastructure offering, *inter alia*, video distribution services, high speed data transfers, distance learning, high-speed Internet services, interactive data, e-mail, and video conferencing capabilities throughout the United States. The proposed services may be integrated with the applicant's existing terrestrial "wireless cable" services operating in the 2 GHz band to provide wireless cable subscribers with a greater variety of video and interactive services distinct from existing Direct Broadcast Satellite (DBS) systems.

Grant of the instant application will advance the Commission's statutory mandate to promote new and innovative technologies. CAI's parent company CAI Wireless Systems, Inc. (Nasdaq: CAWS), is an industry leader in the delivery of high quality video via terrestrial Multichannel Multipoint Distribution Service (MMDS). CAI Wireless Systems, Inc. is on the forefront in the use of its MMDS spectrum for the delivery of two-way voice, data and Internet access services. Integration of CAI's V-band system with its parent company's existing terrestrial network will enhance the value and public interest benefit of the V-band spectrum and terrestrial microwave spectrum. Moreover, this proposal promotes the Commission's public policy goals of establishing viable competition within the wireless communications and satellite markets and maximizes efficient use of the spectrum.

The proposed service will provide additional sources of highly reliable, high-bandwidth services that will be available to relieve network congestion points impeding the continued growth of the packet-switching capabilities of the Internet.[5] Consequently, the CAI system will serve to advance the growing National Information Infrastructure (NII) by interconnecting the nations school systems including those served by Instructional Television Fixed Service (ITFS) facilities that are typically integrated with terrestrial wireless cable systems. In furtherance of Congress' goals as stated in the universal service provisions of the 1996 Telecommunications Act, schools, libraries and rural health care providers will benefit from low-cost Internet access and other distance learning applications that will be possible with the CAI V-band satellite system. The proposed services will also inject further competition in the video marketplace by providing direct and vigorous competition to traditional wireline franchised cable operators and providers of terrestrial wire and wireline bandwidth. Moreover, CAI's system promises to provide robust competition within the satellite industry, by creating dynamic and innovative, nationwide high capacity wireless services.

Finally, CAI is a small business. Grant of its application would satisfy Congress' mandate, embodied in Section 257 of the Act, to eliminate barriers to market entry for small businesses like CAI. 47 U.S.C. § 257. It would also be in compliance with Section 309(j)(4)(D)

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5

Speech by Reed E. Hundt, "From Here to Ubiquity", August 26, 1997(discussing the unmet demand for additional sources of bandwidth for packet-switching applications and identifying congestion points in the traditional wireline circuit-switched network).

of the Act which directs the Commission "to ensure" the participation by small businesses in spectrum based services. 47 U.S.C. § 309(j)(4)(D).

**3.0 Program Milestones.**

Program milestones have been estimated and are provided as Attachment L1 of the instant Exhibit.

**4.0 Estimated Program Costs.**

The estimated costs of the CAI proposal are provided as Attachment L2 of the instant Exhibit.

**5.0 Legal Qualifications of Applicant.**

CAI Satellite Communications, Inc. is incorporated under the laws of the state of Delaware and is a wholly-owned subsidiary of CAI Wireless Systems, Inc. The officers and directors of the applicant, all U.S. citizens, are as follows:

Timothy J. Santora, President
James P. Ashman, Executive Vice President
Sabino Rodriguez, III, Secretary and Treasurer

The applicant's legal qualifications are further demonstrated by its parent company's most recently filed FCC Form 430 dated July 2, 1997, which is attached as Exhibit L3 of the instant application.

## 6.0 Financial Qualifications of Applicant.

*See* Main Form Exhibit D.

## 7.0 Determination of Common Carrier Status.

In accordance with the Commission's DISCO I Report and Order, CAI elects to offer services as a non-common carrier. *Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Satellite Systems*, Report and Order, 11 FCC Rcd 2429, 2436 (1996). The transponders carried on-board each satellite may be offered for sale or lease to customers over the lifetime of the system at the option of CAI. CAI will make individualized decisions with respect to the choice of customers. Accordingly, CAI will not hold itself out indiscriminately to serve the public, nor should there be any legal compulsion to regulate it as a common carrier. *National Association of Regulatory Utility Commissioners v. FCC*, 525 F.2d 630, 642 (D.C. Cir.), *cert denied*, 425 U.S. 999 (1976) (*NARUC I*).

## 8.0 Compliance with Intelsat Article XII.

To the extent that CAI's system is subject to consultation requirements under Article XIV of the INTELSAT Agreement, CAI will provide all information necessary and appropriate for such consultation.

**ATTACHMENT L1**

## PROGRAM MILESTONES

| Event | Completion Date |
|---|---|
| Application Approval | January 1999 |
| Spacecraft RFP Issued | January 1999 |
| Spacecraft Contractor Selected | April 1999 |
| Preliminary Spacecraft Construction Go Ahead (Long Lead Time Items) | April 1999 |
| Spacecraft Construction Commences | May 1999 |
| Spacecraft Construction Completed | May 2000 |
| Spacecraft Launched | July 2000 |
| Spacecraft in Service | November 2000 |

**ATTACHMENT L2**

## ESTIMATED PROGRAM COSTS

| Requirement | Estimated Cost |
|---|---|
| Spacecraft Construction | $150.0 Million |
| Launch Vehicle Cost | $100.0 Million |
| Launch Insurance Premium | $30.0 Million |
| TT&C Construction Cost | $4.0 Million |
| TT&C Operations Cost (First Year) | $1.5 Million |
| First Year Operating Cost | $7.0 Million |
| | $292.5 Million |

**ATTACHMENT L3**

# CAI LEGAL QUALIFICATIONS

CAI Wireless Systems INC.

July 2, 1997

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Re: CAI Wireless Systems, Inc.
Licensee Qualification Report

Dear Mr. Caton:

Transmitted herewith, by CAI Wireless Systems, Inc., is the original and one copy of an FCC Form 430, Licensee Qualification Report.

Questions with regard to this filing may be addressed to me at 703/875-7682.

Sincerely,

Linda Shea Gieseler

Linda Shea Gieseler
Director, Government Affairs

Enclosures

2101 Wilson Boulevard, Suite 100, Arlington, Virginia 22201
Tel. 703-812-8800 Fax 703-812-8808

FCC 430

Federal Communications Commission
Washington, DC 20554

**STAMP & RETURN**

Approved by OMB
3060-0105

# LICENSEE QUALIFICATION REPORT

See reverse for public burden estimate

INSTRUCTIONS:

A. The "Filer" of this report is defined to include: (1) An applicant, where this report is submitted in connection with applications for common carrier and satellite radio authority as required for such applications; or (2) A licensee or permittee, where this report is required by the Commission's Rules to be submitted on an annual basis.

B. Submit an original and one copy (sign original only) to the Federal Communications Commission, Washington, DC 20554. If more than one radio service is listed in Item 6, submit an additional copy for each such additional service. If this report is being submitted in connection with an application for radio authority, attach it to that application.

C. Do not submit a fee with this report.

1. Business Name and Address (Number, Street, State and ZIP Code) of Filer's Principal Office

CAI Wireless Systems, Inc.
18 Corporate Woods Boulevard
Third Floor
Albany, NY 12211

RECEIVED
JUL - 2 1997
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

2. (Area Code) Telephone Number
(518) 462-2632

3. If this report supersedes a previously filed report, specify its date
March 26, 1997

4. Filer is (check one):
☐ Individual ☐ Partnership ☒ Corporation
☐ Other (Specify):

5. Under the laws of what State (or other jurisdiction) is the Filer organized?
Connecticut

6. List the common carrier and satellite radio services in which Filer has applied or is a current licensee or permittee:
Multipoint Distribution Service, Domestic Fixed-Satellite Service

7(a) Has the Filer or any party to this application had any FCC station license or permit revoked or had any application for permit, license or renewal denied by this Commission? *If "YES", attach as Exhibit I a statement giving call sign and file number of license or permit revoked and relating circumstances.* ☐ YES ☒ NO

(b) Has any court finally adjudged the Filer, or any person directly or indirectly controlling the Filer, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement, or other means of unfair methods of competition? *If "YES", attach as Exhibit II a statement relating the facts.* ☐ YES ☒ NO

(c) Has the Filer, or any party to this application, or any person directly or indirectly controlling the Filer ever been convicted of a felony by any state or Federal court? *If "YES", attach as Exhibit III a statement relating the facts.* ☐ YES ☒ NO

(d) Is the Filer, or any person directly or indirectly controlling the Filer, presently a party in any matter referred to in Items 7(b) and 7(c)? *If "YES", attach as Exhibit IV a statement relating the facts.* ☐ YES ☒ NO

8. Is the Filer, directly or indirectly, through stock ownership, contract or otherwise, currently interested in the ownership or control of any other radio stations licensed by the Commission? *If "YES", submit as Exhibit V the name of each such licensee and the licensee's relation to the Filer.* See Exhibit V attached herewith ☒ YES ☐ NO

If Filer is an individual (sole proprietorship) or partnership, answer the following and Item 11: N/A

9(a) Full Legal Name and Residential Address (Number, Street, State and ZIP Code) of Individual or Partners:

(b) Is Individual or each member of a partnership a citizen of the United States? ☐ YES ☐ NO

(c) Is Individual or any member of a partnership a representative of an alien or of a foreign government? ☐ YES ☐ NO

If Filer is a corporation, answer the following and Item 11:

10(a) Attach as Exhibit VI the names, addresses, and citizenship of those stockholders owning of record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries.

See Exhibit VI attached herewith

(b) List below, or attach as Exhibit VII the names and addresses of the officers and directors of the Filer.

See Exhibit VII attached herewith

(c) Is the Filer directly or indirectly controlled by any other corporation? ☐ YES ☒ NO

*If "YES", attach as Exhibit VIII a statement (including organizational diagrams where appropriate) which fully and completely identifies the nature and extent of control. Include the following: (1) the address and primary business of the controlling corporation and any intermediate subsidiaries; (2) the names, addresses, and citizenship of those stockholders holding 10 percent or more of the controlling corporation's voting stock; (3) the approximate percentage of total voting stock held by each such stockholder; and (4) the names and addresses of the president and directors of the controlling corporation.*

(d) Is any officer or director of the Filer an alien? ☐ YES ☒ NO

(e) Is more than one-fifth of the capital stock of the Filer owned of record or voted by aliens or their representatives, or by a foreign government or representative(s) thereof, or by a corporation organized under the laws of a foreign country? ☐ YES ☒ NO

(f) Is the Filer directly or indirectly controlled: (1) by any other corporation of which any officer or more than one-fourth of the directors are aliens, or (2) by any foreign corporation or corporation of which more than one-fourth of the capital stock is owned or voted by aliens or their representatives, or by a foreign government or representatives thereof. ☐ YES ☒ NO

(g) If any answer to questions (d), (e) or (f) is "YES", attach as Exhibit IX a statement identifying the aliens or foreign entities, their nationality, their relationship to the Filer, and the percentage of stock they own or vote.

## 11. CERTIFICATION

This report constitutes a material part of any application which cross-references it, and all statements made in the attached exhibits are a material part thereof. The ownership information contained in this report does not constitute an application for, or Commission approval of, any transfer of control or assignment of radio facilities. The undersigned, individually and for the Filer, hereby certifies that the statements made herein are true, complete and correct to the best of the Filer's knowledge and belief, and are made in good faith. The undersigned, individually and for the Filer, certifies that neither the applicant nor any other party to the application is subject to a denial of Federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance.

**WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001), AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION PERMIT (U.S. CODE, TITLE 47, SECTION 312(A)(1)), AND/OR FORFEITURE (U.S. CODE, TITLE 47, SECTION 503).**

| Filer (must correspond with that shown in Item 1) | Typed or Printed Name | |
|---|---|---|
| CAI Wireless Systems, Inc. | Gerald Stevens-Kittner | |
| Signature: G Stevens-Kittner | Title: Senior Vice President | Date: 7/2/97 |

NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT OF 1974 AND THE PAPERWORK REDUCTION ACT OF 1995

The solicitation of personal information requested in this form is to determine if you are qualified to become or remain a licensee in common carrier or satellite radio service pursuant to the Communications Act of 1934, as amended. No authorization can be granted unless all information requested is provided. Your response is required to obtain the requested authorization or retain an authorization.

Public reporting burden for this collection of information is estimated to average 2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate, or any other aspect of this collection of information, including suggestions for reducing the burden to Federal Communications Commission, Records Management Branch, Washington, DC 20554, Paperwork Reduction Project (3060-0105), or via the Internet to dconway@fcc.gov. DO NOT SEND COMPLETED FORMS TO THIS ADDRESS. Individuals are not required to respond to a collection of information unless it displays a currently valid OMB control number.

# EXHIBIT V

CAI Wireless Systems, Inc. either owns (in some cases, subject to prior FCC approval), owns a majority interest in a company that owns (in some cases, subject to prior FCC approval), has an option to purchase, and/or has a channel capacity lease interest in the following authorized ITFS and MMDS channels:[1]

**Washington, District of Columbia**

BTA Authorization

ITFS A1-A4 - WDT-881

ITFS C4 - WLX-235

ITFS C1-C4 - WHB-652

ITFS D1-D4 - WHG-442

MMDS F1-F4 - WHT659

ITFS G1-G4 - WHR-461

MDS 1 - WOI93

MDS H1 - WNEY445

MDS H2 - WNEK840

MDS H3 - WHJ920

**Hartford, Connecticut**

BTA Authorization

ITFS A3-A4 - WLX-531

ITFS B1-B4 - WLX-569

ITFS C1-C4 - WLX-572

ITFS D1-D2 - WNC-321

ITFS D3-D4 - WLX-831

MMDS F1-F4 - WHT672

MDS H2 - WNTG352

MDS 2A - KNSC257

[1] The market designations are for grouping purposes only and are not necessarily indicative of the community of licenses.

New Haven, Connecticut

BTA Authorization

MDS H2 - KNSC662

MDS H3 - KNSC663

MDS 2A - KNSC263

New London, Connecticut

BTA Authorization

MDS 2A - KNSC264

Dover, Delaware

BTA Authorization

MMDS F1-F3 - KNSC253

Portland, Maine

MDS H1 - WNTH587

MDS H3 - WNTH318

Baltimore, Maryland

BTA Authorization

ITFS A1-A4 - WNC-708

ITFS B1-B4 - WHR-807

ITFS C1-C4 - WLX-789

ITFS D1-D4 - WHR-917

MMDS E1-E4 - WHT630

MMDS F1-F4 - WHT631

ITFS G1-G2 - WLX-790

ITFS G3-G4 - WLX-787

MDS 2 - WHT571

MDS H1 - WNEK883

MDS H2 - KNSC517

MDS H3 - KNSC518

Hyannis, Massachusetts

BTA Authorization

MDS 2A - KNSC451

Boston, Massachusetts

BTA Authorization

ITFS A1-A2 - KQT-47

ITFS B1-B4 - KYP-23

ITFS C1 - WHR-758

ITFS C2-C4 - WBB-421

ITFS D1-D4 - KVQ-24

MMDS E1-E4 - WMI863, WMI863A (Two-way)

ITFS F1-F4 - KQT-48; KMA-57

ITFS G1-G4 - WAL-20; KLC-85

MDS 1 - WSL33, WSL33A (Two-way)

MDS H1 - WNTB229

MDS H2 - WHJ868

MDS H3 - WNEK864

Pittsfield, Massachusetts

BTA Authorization

MDS 2A - KNSC551

Springfield, Massachusetts

BTA Authorization

MMDS E1-E4 - WLK225

MMDS F1-F4 - WLK226

MDS2A - KNSC449

Worcester, Massachusetts

BTA Authorization

MMDS E1-E4 - WMH752

MMDS F1-F4 - WMI893

MDS 2A - KNSC452

Manchester, New Hampshire

BTA Authorization

MDS 2A - KNSC450

Albany, New York

BTA Authorization

ITFS A1-A4 - WHR-729

ITFS B1-B4 - WHR-930

ITFS C1-C4 - WHR-586

ITFS D1-D4 - WHR-885

MMDS E1-E4 - WHT750

MMDS F1-F4 - WHT751

ITFS G1-G4 - WHR-886

MDS 2 - WHI966

MDS H1 - WNTA920

MDS H2 - WNTA389

MDS H3 - WNEZ721

Northern New Jersey

ITFS D1-D4 - WHR-872

ITFS G1-G4 - WHR-821, WHR-822

MDS 1 - WCU573

Buffalo, New York

BTA Authorization

ITFS A1-A2 - WLX-584

ITFS A3-A4 - WNC-353

ITFS B1-B4 - WNC-435

ITFS C1-C4 - WNC-202

ITFS D1-D4 - WNC-338

MMDS E1-E4 - WHT665

MMDS F1-F4 -KNSC579

ITFS G1 - WNC-239

ITFS G2-G4 - WLX-770

MDS 1 - WMY428

MDS 2 - WMY429

MDS H2 - WNEK802

Glen Falls, New York

BTA Authorization

MMDS F1-F4 - KNSC255

Ithaca, New York

BTA Authorization

MDS 2A - KNSC259

Long Island, New York

ITFS A1-A4 - KNZ-67

ITFS B1-B4 - KNZ-68

ITFS D1-D2 - KNU-43

ITFS E1-E4 - KNZ-65

ITFS G1-G4 - WHR-845

MDS 1 - WJM64

MDS H3 - WCX57

New York, New York

BTA Authorization

ITFS B1-B4 - KNZ-69; KZE-20; WHR-691

ITFS C1 - WGM-95

ITFS C2-C3 - WHR-829

ITFS C4 - WHR-828

ITFS D1-D4 - WHR-520

MMDS E1-E4 - WLR500

ITFS F1-F4 - KVS-31; KNZ-70

ITFS G1-G4 - KNZ-71

MDS 1 - WQQ79

MDS 2 - WLK227

MDS H1 - WNEL497

MDS H2 - WHJ897

MDS H3 - WNTQ214

Poughkeepsie, New York

BTA Authorization

MDS 1 - KNSC660

MDS 2A - KNSC270

Utica, New York

BTA Authorization

MDS 1 - KNSC661

MDS 2A - KNSC515

Rochester, New York

ITFS A1-A4 - WLX-613

ITFS B1-B4 - WLX-536

ITFS C1-C4 - WLX-753

ITFS D1-D4 - WLX-870

MMDS F1-F4 - WHT688

ITFS G1-G4 - WLX-543

MDS H1 - WNTE275

MDS H2 - WNTG719

MDS H3 - WNTD891

Syracuse, New York

BTA Authorization

ITFS A1-A4 - WNC-472

ITFS C1-C4 - WLX-929

ITFS D1-D4 - WLX-682

ITFS G1-G4 - WLX-840

MDS 1 - WHC998

MDS 2A - KNSC283

Charlotte, North Carolina

BTA Authorization

ITFS A1-A4 - WHR-535

MDS 1 - WGW715

MDS 2A - KNSC586

Greensboro, North Carolina

MDS 1 - WFY738

Winston-Salem, North Carolina

MDS 1 - WMH664

MDS 2A - WMH668

Philadelphia, Pennsylvania

ITFS A1-A2 - WAU-29

ITFS A3-A4 - WLX-824

ITFS B1-B2 - WLX-578

ITFS B3-B4 - WLX-566

ITFS C1-C2 - WLX-822

ITFS C3-C4 - WLX-825

ITFS D1-D4 - WLX-823

MMDS E1-E4 - WHT643

MMDS F1-F4 - WHT644

ITFS G1-G4 - WHR-527

MDS H1 - WNEY590

MDS H2 - WNET336

MDS 1 - WPE97

Pittsburgh, Pennsylvania

BTA Authorization

ITFS B1-B4 - WHR-525

ITFS C1-C4 - WNC-484

MMDS E1-E4 - WHT645

MMDS F1-F4 - WHT646

ITFS G1-G4 - WLX-537

MDS 1 - WPF48

MDS H1 - KNSC453

MDS H3 - WNTI200

Providence, Rhode Island

BTA Authorization

ITFS A1-A4 - WNC-521

ITFS B1-B4 - WLX-690

ITFS D1-D4 - WHR-971

MMDS E1-E4 - WLW859

MMDS F1-F4 - WLK212

MDS 1 - KNV65

MDS H1 - WNTI210

MDS H2 - KNSC552

MDS H3 - WNTI314

Norfolk/Virginia Beach, Virginia

ITFS A1-A2 - WHF-350

ITFS A3-A4 - WHR-941

ITFS B1-B2 - WNC-681

ITFS B3-B4 - WLX-256

ITFS C1-C4 - WLX-255

ITFS D1-D4 - WHR-526

MMDS E1-E4 - WHT729

MMDS F1-F4 - WHT730

ITFS G1-G4 - WHR-940

MDS 1 - KNSC266

MDS H1 - WNTB576

MDS H2 - WNTB962

MDS H3 - WNTB262

CAI Wireless Systems, Inc. has a majority interest in CS Wireless Systems, Inc. CS Wireless Systems, Inc. either owns (in some cases, subject to prior FCC approval), has an option to purchase, and/or has a channel capacity lease interest in the following authorized ITFS and MMDS channels,

Bakersfield, California

BTA Authorization

ITFS A2-A4 - WHR-797

ITFS B1-B4 - WLX-345

ITFS C1-C4 - WLX-372

ITFS D1-D4 - WLX-550

MMDS E1-E4 - WHT584

MMDS F1-F4 - WHT585

ITFS G1-G4 - WLX-381

MDS 1 - WMH877

MDS 2A - WMI942

MDS H1-H2 - WNTF473

MDS H3 - WNTF312

Stockton/Modesto, California

BTA Authorization

ITFS A1-A4 - WGV-750

ITFS B1 - WHR-656

ITFS C2-C4 - WHR-848

ITFS D1-D4 - WGV-751

MMDS E1-E4 - WGW513

MMDS F1-F4 - WHT786

ITFS G1-G4 - WHR-474

MDS H1 - WNTJ742

MDS H2 - WNTJ715

MDS H3 - WNTJ756

Battle Creek, Michigan

MMDS F1-F4 - WLK-260

Grand Rapids/Moline, Michigan

ITFS A1-A4 - WLK-981

ITFS B1-B4 - WNC-290

ITFS C1-C4 - WNC-483

ITFS D1-D4 - WNC-359

Minneapolis, Minnesota

ITFS A1-A4 - WLX-299

ITFS B1-B4 - WHR-497

ITFS C1-C4 - WHR-636

MMDS E1-E4 - WHT-677

MMDS F1-F4 - WHT-678

MDS H1 - WNEY683

MDS H2 - WNEZ819

MDS H3 - WNTA934

MDS 1 - WPE99

MDS 2 - WCU552

Maysville, Missouri

ITFS A1-A4 - WLX-626

ITFS B1-B4 - WLX-842

ITFS C1-C4 - WLX-821

ITFS D1-D4 - WLX-868

ITFS G1-G4 - WLX-785

MDS 1 - WMX936

MDS H1 - WMX926

MDS H2 - WMX928

MDS H3 - WMK927

Sweet Springs, Missouri

ITFS A1-A4 - WLX-669

ITFS B1-B4 - WLX-606

ITFS C1-C4 - WLX-693

ITFS D1-D4 - WLX-658

ITFS G1-G4 - WLX-620

Napolean, Indiana

ITFS A1-A4 - WNC-277

ITFS B1-B4 - WNC-276

ITFS C1-C4 - WNC-278

ITFS D1-D4 - WNC-284

ITFS G1-G4 - WNC-283

Cleveland, Ohio

ITFS A1 - KNZ-60

ITFS A2-A4 - WAJ-20

ITFS B1-B4 - WAJ-20

ITFS C1-C4 - WAJ-20

ITFS D1-D4 - WNC-508

MMDS E1-E4 - WLK310

MMDS F1-F4 - WLK306

MDS 1 - WQQ66

MDS H2 - WHJ951

Louisville, Kentucky

BTA Authorization

MDS 2A - KNSC448

Rochester, Minnesota

ITFS A1-A4 - WLX-455

ITFS C1-C4 - WLX-469

ITFS D1-D4 - WLX-511

MDS H1-H3 - WNTJ817

Dayton, Ohio

ITFS A1-A4 - WHR-537

ITFS B1-B4 - WLX-573

ITFS C1-C4 - WHR-939

ITFS D1-D4 - WLX-568

MMDS E1-E4 - WHT713

MMDS F1-F4 - WHT714

ITFS G1-G4 - WLX-375

MDS 1 - WMX909

MDS H1 - WNTB420

MDS H2 - WNEZ725

MDS H3 - WNTB689

Dallas, Texas

ITFS A1-A2 - WNC-582

ITFS C1-C4 - KWU-30

ITFS D1-D4 - WLX-843

ITFS F1-F4 - KWU-30

ITFS G1-G3 - WHR-830

ITFS G4 - WHR-831

MDS H2 - WHJ873

MDS H3 - WNTD967

MDS 1 - WQQ65

MDS 2 - WHT564

Fort Worth, Texas

ITFS A1-A4 - WHR-506

ITFS B1-B4 - WLX-649

ITFS C1-C4 - WHR-883

ITFS E1-E4 - KWU-29

MMDS F1-F4 - WHT789

ITFS G1-G4 - WNC-823

MDS 1 - WJM75

MDS 2 - WFY900

San Antonio, Texas

ITFS A1-A4 - WLX-328

ITFS B1-B4 - WHR-920

ITFS C1-C4 - WLX-874

ITFS D1-D4 - WLX-248

MMDS E1-E4 - WHT693

MMDS F1-F4 - WHT694

ITFS G1-G4 - WLX-704

MDS H1 - WNTA693

MDS H2 - WNEY637

MDS H3 - WNEY637

MDS 2 - WFY852

Salt Lake City, Utah

ITFS A1-A4 - WLX-487

ITFS D1-D4 - WLX-667

MMDS E1-E4 - WLW775

MMDS F1-F4 - WHT692

MDS H1 - WNTB421

MDS H2 - WNTB690

MDS H3 - WNTB688

MDS 1 - KEW74

Adairsville, Georgia

ITFS A1-A4 - WLX-797

ITFS C1-C4 - WLX-766

ITFS D1-D4 - WLX-701

ITFS G1-G4 - WLX-765

Relay Stations

ITFS A1-A4 - WNC-414

ITFS C1-C4 - WNC-688

ITFS D1-D4 - WNC-665

ITFS G1-G4 - WNC-666

Powers Crossroads, Georgia

ITFS A1-A4 - WNC-390

ITFS B1-B4 - WLX-861

ITFS C1-C4 - WNC-389

ITFS D1-D4 - WLX-866

ITFS G1-G4 - WLX-795

Rutledge, Georgia

ITFS A1-A4 - WLX-784

ITFS B1-B4 - WLX-788

ITFS D1-D4 - WLX-856

ITFS G1-G4 - WLX-867

Effingham, Kansas

ITFS A1-A4 - WLX-473

ITFS B1-B4 - WLX-329

ITFS C1-C4 - WLX-339

IFTS D1-D4 - WLX-340

ITFS G1-G4 - WLX-360

MDS 1 - WMH876

Wellsville, Kansas

ITFS A1-A4 - WLX-330

ITFS B1-B4 - WLX-331

ITFS C1-C4 - WLX-327

ITFS D1-D4 - WLX-335

ITFS G1-G4 - WNC-431

# EXHIBIT VI

No stockholders of CAI Wireless Systems, Inc. ("CAI") own and/or vote 10% or more of CAI's stock.

# EXHIBIT VII

The names and addresses of the officers and directors of CAI Wireless Systems, Inc. are as follows:

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George M. Williams
Chief Administrative Officer and
Corporate Analyst, Secretary and
Treasurer; Director
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# Technical Description of the CAI Satellite System and the CAI Satellite

## 1.0 Introduction.

The CAI V-band system will employ a single geostationary communication satellite located at 93°WL, 95°WL or 103°WL, and will utilize 40.5-41.5 GHz (space-to-Earth) and 49.2-50.2 GHz (Earth-to-space). The CAI system will provide domestic delivery of two-way video and high bandwidth data services to business and residential subscribers in the U.S.

## 2.0 Satellite Description.

CAI will use a spacecraft model employing a three-axis body-stabilized bus that is currently in production, *e.g.*, the Loral 1300, Hughes 601 HP or the Martin A2100. Each of these spacecraft is capable of supporting a payload necessary to support the service proposed in this application. Because these satellites are currently in production they can be deployed by several launch vehicles including the Ariane 4, Atlas 2, the Long March 2E or the Proton. The launch vehicle chosen will be capable of deploying the CAI satellite into a geostationary transfer orbit. Final deployment into geosynchronous orbit will be accomplished by an on-board liquid propulsion system.

### 2.1 Spacecraft Bus.

The following describes the subsystems comprising the spacecraft bus.

#### 2.1.1 Structure.

The basic structure of the satellite will be dependent upon CAI's choice of manufacturer and will be either a rectangle (Hughes and Martin) or a cylinder (Loral). Each structure is designed with panels and/or shelves utilized for mounting of the various spacecraft

systems, including supports for liquid propellant tanks. The structure is also a critical element in maintaining thermal control during spacecraft lifetime. The total satellite separation mass is estimated to be approximately 3500 kgs including propellant for a twelve year lifetime.

### 2.1.2 Thermal Control System.

Thermal control is achieved through the use of heaters, blankets, optical solar reflecting surfaces, heat pipes, heat sinks and radiators. In the vacuum of space, cooling and heating are restricted to the technologies listed and traditional thermal techniques such as convection are not available. In the end, radiation to outer space after conduction to outer surfaces is the primary method ridding the spacecraft's enclosure of the excess heat due to the inefficiencies of payload amplifiers, unit heating and battery activity. The operation of heaters and other power consuming units prove to be critical elements in the delicate heat balance operations controlled by the spacecraft's on-board computer.

### 2.1.3 Propulsion System.

The CAI satellite propulsion system will include all propellants, components, and assemblies associated with storing, conditioning, routing, controlling, and expelling propellant, required to change the spacecraft's attitude and its angular or linear velocity to meet the mission requirements. The propulsion subsystem operates from the moment of separation from the launch vehicle, through and including the final orbit raising maneuver.

The propulsion system also maintains the satellite's position in orbit for the lifetime of the program. This system will maintain the satellite's E-W and N-S drift so as to remain within +/- 0.05° of the satellite's intended orbital location. With use of the propulsion system described above in combination with remote sensing systems designed to allow accurate

measurement of the satellite's position and attitude in space, a satellite lifetime of at least twelve years can be achieved.

### 2.1.4 Attitude Control System.

The attitude control system (ACS) will be used to perform multiple tasks intended to maintain the spacecraft's attitude control during its launch and throughout its lifetime. The ACS will provide station acquisition and on-station attitude control. The ACS will vary widely based on which manufacturer is finally selected to build the CAI satellite, however the ACS design will incorporate sun and earth sensors, momentum wheels, and thrusters to perform its required functions.

### 2.1.5 Electric Power System.

The electric power system is expected to provide electric power to all satellite subsystems during all phases of the satellite's mission. Power is supplied by a gallium arsenide or silicon solar array (the decision between the two options to be made during the vendor selection process) which would generate electrical power from sunlight, and a nickel-hydrogen battery which would be used for energy storage. During times of full or partial eclipse, the battery would be available to run all satellite systems at full power for the lifetime of the satellite. In addition to the arrays and batteries, the power system consists of regulating and distribution devices which monitor and control the satellite's internal power system.

The satellite's power requirements are approximately as follows:

Payload requirement - approximately 6000 watts

Bus requirement - approximately 500 watts

Batteries capable of full eclipse operation for lifetime

Batteries to operate with maximum 80% DOD.

For an estimated 12-year lifetime, the total power required is approximately 7500 watts. This includes the peak power needed for summer solstice, as well as the expected degradation over the satellite's proposed 12-year useful lifetime.

### 2.1.6 Command, Telemetry and Ranging System.

The Command subsystem receives, demodulates, decrypts and distributes command messages originated on the earth or internally from the attitude control system. The Telemetry subsystem collects, formats, modulates and transmits information related to spacecraft performance and configuration to the earth. The ranging subsystem modulates ranging tones received by the command receivers on to the telemetry system permitting accurate determination of the satellite's range to ground controllers. The TT&C system forms the basic link between the satellite's operators and the satellite, allowing control of its various functions from the earth, and monitoring its vital functions in space. The telemetry system will be operated by the vendor utilizing the V-Band as noted in the section on frequencies to be employed.

## 3.0 Communications Payload.

The CAI payload will consist of a V-Band communication system including redundant V-Band receivers and downconverters, traveling wave tube amplifiers plus spare amplifiers, input and output multiplexers and transmit and receive antennas. A total of forty-eight V Band transponders will be employed, each of which is to be 40 MHz in bandwidth. These transponders will be coupled with a series of spacecraft antennas designed to provide multi-area coverage of the continental United States.

### 3.1 Antenna Coverage.

CAI intends to provide coverage of the continental United States from an available position in the CONUS orbital arc. The coverage outlined for CONUS will consist of five separate service areas corresponding with the five separate beams shown in Figure 1. Additional coverages may also be employed for Alaska and Hawaii although these states might not be covered initially. The ground terminals in these areas will operate at elevation angles above 30°. The coverage areas have been determined by analysis of rain conditions in the various regions. CAI has attempted to obtain the highest signal availability coupled with the smallest ground terminal antenna size.

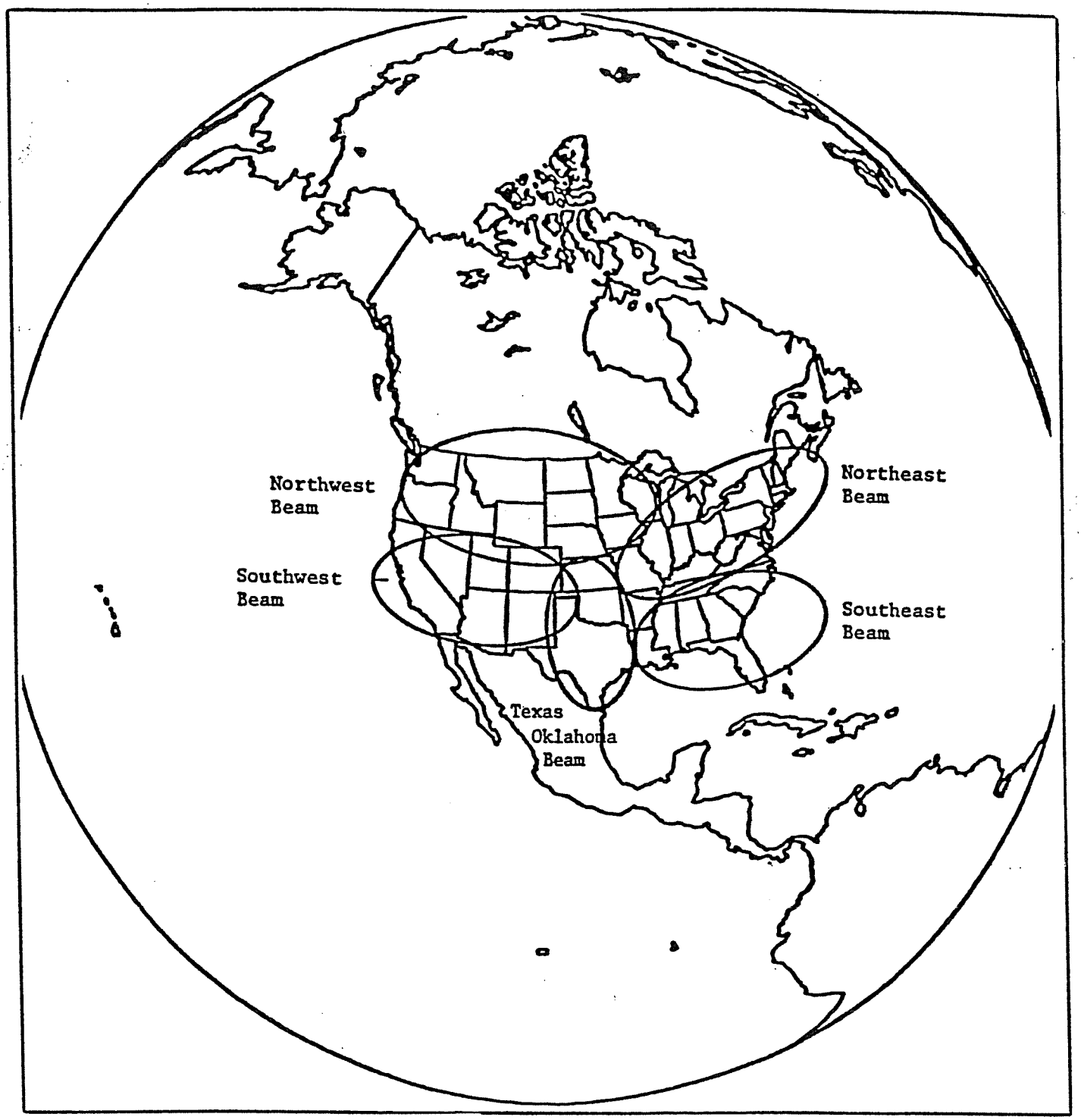


FIGURE 1 - CAI Satellite Coverages from 93 WL

### 3.1.1 Rain Rates and Beam Sizes.

As demonstrated in Figure 1, CONUS coverage is achieved by five separate beams. These beams are designed to provide increased EIRP in high rain rate areas (*see* Figure 2, the CCIR rain climatic zones map of North America). For example, Florida and the gulf coast and the adjoining states in the Southwest Beam (1) lie in either an M or N rain zone, varying from 22-35mm/hour (for 0.1% of the time). For the Northwest Beam (5) the Great Lakes westward to the Pacific, rain rate zones vary from B to D to E rain zones. For the Southeast Beam (2), the South-Atlantic and westward to the Mississippi, rain conditions vary between the 12-22mm/hour rates. For the Texas/Oklahoma Beam (3) coverage varies from 10-22mm/hour. For the Southwest Beam (4), rain conditions vary between E and B zones, 5-10mm/hour. In each case, coverages have been sized in accordance with expected rain rates, deriving from the relationship between beam size and antenna isotropic gain, where the smaller the covered area, the greater the antenna gain.

### 3.1.2 Coverage Areas.

The coverage areas have been designed in the form of an ellipse. However, the specific shapes of the coverage areas are likely to change during the antenna system design phase. Once the design phase has been completed, it may be necessary to increase the number of beams, which could result in fewer transponders available for each beam, or transponders could be added to make up for any required additional coverage(s).

In the preliminary design provided herein, Beam 1 covers the state of Florida and the high rain rate areas of the gulf coast, Georgia, Alabama, Mississippi, North and South Carolina and Tennessee. Beam 2 is intended to cover the states of Virginia, West

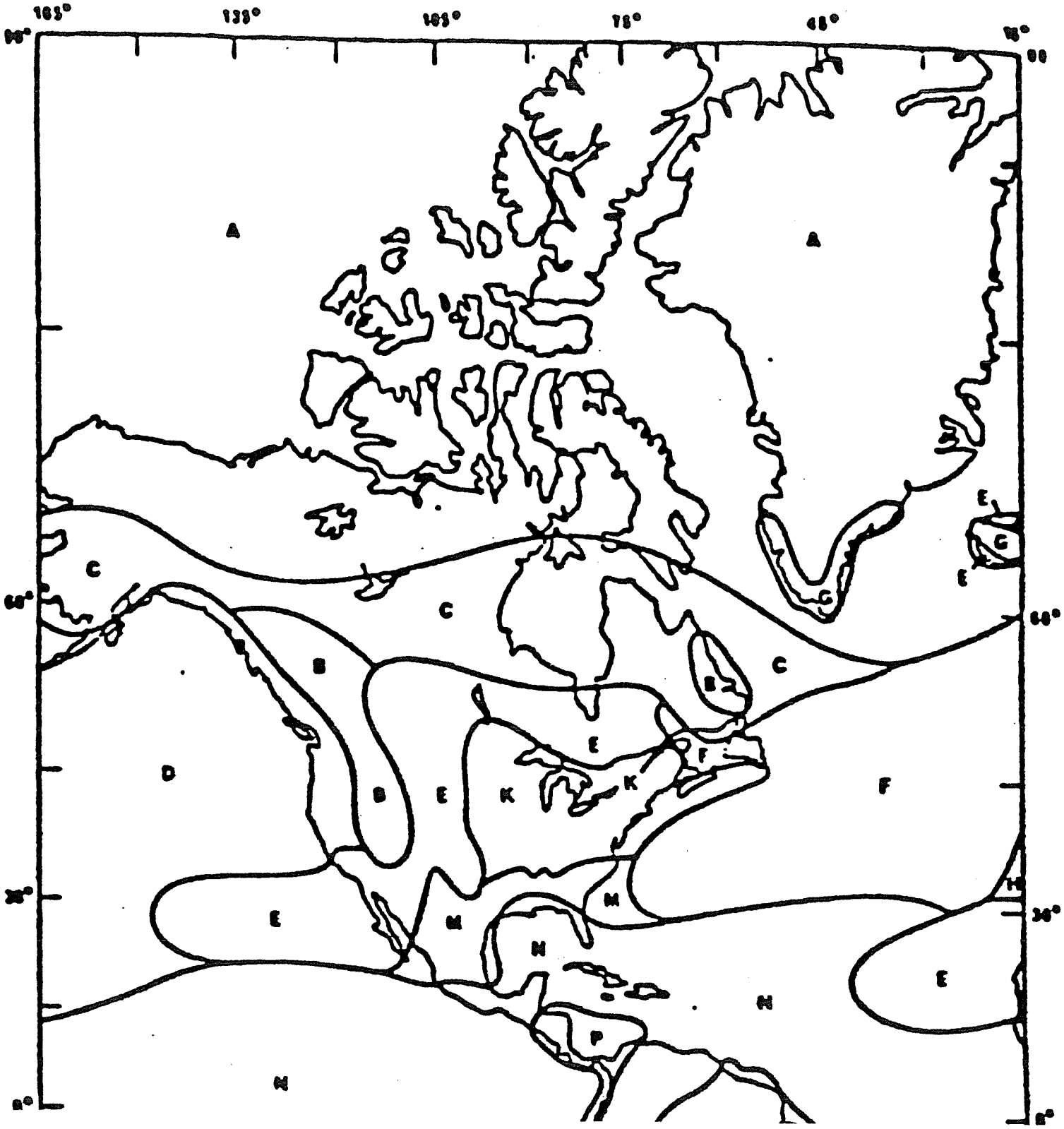


FIGURE 2 - Rain Climatic Zones for Region 2

Virginia, Kentucky, Missouri and Kansas, Michigan, Ohio, Indiana, Illinois and the Mid-Atlantic and New England states. Beam 3 covers Texas, Kansas and Oklahoma. Beam 4 covers the Southwestern states including Colorado and Utah. Beam 5 covers the Pacific Northwest, Montana, Idaho, North and South Dakota, Nebraska, Wyoming, Minnesota and Wisconsin. All CONUS coverage areas provide look angles above thirty degrees.

### 3.2 Transponders.

The current band plan described herein yields forty-eight 40 MHz transponders. The design assigns ten transponders to three of the beams and nine transponder to the two remaining beams. The actual number of transponders assigned to each beam will be driven by marketplace considerations (*e.g.*, projected demand in the various regions) and may change during the design phase. In terms of the number of video channels available and assuming that typical digital compression techniques will be available, the allocation of transponders would result in approximately 100 TV channels per beam for those beams with ten channels, and ninety channels for those beams with only nine transponders. If additional transponders are necessary, the geographic separation of beams 1 and 5 may allow frequency sharing of those bands and the possibility of adding at least ten more transponders.

The satellite will utilize transponders of 100 watts. This yields a total payload power less than 6 kilowatts, which is well within the capability of any of today's principal U.S. satellite manufacturers.

### 3.3 Frequency Plan.

The frequency plan is based on using 2000 MHz of the V-Band frequencies. For the uplink, CAI proposes to use the bands: 49.2 - 50.2 GHz - Total 1000 MHz. For the downlink, CAI proposes to use the bands: 40.5 - 41.5 GHz - Total 1000 MHz. The complete frequency plan for the CAI satellite is shown in Table 1.

**Table 1 - CAI Frequency Plan**

| Transmission Channel | Freq Up/Dn (MHz) | Pol | Transmission Channel | Freq Up/Dn (MHz) | Pol |
|---|---|---|---|---|---|
| 1 | 49205/40505 | V/H | 25 | 49225/40525 | H/V |
| 2 | 49245/40545 | V/H | 26 | 49265/40565 | H/V |
| 3 | 49285/40585 | V/H | 27 | 49305/40605 | H/V |
| 4 | 49325/40625 | V/H | 28 | 49345/40645 | H/V |
| 5 | 49365/40665 | V/H | 19 | 49385/40685 | H/V |
| 6 | 49405/40705 | V/H | 30 | 49425/40725 | H/V |
| 7 | 49445/40745 | V/H | 31 | 49465/40765 | H/V |
| 8 | 49485/40785 | V/H | 32 | 49505/40805 | H/V |
| 9 | 49525/40825 | V/H | 33 | 49545/40845 | H/V |
| 10 | 49565/40865 | V/H | 34 | 49585/40885 | H/V |
| 11 | 49605/40905 | V/H | 35 | 49625/40925 | H/V |
| 12 | 49645/40945 | V/H | 36 | 49665/40965 | H/V |
| 13 | 49685/40985 | V/H | 37 | 49705/41005 | H/V |
| 14 | 49725/41025 | V/H | 38 | 49745/41045 | H/V |
| 15 | 49765/41065 | V/H | 39 | 49785/41085 | H/V |
| 16 | 49805/41105 | V/H | 40 | 49825/41125 | H/V |
| 17 | 49845/41145 | V/H | 41 | 49865/41165 | H/V |
| 18 | 49885/41185 | V/H | 42 | 49905/41205 | H/V |
| 19 | 49925/41225 | V/H | 43 | 49445/41245 | H/V |

**Table 1 - CAI Frequency Plan**

| Transmission Channel | Freq Up/Dn (MHz) | Pol | Transmission Channel | Freq Up/Dn (MHz) | Pol |
|---|---|---|---|---|---|
| 20 | 49965/41265 | V/H | 44 | 49985/41285 | H/V |
| 21 | 50005/41305 | V/H | 45 | 50025/41325 | H/V |
| 22 | 50045/41345 | V/H | 46 | 50065/41365 | H/V |
| 23 | 50085/41385 | V/H | 47 | 50105/41405 | H/V |
| 24 | 50125/41425 | V/H | 48 | 50145/41445 | H/V |

The exact assignment of frequencies to beams and transponders will emerge during the satellite's preliminary design effort.

### 3.4 TT&C Frequency Plan.

Sufficient bandwidth is located in the V-Band spectrum (5 MHz at lower end and 30 MHz at upper end) for use to provide for TT&C operations during mission life, however, during transfer orbit when the omni antenna is in use, FSS Ku-Band frequencies would be employed. The frequency plan for the TT&C system for CAI is shown in Table 2.

**Table 2 - CAI TT&C Frequency Assignments**

| Usage | Freq Up/Dn (MHz) | Pol |
|---|---|---|
| Transfer orbit | 14000.3/11700.3 | H/V |
| On orbit | 50167/41467 | H/V |

### 3.5 Spatial Frequency Reuse.

Currently, CAI has no plans for spatial frequency reuse because the number of transponders identified in Table 1 appears to be sufficient to permit full operation of the system. However, to the extent required by the FCC's Rules to be adopted in any forthcoming Order concerning 38 GHz Satellite Rules, CAI will consider necessary adjustments to its proposal. For example, as discussed above spacial diversity may be employed to add transponders. No interference assessment has been included to address frequency reuse issues. In the event that it is necessary, CAI stands ready to provide any additional interference analysis.

### 3.6 Link Analysis.

To the extent that CAI will be engaged in the delivery of digitally compressed NTSC television to very small ground terminals, it provides the following Link Analysis. Depending on the rain zone where the terminal is located, dish size could vary between 0.6-meters and 1.2-meters (*see* the availability analysis below in Section 3.7 for exact details). Analyses for each beam shown in the accompanying link budgets using the spacecraft parameters set forth below.

#### 3.6.1 Spacecraft Payload Parameters.

The Amplifiers employed by CAI will be 100 watts. The conversion factor for these amplifiers has been assumed to be 2dB resulting in power available to the various antennas of 18 dBW. This assumption is necessary because the actual layout of the spacecraft will not be determined until the design phase is completed. At that time, CAI will determine the precise conversion factor. The gains of the individual downlink beams are conservatively predicted as shown in Table 3 together with predicted EIRP of each beam.

Uplink performance is, inter alia, a function of beam coverage. Although not detailed in this application, each of the individual downlink beams will be capable of providing certain narrowband uplink services. In addition, there is a principle uplink beam covering CONUS and three independent US Spot Beams (1° x 1°, with G/T = + 18dB/°K). The CONUS uplink beam is for future use. The US Spot Beams are designed to allow program origination, program assembly, compression (encoders) and multiplex equipment to be located

**Table 3 - Beam EIRP's**

| Beam Name | Power (DBW) | Antenna Gain (DBI) | EIRP (DBI) |
|---|---|---|---|
| Southeast | 18 | 36.6 | 54.6 |
| Northeast | 18 | 37.1 | 55.1 |
| Texas/Oklahoma | 18 | 38.5 | 56.5 |
| Southwest | 18 | 36.9 | 54.9 |
| Northwest | 18 | 35.37 | 53.4 |

at two or three strategic cities. The spot beams are moveable allowing uplinking to occur from different locations.

### 3.7 Link Performance.

The expected performance of the CAI system is described in the following link analyses for each of the spacecraft's beams. In most cases where a beam covers more than one rain climatic zone, a link analysis has been performed for each zone. To maintain availability above 99.0%, earth station size may have been increased to improve link performance in the same beam coverage.

All main hub uplink beams will use uplink power control systems (ULPC) in which a downlink carrier (beacon) located in the 40 GHz frequency band is monitored by the earth station and uplink power at 50 GHz is adjusted to compensate for losses incurred due to rain or other unfavorable meteorological conditions. In this way the system compensates for uplink power which would be lost without such a feedback system. In addition, the satellite will be equipped with a limiter system so that the amplifiers cannot be overdriven. This allows uplink power to be continuously set for a higher power, thus preparing in advance, for transmission losses due to rain degradation. As can be seen in the accompanying tables, the uplink availability has therefore been set to 99.9%. In practice this is accomplished by setting the uplink rain zone to an A zone which is typically the weather of a desert like area with a lower probability of rain. It is acknowledged that at certain times insufficient uplink EIRP may be available to overcome some infrequent rainstorms of a particularly heavy nature. If after further study this looks realistic, a larger uplink antenna will be used.

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | SouthEast | | Transponder Max EIRP | 57.6 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 26.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 80.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 1.2 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 29.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 207.77 | deg |
| Elevation | 38.78 | deg | Elevation | 56.34 | deg |
| Rain Zone | A | | Rain Zone | N | |

| **Uplink Analysis** | **Clear sky** | **Rain Up** | **Rain Down** | **Units** |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 54.6 | 54.6 | 54.6 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.0 | -216.0 | -216.0 | dB |
| Rain Attenuation | 0.0 | 0.0 | -7.2 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 29.6 | 29.6 | 25.1 | dB/K |
| Downlink C/N | 20.7 | 19.7 | 8.1 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 20.7 | 19.7 | 8.1 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 14.9 | 11.7 | 7.5 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 8.4 | 5.2 | 1.0 | dB |

| **Link Summary** | | | | | | |
|---|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | | |
| D/L EIRP Den | -18.0 | dBW/Hz | Transpopnder B/W | 100.00% | | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% | |

**Table 4A**

SouthEast Beam, 1.2 (m) Remote Terminal Rain Zone N

## Satellite Link Analysis

| | | | | | |
|---|---|---|---|---|---|
| **Satellite Parameters** | | | | | |
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | SouthEast | | Transponder Max EIRP | 57.6 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 34.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 84.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.9 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 27.1 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 195.81 | deg |
| Elevation | 38.78 | deg | Elevation | 49.33 | deg |
| Rain Zone | A | | Rain Zone | M | |

| **Uplink Analysis** | **Clear sky** | **Rain Up** | **Rain Down** | **Units** |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 54.6 | 54.6 | 54.6 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.1 | -216.1 | -216.1 | dB |
| Rain Attenuation | 0.0 | 0.0 | -5.6 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 27.1 | 27.1 | 22.9 | dB/K |
| Downlink C/N | 18.1 | 17.1 | 7.4 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 18.1 | 17.1 | 7.4 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 14.0 | 11.2 | 6.8 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 7.5 | 4.7 | 0.3 | dB |

| **Link Summary** | | | | | | |
|---|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | | |
| D/L EIRP Den | -18.0 | dBW/Hz | Transpopnder B/W | 100.00% | | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% | |

**Table 4B**

SouthEast Beam, 0.9 (m) Remote Terminal Rain Zone M

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | NorthEast | | Transponder Max EIRP | 58.1 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 41.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 74.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.6 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 23.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 207.69 | deg |
| Elevation | 38.78 | deg | Elevation | 38.78 | deg |
| Rain Zone | A | | Rain Zone | K | |

| **Uplink Analysis** | **Clear sky** | **Rain Up** | **Rain Down** | **Units** |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 55.1 | 55.1 | 55.1 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.3 | -216.3 | -216.3 | dB |
| Rain Attenuation | 0.0 | 0.0 | -3.0 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 23.6 | 23.6 | 20.4 | dB/K |
| Downlink C/N | 14.9 | 13.9 | 7.7 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 14.9 | 13.9 | 7.7 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 12.5 | 10.1 | 7.2 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 6.0 | 3.6 | 0.7 | dB |

| **Link Summary** | | | | | | |
|---|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | | |
| D/L EIRP Den | -17.5 | dBW/Hz | Transpopnder B/W | 100.00% | | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% | |

**Table 5**

NorthEast Beam, 0.6 (m) Remote Terminal Rain Zone K

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | Tx/Ok | | Transponder Max EIRP | 59.5 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 33.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 97.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.9 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 27.1 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 172.68 | deg |
| Elevation | 38.78 | deg | Elevation | 51.39 | deg |
| Rain Zone | A | | Rain Zone | M | |

| **Uplink Analysis** | **Clear sky** | **Rain Up** | **Rain Down** | **Units** |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 56.5 | 56.5 | 56.5 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.1 | -216.1 | -216.1 | dB |
| Rain Attenuation | 0.0 | 0.0 | -5.6 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 27.1 | 27.1 | 22.9 | dB/K |
| Downlink C/N | 20.1 | 19.1 | 9.3 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 20.1 | 19.1 | 9.3 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 14.7 | 11.6 | 8.5 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 8.2 | 5.1 | 2.0 | dB |

| **Link Summary** | | | | | |
|---|---|---|---|---|---|
| U/L Power Den | -67.9 | dBW/Hz | Transponder Power | 100.00% | |
| D/L EIRP Den | -16.1 | dBW/Hz | Transpopnder B/W | 100.00% | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% |

**Table 6A**

Tx/Ok Beam, 0.9 (m) Remote Terminal Rain Zone M

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | Tx/Ok | | Transponder Max EIRP | 59.5 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 37.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 94.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.6 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 23.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 178.34 | deg |
| Elevation | 38.78 | deg | Elevation | 47.10 | deg |
| Rain Zone | A | | Rain Zone | K | |

| Uplink Analysis | Clear sky | Rain Up | Rain Down | Units |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 56.5 | 56.5 | 56.5 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.1 | -216.1 | -216.1 | dB |
| Rain Attenuation | 0.0 | 0.0 | -2.8 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 23.6 | 23.6 | 20.4 | dB/K |
| Downlink C/N | 16.5 | 15.5 | 9.5 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 16.5 | 15.5 | 9.5 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 13.3 | 10.7 | 8.7 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 6.8 | 4.2 | 2.2 | dB |

| Link Summary | | | | | | |
|---|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | | |
| D/L EIRP Den | -16.1 | dBW/Hz | Transpopnder B/W | 100.00% | | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% | |

**Table 6B**

Tx/Ok Beam, 0.6 (m) Remote Terminal Rain Zone K

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | SouthWest | | Transponder Max EIRP | 57.9 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.6 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 40.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 119.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.6 | m |
| Uplink Power/Carrier | -7.6 | dBW | Rx E/S G/T | 23.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 142.81 | deg |
| Elevation | 38.78 | deg | Elevation | 36.56 | deg |
| Rain Zone | A | | Rain Zone | B | |

| **Uplink Analysis** | **Clear sky** | **Rain Up** | **Rain Down** | **Units** |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 54.9 | 54.9 | 54.9 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.3 | -216.3 | -216.3 | dB |
| Rain Attenuation | 0.0 | 0.0 | -1.6 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 23.6 | 23.6 | 21.3 | dB/K |
| Downlink C/N | 14.7 | 13.7 | 9.8 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 14.7 | 13.7 | 9.8 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 12.4 | 10.0 | 8.9 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 5.9 | 3.5 | 2.4 | dB |

| **Link Summary** | | | | | | |
|---|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | | |
| D/L EIRP Den | -17.7 | dBW/Hz | Transpopnder B/W | 100.00% | | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% | |

**Table 7A**

SouthWest Beam, 0.6 (m) Remote Terminal Rain Zone B

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | SouthWest | | Transponder Max EIRP | 57.9 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 34.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 118.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.6 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 23.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 140.18 | deg |
| Elevation | 38.78 | deg | Elevation | 42.31 | deg |
| Rain Zone | A | | Rain Zone | E | |

| **Uplink Analysis** | **Clear sky** | **Rain Up** | **Rain Down** | **Units** |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 54.9 | 54.9 | 54.9 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.2 | -216.2 | -216.2 | dB |
| Rain Attenuation | 0.0 | 0.0 | -1.6 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 23.6 | 23.6 | 21.3 | dB/K |
| Downlink C/N | 14.8 | 13.8 | 9.9 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 14.8 | 13.8 | 9.9 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 12.4 | 10.1 | 9.0 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 5.9 | 3.6 | 2.5 | dB |

| **Link Summary** | | | | | |
|---|---|---|---|---|---|
| U/L Power Den | -67.9 | dBW/Hz | Transponder Power | 100.00% | |
| D/L EIRP Den | -17.7 | dBW/Hz | Transpopnder B/W | 100.00% | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% |

**Table 7B**

SouthWest Beam, 0.6 (m) Remote Terminal Rain Zone E

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | NorthWest | | Transponder Max EIRP | 56.4 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 48.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 111.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.6 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 23.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 156.38 | deg |
| Elevation | 38.78 | deg | Elevation | 32.19 | deg |
| Rain Zone | A | | Rain Zone | E | |

| Uplink Analysis | Clear sky | Rain Up | Rain Down | Units |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 53.4 | 53.4 | 53.4 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.4 | -216.4 | -216.4 | dB |
| Rain Attenuation | 0.0 | 0.0 | -1.5 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 23.6 | 23.6 | 21.4 | dB/K |
| Downlink C/N | 13.1 | 12.1 | 8.5 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 13.1 | 12.1 | 8.5 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 11.4 | 9.3 | 7.8 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 4.9 | 2.8 | 1.3 | dB |

| Link Summary | | | | | | |
|---|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | | |
| D/L EIRP Den | -19.2 | dBW/Hz | Transpopnder B/W | 100.00% | | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% | |

**Table 8A**

NorthWest Beam, 0.6 (m) Remote Terminal Rain Zone E

## Satellite Link Analysis

| Satellite Parameters | | | | | |
|---|---|---|---|---|---|
| Satellite | CAI | | Transponder IPBO | 0.0 | dB |
| Orbital Location | 93.0 | WL | Transponder OPBO | 0.0 | dB |
| SFD | -98.0 | dBW/m2 | Transponder B/W | 36.0 | MHz |
| U/L Beam Type | Spot | | Transponder G/T | 18.0 | dB/K |
| D/L Beam Type | NorthWest | | Transponder Max EIRP | 56.4 | dBW |
| **Link Requirements** | | | | | |
| Link Availability | 99.0 | % | Carrier Type | Dig TV | |
| Channel bandwidth | 36.0 | MHz | Modulation Type | QPSK | |
| Required C/No | 82.4 | dBHz | Information Rate | 38878.0 | kbps |
| Required Eb/No | 6.5 | dB | FEC Rate | 0.750 | |
| **Earth Station Parameters** | **Uplink** | | **Downlink** | | |
| Site Latitude | 41.0 | deg N | Site Latitude | 46.0 | deg N |
| Site Longitude | 74.0 | deg W | Site Longitude | 122.0 | deg W |
| Antenna Size | 3.7 | m | Antenna Size | 0.6 | m |
| Uplink Power/Carrier | 7.6 | dBW | Rx E/S G/T | 23.6 | dB/K |
| Azimuth | 207.69 | deg | Azimuth | 142.38 | deg |
| Elevation | 38.78 | deg | Elevation | 29.90 | deg |
| Rain Zone | A | | Rain Zone | D | |

| Uplink Analysis | Clear sky | Rain Up | Rain Down | Units |
|---|---|---|---|---|
| Frequency | 50.00 | 50.00 | 50.00 | GHz |
| Uplink E/S EIRP | 70.8 | 70.8 | 70.8 | dBW |
| Path Loss | -218.0 | -218.0 | -218.0 | dB |
| Atmospheric Loss | 0.0 | -2.0 | 0.0 | dB |
| Rain Fade Loss | 0.0 | -4.2 | 0.0 | dB |
| Satellite G/T | 18.0 | 18.0 | 18.0 | dB/K |
| Uplink C/N | 23.8 | 17.6 | 23.8 | dB |
| **Downlink Analysis** | | | | |
| Frequency | 41.00 | 41.00 | 41.00 | GHz |
| Satellite EIRP | 53.4 | 53.4 | 53.4 | dBW |
| Output Backoff Per carrier | 0.0 | -1.0 | 0.0 | dB |
| Path Loss | -216.5 | -216.5 | -216.5 | dB |
| Rain Attenuation | 0.0 | 0.0 | -4.7 | dB |
| Atmospheric Loss | 0.0 | 0.0 | -1.0 | dB |
| Pointing Loss | -0.5 | -0.5 | -0.5 | dB |
| E/S G/T | 23.6 | 23.6 | 19.7 | dB/K |
| Downlink C/N | 13.1 | 12.1 | 3.4 | dB |
| **Interference** | | | | |
| Uplink Co-channel C/I | 27.0 | 22.8 | 27.0 | dB |
| Dnlink Co-channel C/I | 27.0 | 26.0 | 27.0 | dB |
| Uplink Adj Satellite C/I | 21.0 | 16.8 | 21.0 | dB |
| Dnlink Adj Satellite C/I | 21.0 | 20.0 | 21.0 | dB |
| Total C/I | 17.0 | 14.1 | 17.0 | dB |
| **Overall Link** | | | | |
| C/Nd | 13.1 | 12.1 | 3.4 | dB |
| C/Nu | 23.8 | 17.6 | 23.8 | dB |
| C/I(total) | 17.0 | 14.1 | 17.0 | dB |
| C/(N+I) total | 11.3 | 9.3 | 3.2 | dB |
| Required C/N | 6.5 | 6.5 | 6.5 | dB |
| Margin | 4.8 | 2.8 | -3.3 | dB |

| Link Summary | | | | | |
|---|---|---|---|---|---|
| U/L Power Den | -68.0 | dBW/Hz | Transponder Power | 100.00% | |
| D/L EIRP Den | -19.2 | dBW/Hz | Transpopnder B/W | 100.00% | |
| U/L Avail | 99.90% | D/L Avail | 99.10% | Total Link Avail | 99.00% |

**Table 8B**

NorthWest Beam, 0.6 (m) Remote Terminal Rain Zone D

### 3.7.1 Southeast Beam Performance.

The Southeast Beam covers the heaviest rain zone in the continental US. Although the elliptical beam covering this area only has a gain of 36.6 dBi, in reality a shaped coverage will be used, eliminating between 35-45% of the area shown covered. This concentrated coverage will increase beam gain by 3-5 dB providing improved performance over the designated land masses. This analysis however will continue to use the elliptical coverage beam gains since those have been calculated using the gain-area product method.

For that portion of the covered area located in rain zone N, the analysis in Table 4A indicates a total link availability of 99.0% (approximately 14.4 minutes per day). This availability is the result of a satellite EIRP of 54.6 dBW and a receiving antenna of 1.2m (47 inches) with a station G/T of 29.6 dB/°K. It is widely agreed that the Florida/Gulf Coast area is a particularly heavy rain area in the US. Additional margin and availability improvement will be obtainable when the satellite beam covering Florida is shaped.

For that portion of the covered area located in rain zone M (22mm/hour), the analysis in Table 4B indicates a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 54.6 dBW and a receiving antenna of 0.9m (35 inches) with a station G/T of 27.1 dB/°K.

### 3.7.2 Northeast Beam Performance.

The covered area in Northeastern US is located in rain zone K (12mm/hour). The analysis in Table 5 indicates a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 55.1 dBW and a receiving antenna of 0.6m (23.5 inches) with a station G/T of 23.6 dB/°K.

### 3.7.3 Texas/Oklahoma (Kansas) Beam Performance.

The covered area in south central US is located in rain zones K, M and E. The analysis in Table 6A is for rain zone M (22mm/hour) and indicates that a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 56.5 dBW and a receiving antenna of 0.9m (35 inches) with a station G/T of 27.1 dB/°K.

For that portion of the covered area located in rain zone K (12mm/hour), the analysis in Table 6B indicates a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 56.5 dBW and a receiving antenna of 0.6m (23.5 inches) with a station G/T of 23.6 dBK.

### 3.7.4 Southwest Beam Performance.

The covered area in southwestern US is located in rain zones B and E. The analysis in Table 7A is for rain zone B (3mm/hour) and indicates that a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 54.9 dBW and a receiving antenna of 0.6m (23.5 inches) with a station G/T of 23.6 dB/°K. The very low rain rate in Zone B covering Arizona and New Mexico are the principle reasons for the possibility of very good availability.

For that portion of the covered area located in rain zone E (6mm/hour), the analysis in Table 7B indicates a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 54.9 dBW and a receiving antenna of 0.6m (23.5 inches) with a station G/T of 23.6dB/°K.

### 3.7.5 Northwest Beam Performance.

The covered area in Pacific Northwest and Northcentral US is located in rain zones D, B and E. The analysis in Table 8A is for rain zone E (6mm/hour) and indicates that a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 53.4 dBW and a receiving antenna of 0.6m (23.5 inches) with a station G/T of 23.6 dB/°K.

For that portion of the covered area located in rain zone D (8mm/Hour), the analysis in Table 8B indicates a total link availability of 99.0% could be achieved. This availability is the result of a satellite EIRP of 53.4 dBW and a receiving antenna of 0.9m (3.5 inches) with a station G/T of 27.1dB/°K. Higher powered amplifiers could be employed to provide better EIRP coverage to the large area covered by the Northwest beam.

### 3.8 Maximum Power Flux Density Analysis.

The power flux density limits for space stations are specified in Section 25.208 of the Commissions Rules and Regulations. This analysis demonstrates that the CAI satellite would be in compliance with those rules using multiplexed digital TV for all five beams described. The compliance described above assumes the limits are those specified for Ku-Band as follows:

a) -150 dBW/m2 in any 4 KHz band for angles of arrival between 0° and 5° above the horizon;

b) -150 + (d - 5) / 2 dBW/m2 for any 4KHz band for angles of arrival between 5° and 25° above the horizon; and

c) -140 dBW/m2 in any 4 KHz band for angles of arrival between 25° and 90° above the horizon.

### 3.8.1 Demonstrating Compliance with Power Flux Limits for CAI's Beams.

Using the antenna coverages shown in Figure 1, and the values computed for beam center maximum EIRPs as shown in Table 3, it can be seen that the Southeast Beam meets the Commission's 25.208 regulations for Ku-Band emissions although it is acknowledged that those limits may or may not apply to the V-Band frequencies used by this satellite.

The power flux density at the earth's surface for each beam is calculated by the method which involves computing the path loss (in dB) from the satellite to the earth's surface and adding to that the gain of a $1m^2$ antenna (in dB). This value is then subtracted from the maximum EIRP of the satellite to determine the boresite maximum flux density. Since CAI's satellite will be all digital, no analog cases need be considered.

#### 3.8.1.1 For the Southeast Beam.

| | |
|---|---|
| Maximum EIRP in Southeast Beam (dBW) | 54.6 |
| Path Loss to Beam Coverage (dB) | -216.0 |
| Gain of $1m^2$ Antenna (dB) | 55.44 |
| Bandwidth of Digital Signal (dB) | -74.3 |
| Conversion to 4kHz bandwidth (dB) | 36.0 |
| Maximum Power Flux Density ($dBW/m^2$ per 4kHz) | -144.3 |

Since the boresite of Southeast beam is above 30°, the allowable flux density is -140 $dBWm^2$ for this beam. The Southeast Beam calculation is 4.3 dB above the required value.

### 3.8.1.2 For the Northeast Beam.

| | |
|---|---|
| Maximum EIRP in Northeast Beam (dBW) | 55.1 |
| Path Loss to Beam Coverage (dB) | -216.3 |
| Gain of $1m^2$ Antenna (dB) | 55.44 |
| Bandwidth of Digital Signal (dB) | -74.3 |
| Conversion to 4kHz bandwidth (dB) | 36.0 |
| Maximum Power Flux Density ($dBW/m^2$ per 4kHz) | -144.0 |

Since the boresite of Northeast beam is above 30°, the allowable flux density is -140 $dBW/m^2$ for this beam. The Northeast Beam calculation is 4.0 dB above the required value.

### 3.8.1.3 For the Texas/Oklahoma Beam.

| | |
|---|---|
| Maximum EIRP in Texas/Oklahoma Beam (dBW) | 56.5 |
| Path Loss to Beam Coverage (dB) | -216.1 |
| Gain of $1m^2$ Antenna (dB) | 55.4 |
| Bandwidth of Digital Signal (dB) | -74.3 |
| Conversion to 4kHz bandwidth (dB) | 36.0 |
| Maximum Power Flux Density ($dBW/m^2$ per 4kHz) | -142.46 |

Since the boresite of the Texas/Oklahoma beam is above 30°, the allowable flux density is -140 $dBW/m^2$ for this beam. The Texas/Oklahoma Beam calculation is 2.46 dB above the required value.

### 3.8.1.4 For the Southwest Beam.

| | |
|---|---|
| Maximum EIRP in Southwest Beam (dBW) | 54.9 |
| Path Loss to Beam Coverage (dB) | -216.2 |
| Gain of $1m^2$ Antenna (dB) | 55.44 |
| Bandwidth of Digital Signal (dB) | -74.3 |
| Conversion to 4kHz bandwidth (dB) | 36.0 |
| Maximum Power Flux Density ($dBW/m^2$ per 4kHz) | -144.2 |

Since the boresite of the Southwest beam is above 30°, the allowable flux density is -140 $dBW/m^2$ for that beam. The Southwest Beam calculation above is 4.2dB above the required value.

### 3.8.1.5 For the Northwest Beam.

| | |
|---|---|
| Maximum EIRP in Northwest Beam (dBW) | 53.4 |
| Path Loss to Beam Coverage (dB) | -216.5 |
| Gain of $1m^2$ Antenna (dB) | 55.44 |
| Bandwidth of Digital Signal (dB) | -74.3 |
| Conversion to 4kHz bandwidth (dB) | 36.0 |
| Maximum Power Flux Density ($dBW/m^2$ per 4kHz) | -145.9 |

Since the boresite of the Northwest beam is above 30°, the allowable flux density is -140 $dBW/m^2$ for this beam. The Northwest Beam calculation shown above results in a value 5.9 dB above the required value and the system is in compliance.

#### 3.8.1.6 Flux Density Beam Summary

In summary, the power flux density for each of the CAI beams is as follows:

Southeast Beam - Digital TV PFD = -144.3dBW/$m^2$/4KHz

Northeast Beam - Digital TV PFD = -144.0dBW/$m^2$/4KHz

Texas/Oklahoma Beam - Digital TV PFD = -142.5dBW/$m^2$/4KHz

Southwest Beam - Digital TV PFD = -144.2dBW/$m^2$/4KHz

Northwest Beam - Digital TV PFD = -145.9dBW/$m^2$/4KHz

All of these values are consistent with Section 25.208 of the Commission's rules concerning power flux density.

### 3.9 Interference Analysis.

#### 3.9.1 Frequency Reuse Interference.

At this time, CAI does not plan to reuse the frequency bands described in this application. As discussed above, depending on the outcome of the Commission's forthcoming 38 GHz Band Satellite Report and Order, CAI may modify its band plan to satisfy any frequency reuse requirements adopted by the FCC.

#### 3.9.2 Cross Polarization Interference.

The cross-polarization between orthogonal transmissions at the same frequency will be 30dB or greater. As the transmissions will be of the same power level, the 30dB isolation will be sufficient to prevent harmful interference between CAI's own transmissions.

### 3.9.3 Adjacent Satellite Interference.

CAI assumes a 2-degree spacing environment and will examine the potential interference that would arise if a satellite similar to the Hughes "Expressway" satellite proposed by Hughes were located at 95° WL. We also examine the potential interference that would arise if a satellite similar to the CAI satellite proposed herein were spaced two degrees away.

The underlying assumptions regarding maximum uplink power density and minimum uplink EIRP that are required to compute the uplink carrier-to-interference ratio [(C/I)up] are shown in Table 9 for the analyzed systems. Similarly, the underlying assumptions concerning maximum downlink EIRP density and minimum downlink EIRP needed to compute the downlink carrier-to-interference [(C/I)down] are shown in Table 10.

The results of the CAI interference assessment are summarized in Table 11. The calculations assume that all transmit and receive stations meet the sidelobe performance objectives currently required for Ku-Band antennas, namely that they satisfy a sidelobe envelope of [29 - 25 log $\phi$]

As Table 11 indicates, the mutual interference between the three satellites is generally within acceptable limits. It may, however, be necessary to rely upon some degree of beam or polarization isolation between closely spaced satellites which employ widely different EIRP densities, or to coordinate frequency assignments.

**Table 9 - Uplink Interference Assumptions**

| System/Carrier | Bwo MHz | Max Uplink Power dBW | Max Power Density dBW/Hz | Min Uplink EIRP dBW |
|---|---|---|---|---|
| **Hughes Expressway 155 MBPS (2.5m)** | 300 | 14.8 | -69.97 | 70.3 |
| **Hughes Expressway 155 MBPS (0.6m)** | 300 | 14.8 | -69.97 | 74.5 |
| **CAI 38.9 MBPS TV/PSK** | 36.0 | 7.6 | -69.97 | 70.8 |

**Table 10 - Downlink Interference Assumptions**

| System/Carrier | BW MHz | Max Downlink EIRP dBW | Max Dn EIRP Density dBW/Hz | Min Downlink EIRP dBW | Min EIRP Density dBW/Hz | Receive E/S Gain dBi |
|---|---|---|---|---|---|---|
| **Hughes Expressway 155 MBPS (2.5m)** | 300 | 69.7 | -15.1 | 55 | -29.8 | 57.8 |
| **Hughes Expressway 155 MBPS (0.6m)** | 300 | 69.7 | -15.1 | 55 | -29.8 | 46.9 |
| **CAI 38.9 MBPS (0.6m)** | 300 | 56.5 | -19.1 | 53.4 | -22.2 | 45.6 |

| Table 11 - Adjacent Satellite C/I for Three Proposed With 2° Spacings | | | |
|---|---|---|---|
| "Interfering" System | "Wanted" System | (C/I) up dB | (C/I) down dB |
| CAI | CAI | 41.7 | 21.0 |
| CAI | Hughes 2.5m | 32.0 | 25.6 |
| CAI | Hughes 0.6m | 36.23 | 14.7 |
| Hughes | CAI | 43.9 | 17.0 |

## ENGINEERING CERTIFICATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application and the exhibits attached hereto; that I am familiar with Part 25 of the Commission's Rules and Appendix B to the 1983 Orbital Assignment Order; that I have either prepared or reviewed the engineering information contained in this application and the exhibits attached hereto; and that it is complete and accurate to the best of my knowledge.

By: _____

Date: 9/25/97