WILLKIE FARR & GALLAGHER

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Washington, DC 20036-3384

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S2160 SAT-MOD-19991102-00106
LORAL SPACE & COMMUNICATIONS LTD
Telstar 8 (Loral 2)

November 2, 1999

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: 72/73-SAT P/LA-95; 6029-DSS-P/LA-87, 118-SAT-LA-95; 195-197-SAT-P/LA-95

Dear Ms. Salas:

Enclosed for filing, please find the modification applications of:

(A) Loral Space & Communications Ltd. to modify its Telstar 8 authorization to (1) operate Telstar 8 at 89° W.L. instead of 77° W.L.; (2) redefine the coverage area to provide service throughout North and South America using separate switchable beams; (3) modify the C-band transponder configuration and channelization and provide for the use of TWTAs; (4) modify the Ku-band transponder configuration and channelization and increase the power of the TWTAs; and (5) incorporate a Ka-band payload;

(B) Loral Space & Communications Ltd. to modify its Telstar 8 authorization to extend the remaining milestones;

(C) Loral Orion, Inc. to modify its Orion F7 89° W.L. Ka-band authorization; and

(D) Loral SpaceCom Corporation to modify its Telstar 4 authorization in order to relocate the satellite from 89° W.L. to 77° W.L.

These modification requests are submitted on four separate Form 312s. Also included is one completed Form 159 and a check for the applicable filing fee.

Sincerely,

Stephen R. Bell
Jennifer D. McCarthy

Enclosures

cc: Kathleen Campbell
Fern Jarmulnek
Cassandra Thomas
Julie Garcia
John Martin

0099648.01

FCC 312
Main Form

Approved by OMB 3060-0678
Ext. Avg. Burden Hours Per Response: 11 Hrs.

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS

FCC Use Only
File Number:
Call Sign:
Fee Number:

APPLICANT INFORMATION

1. Legal Name of Applicant Loral Space & Communications Ltd.		2. Voice Telephone Number 212-697-1105
3. Other Name Used for Doing Business (if any)		4. Fax Telephone Number 212-338-5350
5. Mailing Street Address or P.O. Box 600 Third Ave. c/o Loral SpaceCom Corporation ATTENTION: Eric Zahler, General Counsel	6. City New York 7. State / Country (if not U.S.A.) New York	8. Zip Code 10016
9. Name of Contact Representative (If other than applicant) Stephen Bell/Jennifer McCarthy		10. Voice Telephone Number 202-328-8000
11. Firm or Company Name Willkie Farr & Gallagher		12. Fax Telephone Number 202-887-8979
13. Mailing Street Address or P.O. Box 1155 21st Street, NW, Suite 600 ATTENTION:	14. City Washington, DC 15. State / Country (if not U.S.A)	16. Zip Code 20036

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

- [ ] b1. Application for License of New Station
- [ ] b2. Application for Registration of New Domestic Receive-Only Station
- [ ] b3. Amendment to a Pending Application
- [X] 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. Application for License of New Receive-Only Station Using Non-U.S. Licensed Satellite
- [ ] b9. Letter of Intent to Use Non-U.S. Licensed Satellite to Provide Service in the United States
- [ ] b10. Other (Please Specify):

18. If this filing is in reference to an existing station, enter:
Call sign of station:
Telstar 8 at 77^{o} W.L. (also called Loral 2)

19. If this filing is an amendment to a pending application enter:
(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 [ ] c. Radiodetermination Satellite [ ] e. Direct to Home Fixed Satellite

[ ] b. Mobile Satellite [ ] d. Earth Exploration Satellite [ ] f. Digital Audio Radio Service [ ] g. 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.

[ ] a. Using U.S. licensed satellites [ ] b. Using Non-U.S. licensed satellites **N/A**

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).

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

[X] b. Ku-Band (12/14 GHz) [ ] c. Other (Please specify) ______

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.

[ ] a. Transmit/Receive [ ] b. Transmit-Only [ ] c. Receive-Only **N/A**

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.

- [ ] 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
- [X] k -- Other (Please Specify) Modify space station design

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? 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 an exhibit to this application. [ ] YES [X] NO

A Radiation Hazard Study must accompany all applications as an exhibit 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 an exhibit, the 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 an exhibit, 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 an exhibit, 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? If Yes, attach as an exhibit, an explanation of the circumstances.	☐ 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? If Yes, attach as an exhibit, an explanation of the circumstances.	☐ 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? If Yes, attach as an exhibit, an explanation of the circumstances.	☐ YES	☒ NO
40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit 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. Also list the names and addresses of the officers and directors of the Filer.	N/A	
41. 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
42a. Does the applicant intend to use a non-U.S. licensed satellite to provide service in the United States? If yes, answer 42b and attach an exhibit providing the information specified in 47 C.F.R. § 25.137, as appropriate. If no, proceed to question 43.	☐ YES	☒ NO
42b. What administration has licensed or is in the process of licensing the space station? If no license will be issued, what administration has coordinated or is in the process of coordinating the space station? N/A		

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

Modification of Telstar 8 satellite design (see attabhed narrative)

Exhibit No.	Identify all exhibits that are attached to this application.
A	Response to item 34

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.

44. 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) ______

45. Typed Name of Person Signing: John P. Stern

46. Title of Person Signing: Associate General Counsel, Loral Space & Communications Ltd.

47. Signature: John P. Stern

48. Date: 11/1/99

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).

Loral Space & Communications Ltd. ("Loral") is a Bermuda company which is publicly traded on the New York Stock Exchange (NYSE: LOR). Loral's home market is the United States. See In re Application of AT&T Corp. and Loral SpaceCom Corporation, *Order and Authorization*, 12 FCC Rcd. 925 at ¶ 9 (1997).

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C.

In the Matter of	)	
	)	
Loral Space & Communications Ltd.	)	File No. ________________
	)	
Application for Modification of Space Station Authorization	))	

APPLICATION FOR MODIFICATION OF AUTHORIZATION

Loral Space & Communications Ltd. ("Loral") seeks modification of its authority to construct, launch and operate Telstar 8,[1] a hybrid C/Ku-band GSO FSS satellite at the 77° W.L. orbital location.[2] The proposed modifications will enhance Loral's ability to provide more domestic and international satellite services to more customers using state-of-the-art technology.[3]

Specifically, Loral seeks authority to (1) operate Telstar 8 at 89° W.L. instead of 77° W.L.; (2) redefine the coverage area to provide service throughout North and South America using separate switchable beams; (3) modify the C-band transponder configuration and channelization and provide for the use of TWTAs; (4) modify the Ku-band transponder

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1 This satellite was originally designated Loral 2.

2 Applications of Loral Space & Communications Ltd., 11 FCC Rcd 13788 (1996), 11 FCC Rcd 20441 (1996) (hereinafter "Telstar 8 Authorization"). On October 8, 1999 Loral filed a request for the *pro forma* assignment of the Telstar 8 authorization to its wholly-owned subsidiary, Loral Satellite Ltd. This request is pending.

3 On June 10, 1996, Loral filed an application to modify its authorization in order to provide coverage to South America. That application is pending. No pleadings were filed in response to that application's public notice. See File No. 123/124-SAT-MP-96. *Public Notice*, Report No. SPB-53 (rel. July 17, 1996). This application moots that filing and should be accepted in lieu of the June 1996 modification application.

configuration and channelization and increase the power of the TWTAs; and (5) incorporate a Ka-band payload. Loral plans to launch Telstar 8 in July 2002.[4]

The following is a summary of Loral's modification request. Technical appendices providing detailed information, including an interference analysis, in support of this application are attached as Appendices A and B. Appendix C consists of new ApS4 documentation for the 89° W.L. orbital position.

I. PROPOSED MODIFICATIONS.

Loral requests that the Commission modify the Telstar 8 Authorization to permit changes to the satellite design, technical parameters and coverage area. Appendix A summarizes the characteristics of the Telstar 8 satellite.

A. REASSIGNMENT TO 89° W.L.

Loral seeks to have its Telstar 8 satellite reassigned to the 89° W.L. orbital position. As noted, Telstar 8 is currently assigned to 77° W.L. Another Loral satellite, Telstar 4, is operating at 89° W.L.[5] Loral does not propose to relocate Telstar 4 until Telstar 8 has been tested and is ready to be placed into service at 89° W.L. As discussed below, by deploying Telstar 8 at 89° W.L., Loral will be able to deploy a more robust, higher-power hybrid (C/Ku/Ka) satellite to serve a broader coverage area (including North and South America) and to offer more services to more people.

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4 Loral is concurrently filing an application for an extension of the remaining milestones associated with Telstar 8.

5 See Application of American Telephone and Telegraph Company, *Order and Authorization*, 3 FCC Rcd. 6980 (1988). Loral is filing, concurrently with this application, a request for reassignment of the Telstar 4 satellite to 77° W.L.

B. COVERAGE AREA OF C AND KU-BAND TRANSPONDERS

Loral proposes to provide C-band and Ku-band coverage to the 48 contiguous states (CONUS), Alaska, Hawaii, Puerto Rico and the Virgin Islands, Canada, Mexico and most of South America by using multiple beams.[6] This represents a larger geographic service area than the CONUS coverage originally proposed. The increased coverage area will permit Loral to provide additional services and greater flexibility for its customers.

C. MODIFICATIONS TO C-BAND TRANSPONDER BANDWIDTH AND POWER AND USE OF TWTAS

Loral proposes to employ twenty 36 MHz, two 72 MHz (both for NAFTA coverage) and six 72 MHz C-band transponders (for South American coverage) in lieu of the twenty-four 36 MHz C-band transponders previously authorized. The modified satellite would make efficient use of scarce orbital resources by utilizing all of the 500 MHz authorized for C-band service. These changes will provide increased configuration flexibility to meet customer requirements.

Loral also proposes to deliver C-band services by using efficient, state-of-the-art 37 and 100 watt TWTAs rather than the 20 watt solid-state power amplifiers (SSPAs) previously authorized. TWTAs permit more efficient use of satellite power and will deliver a higher quality of service to Loral's customers. The C-band EIRP for the 36 MHz CONUS transponders will increase by only .2 dB with respect to the original application. For the 72 MHz transponders, the EIRP will increase by 4.5 dB. However, on a power spectral density basis, the net increase is only 1.5 dB. These EIRP levels will not cause any unacceptable interference into adjacent satellites that cannot be successfully addressed through normal inter-system coordination.[7]

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6 Specific coverage contours are described in Appendix A.

7 If analog video is placed on any of the 72 MHz transponders, Loral will comply with 47 C.F.R. § 25.211 of the Commission's rules.

D. MODIFICATIONS TO KU-BAND TRANSPONDER BANDWIDTH, POWER AND TWTAS

Loral proposes to employ thirty-six 36 MHz Ku-band transponders in lieu of the thirty-two 27 MHz Ku-band transponders previously authorized.[8] The satellite will use 130 watt TWTAs instead of the 110 watt TWTAs previously authorized. The satellite will make full use of the 500 MHz of Ku-band spectrum assigned to Loral. The proposed changes to the Ku-band transponders will provide increased configuration flexibility to meet customer requirements. The maximum Ku-band EIRP over the Southeast CONUS region will be 51.6 dBW instead of the 53.0 dBW CONUS peak value found in the original Telstar 8 application. The CONUS edge of coverage EIRP will be 50.0 dBW instead of the 48.0 dBW described in the original Telstar 8 application. This differential of 2 dB reduces to .75 dB when the difference in the transponder bandwidth is considered. As with the C-band, no unacceptable interference into adjacent satellites will result that cannot be successfully addressed through normal inter-system coordination.

E. ADDITION OF A KA-BAND PAYLOAD

Loral's subsidiary, Loral Orion Inc. ("Loral Orion") is authorized to construct, launch and operate a Ka-band satellite to be located at 89° W.L. (Orion F7).[9] Loral proposes to add a Ka-band payload to the Telstar 8 satellite in order to implement part of that authorization.[10] The Ka-band payload will provide full blanketed uplink coverage of CONUS with four times frequency re-

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8 Several Loral customers have indicated that 36 MHz Ku-band transponders are more suited to their transmission requirements.

9 In re Application of Orion Network Systems, Inc. for Authority to Construct, Launch and Operate a Ka-Band Satellite System in the Fixed-Satellite Service, *Order and Authorization*, 12 FCC Rcd. 23027 (1997). On July 2, 1998, Orion notified the Commission of the name change of the licensee to Loral Orion.

10 Loral Orion is filing, concurrently with this application, a request to modify the Orion F7 authorization to implement the changes proposed herein.

use of the 29.50-30.0 GHz uplink frequency band. All Ka-band transponders will operate with 120 watt TWTAs. The Ka-band uplink spot beams will provide full CONUS coverage. The satellite will have four downlink Ka-band beams, each operating in the 19.7-20.2 GHz frequency band, which will cover Los Angeles-San Francisco, Denver, Chicago, and New York-Washington, D.C. With its blanketed uplink coverage and 2 GHz of capacity, the Telstar 8 Ka-band capacity can be used to provide a vast range of services, from modest bit-rate Internet return links to high speed data transfers, for U.S. customers.

II. PUBLIC INTEREST CONSIDERATIONS.

Loral's modification proposal is consistent with the goals of the Commission's orbital assignment policies in that it will utilize the 89° W.L. location more efficiently.[11] The Telstar 8 satellite will permit the integration of Ka, C and Ku-band frequencies onto a single spacecraft.[12] Grant of Loral's modification application will therefore permit the most cost-effective use of a limited orbital resource, consistent with Commission precedent. As noted by the Commission, "hybrid satellites can provide cost savings to operators and customers without a decrease in

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11 The reassignment portion of the request is consistent with the public interest as it involves a previously authorized satellite and does not require the assignment of an additional orbital location. See, e.g., In re Application of GTE Spacenet Corp., *Order and Authorization*, 9 FCC Rcd. 1271, 1273 (1994).

12 As Loral Orion is not authorized to construct, launch and operate a Ka-band satellite at 77° W.L., Loral would not be able to add a Ka-band payload to a satellite to be located at that location. Mortorola's subsidiary, Comm Inc. is authorized to construct, launch and operate a Ka-band satellite at 77° W.L. In re Application of Comm, Inc., *Order and Authorization*, 12 FCC Rcd. 23001 (1997).

technical performance."[13] Hybrid satellites "represent an economic and efficient" use of satellites and launch vehicles.[14] The Commission has accommodated hybrid satellites whenever possible.[15]

The addition of Ka-band capacity to the Telstar 8 satellite will implement part of the Orion F7 Ka-band authorization at 89° W.L. and bring Ka-band services to the market The deployment of Ka-band capacity at 89° W.L. will further the Commission's stated objective in its Ka-band rulemaking: to stimulate "economic growth both in the United States and abroad," and promote "global development through enhanced communication infrastructures and services."[16] The Ka-band capacity on Telstar 8 will provide Loral with the ability to offer new and enhanced services such as two-way multimedia services with digitally compressed video, high definition video and audio, voice, telemedicine, video conferencing, high-speed Internet access and distance learning. Indeed, the implementation of Ka-band capacity at 89° W.L. will be one of the first steps taken towards the Commission's goal of "achieving a seamless information infrastructure."[17]

Grant of this application will also further the policy objectives set forth in the Commission's DISCO I and II Orders[18] by permitting Loral to increase Telstar 8's coverage area

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13 In re Application of Hughes Communications Galaxy, Inc., *Order*, 11 FCC Rcd. 5532 at ¶ 6 (1995).

14 See In re Assignment of Orbital Locations to Space Stations in the Domestic Fixed-Satellite Service, *Memorandum Opinion and Order*, 84 FCC 2d 584, 607 (1980).

15 See e.g., In re Application of AT&T Corp., *Order*, 11 FCC Rcd. 15038 (1996); In re Application of GE American Communications, Inc., *Memorandum, Opinion, & Order*, 11 FCC Rcd. 15050 (1996); In re Application of GTE Spacenet Corp., *Order*, 9 FCC Rcd 1271, 1273.

16 In re Rulemaking to Amend Parts 1, 2, 21 and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Service, *Third Report and Order*, 12 FCC Rcd. 22310 at ¶ 2 (1997).

17 Id. at ¶ 2.

18 See In re Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Satellite Systems, *Report and Order*, 11

for both domestic and international service from the 89° W.L. orbital position. Satellite customers have both domestic and international communications needs and are demanding capacity that can fill these needs. The ability to provide service to additional geographic regions will maximize efficient use of scarce orbital resources, increase the number of choices for international service and serve the public interest.

Generally, the Commission leaves "spacecraft design decisions to the space station licensee because the licensee is in a better position to determine how to tailor its system to meet the particular needs of its customers."[19] Thus, the Commission has generally granted system modification requests, such as this one, "provided there are no countervailing public interest considerations."[20] The modifications proposed by Loral are in the public interest because they will implement and incorporate technological advances, and will provide significant operating efficiencies and more valuable services to more consumers, consistent with Commission policies. The expanded coverage areas in the modified design will permit Loral to take advantage of recent market openings which have resulted from the WTO Agreement. Grant of the application will thereby enhance competition in the satellite services market.

FCC Rcd. 2429 (1996); In re Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States, *Report and Order*, 12 FCC Rcd. 24094 (1997).

19 In re Application of AMSC Subsidiary Corporation for Modification of Mobile Satellite Service License, *Order and Authorization*, 13 FCC Rcd. 12316 at ¶ 8 (1998) (*citing* Big LEO Notice of Proposed Rulemaking, 9 FCC Rcd. 1094 (1994) at ¶ 11).

20 Id.

III. CONCLUSION.

In short, the requested modifications will allow Loral to more efficiently and reliably provide a broader range of services to more people. Loral requests that the Commission grant the requested modifications at the earliest possible date.

In accordance with § 25.117(d) of the Commission's rules, the appendices include those items of information listed in § 25.114(c) that have changed from the original application. Loral certifies that the remaining information has not changed.

Respectfully submitted,

By: ______________________

John P. Stern
Associate General Counsel
Loral Space & Communications Ltd.
1755 Jefferson Davis Highway, Suite 1007
Arlington, VA 22202-3501

November 1, 1999

ENGINEERING CERTIFICATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this Modification of Loral Space & Communications Ltd. to modify the design of the Telstar 8 satellite; that I am familiar with Parts 21 and 25 of the Commission's Rules; that I have either prepared or reviewed the engineering information contained in the underlying application; and that it is complete and accurate to the best of my knowledge.

Dated the 29th day of October 1999

By: ______________________

Sundaram C. Moorthy
Director, Satellite & Spectrum Development
Loral Skynet®[1]

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1 Skynet is a registered trademark of Loral SpaceCom Corporation.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. APPLICANT INFORMATION

Loral Space & Communications
c/o Loral Spacecom Corporation
600 Third Avenue
New York, NY 10016
Telephone: (212)-697-1105

2. KEY APPLICANT CONTACTS FOR CORRESPONDENCE

Correspondence with respect to this application should be sent to the following persons at the address and telephone number below:

John P. Stern
Associate General Counsel
Loral Space & Communications Ltd.
1755 Jefferson Davis Hwy., Suite 1007
Arlington, VA 22202-3501
(703) 414-1060

with a copy to:

Stephen R. Bell
Jennifer D. McCarthy
Willkie Farr & Gallagher
1155 21st Street, N.W., Suite 600
Washington, DC 20036
(202) 328-8000

3. TYPE OF AUTHORIZATION REQUESTED

Modification of authorization.

4. GENERAL SYSTEM AND SERVICE DESCRIPTION

4.1. GENERAL SYSTEM DESCRIPTION

The Telstar 8 satellite will be deployed at 89° WL and will be a Space Systems/Loral extended FS1300 class, three-axis stabilized spacecraft that will operate in the C-, Ku-, and Ka-Bands. The satellite will have 28 C-Band transponders, 36 Ku-Band transponders, and four 500MHz Ka-Band transponders. Frequency reuse will be provided in each frequency band through the use of orthogonal polarization (linear for C- and Ku-band, circular for Ka-band) and spatial isolation. The C-Band transponders will operate with 37 and 100 watt TWTAs, the Ku-Band transponders will have with 130 watt TWTAs, and the Ka-Band transponders will operate with 120-W TWTAs. All transponders will contain gain-step attenuators (adjustable in 1 dB steps) that can be adjusted remotely by ground commands. The satellite will also include inter-beam switching on a channel by channel basis, which, for example, would permit a C-band uplink in North America to be connected to a South America downlink earth station.

The satellite will provide coverage to the 48 contiguous states (CONUS), Hawaii, Alaska, Canada, Mexico, Puerto Rico, the Virgin Islands, and most of South America by using multiple C- and Ku-band beams. The mapping of transponders to beams is shown in Table 4-1. The satellite will be designed for a 15 year service life and will use linearized Traveling Wave Tube Amplifiers (TWTAs) exclusively.

Ka-band uplink spot beams will provide full CONUS coverage. The satellite will have 4 downlink Ka-band beams which cover LA-SF, Denver, Chicago, and NY-Wash DC.,. The beam widths of the CONUS downlink beams are expected to be about 1°. Figures 4-1 and 4-2 depict the Ka-band beam arrangement, and Table 4-1 shows the mapping of the transponders into the beams.

Loral Skynet will develop the necessary Telemetry, Tracking, and Control (TT&C) facilities to operate the satellite from east coast or west coast facilities.

Table 4-1. Transponder Arrangement for C-band, Ku-band, and Ka-band Beams

Beam Name	Areas Covered	Frequency Band	BW and # of Transponders
NAFTA-C	CONUS, Hawaii, Alaska, Canada, Mexico, Puerto Rico, Virgin Islands	C	20 @ 36 MHz
			2 @ 72 MHz
SA-C	South America	C	6 @ 72 MHz
NAFTA-Ku	CONUS, Hawaii, Alaska, Canada, Mexico, Puerto Rico, Virgin Islands	Ku	24 @ 36 MHz
SA-Ku	South America	Ku	12 @ 36 MHz
Ka-Band 1	CONUS	Ka	U/L: 24 @ 72 MHz
			D/L: 4 @ 500MHz

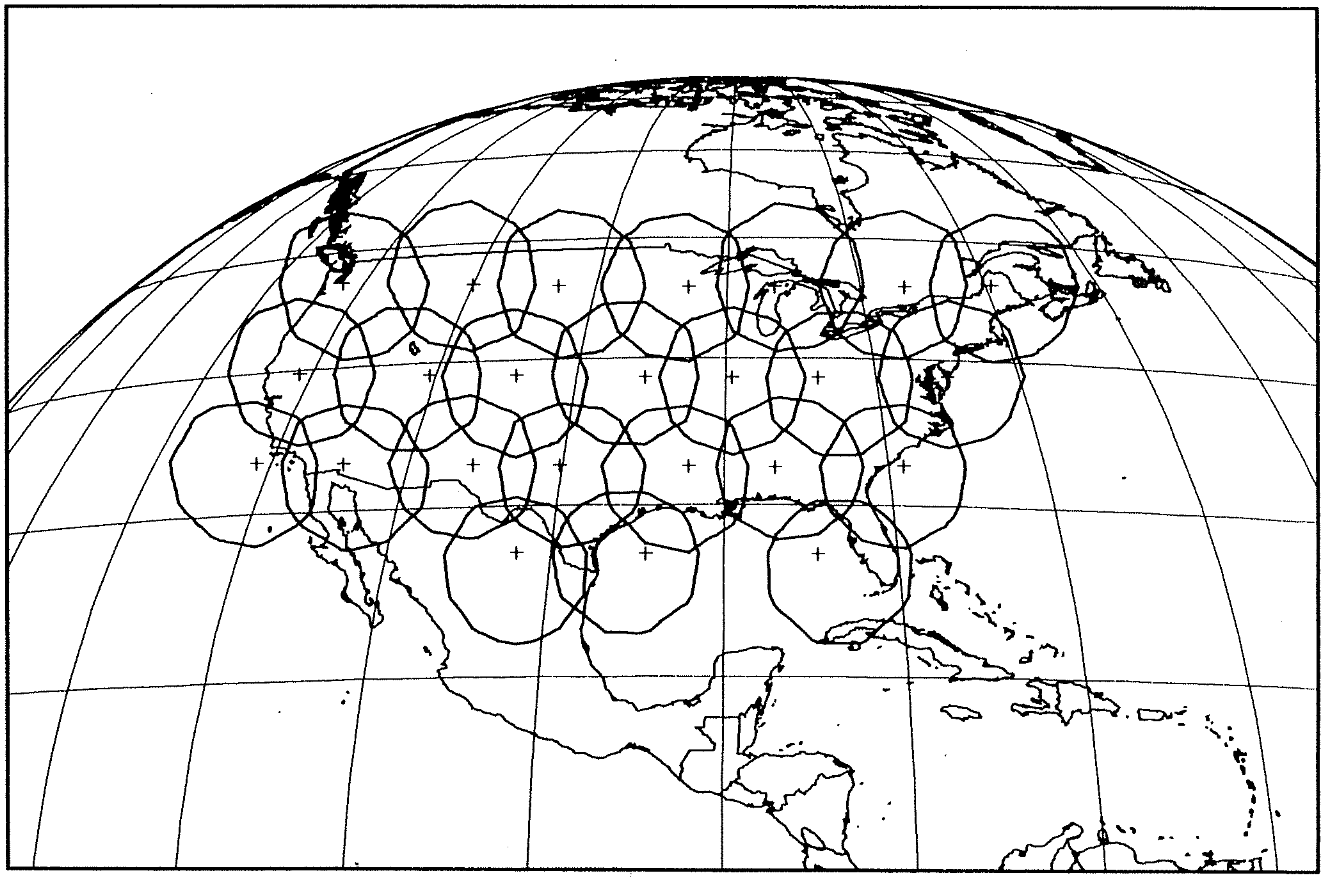


Figure 4-1. Beam Arrangement for Uplink Ka-band CONUS Beams

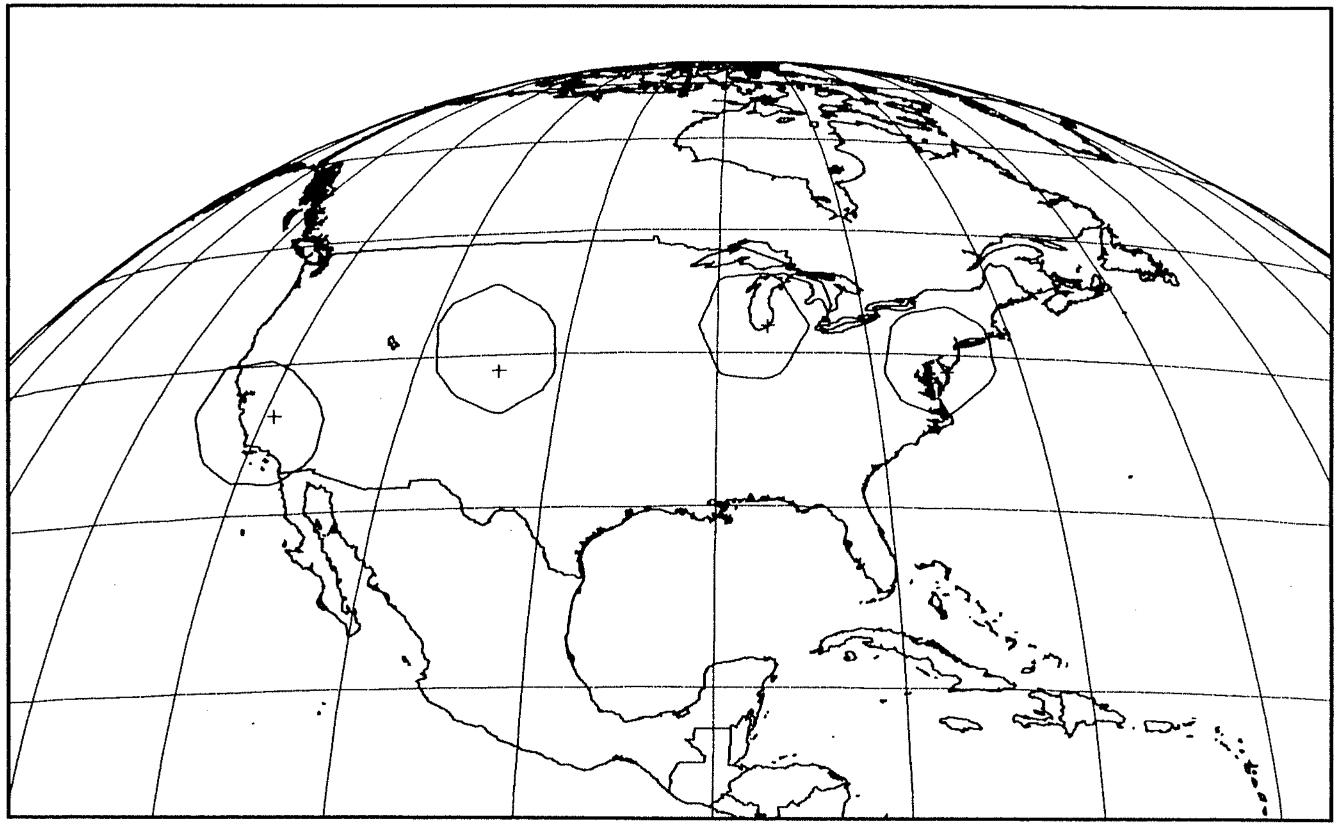


Figure 4-2. Beam Arrangement for Downlink Ka-band CONUS Beams

4.2. GENERAL SERVICES DESCRIPTION

The service objectives are to provide:

- Digital Services supporting a variety of information rates ranging between a single carrier per transponder to many hundreds of carriers per transponder types of operation. These will employ Phase Shift Keying (e.g. 8PSK, QPSK) modulation and use Forward Error Correction Coding (FEC) where appropriate.
- Analog Video Services using Frequency Modulation (FM) in the full-transponder mode as well as in the half transponder mode. These services will be both point-to-point and point-to-multipoint.

Detailed characteristics for some typical services are given in section 8.

5. PAYLOAD DESCRIPTION

Table 5-1 summarizes the key characteristics of the Telstar 8 satellite.

The satellite design conforms to the International Radio Regulations technical standards, Part 25 of the Commission's rules, and CC Docket No. 81-704's Report and Order. The design is also fully compatible with the Commission's 2-degree orbital separation plan. The following subsections provide more detailed information on the satellite design.

Table 5-1. Spacecraft Characteristics Summary

General	
Mission Life	15 Years
Stabilization	Three-Axis
Stationkeeping	± 0.05° N-S, E-W
Eclipse Capability	100%
Antenna Pointing Accuracy	Within 0.13°, half cone
Launch Vehicle	Compatible with Sea Launch, Ariane 4 and 5, Proton, and Atlas III
Communications	
Frequency Band	Standard C, Standard Ku, Ka
Antenna Coverage	The 48 contiguous states (CONUS), Hawaii, Alaska, Canada, Puerto Rico and the Virgin Islands, Mexico and most of South America
Polarization	Orthogonal Linear
Number of Transponders	28 C-Band 36 Ku-Band 4 Ka-Band (Each with a BW of 500 MHz)
Usable Bandwidth	1296 MHz at C-Band 1296 MHz at Ku-Band 2160 MHz at Ka-Band
Transmitter RF Power	C- Band: 37 and 100 watts Ku-Band: 130 Watts Ka-Band: 120 Watts
Connectivity C-band Ku-band Ka-band	 NAFTA up to either NAFTA down or SA down SA up to either NAFTA down or SA down NAFTA up to either NAFTA down or HEMI down HEMI up to either NAFTA down or HEMI down Six uplink beams to one downlink beam (Replicated 4 times)
Redundancy: LNAs / Receivers Channel Amplifiers and TWTAs	 C-Band : N/A / 5 for 3 Ku-Band : N/A / 5 for 3 Ka-Band : 6 for 4 / 48 for 24 C-Band : One ring of 15 for12 One ring of 10 for 8 One ring of 12 for 8 Ku-Band : Three rings of 15 for 12 Ka-Band : One ring of 6 for 4
Tracking, Telemetry, and Command (TT&C)	
Frequency	C-Band
Earth Station Locations	One in Western United States One in Eastern United States

5.1. C-BAND COMMUNICATIONS SUBSYSTEM

5.1.1. Capacity

The 28 C-Band transponders provide 1296 MHz of usable bandwidth (1500 MHz including guard bands). The TWTAs for the 36-MHz transponders provide 37 W at single-carrier saturation, while the TWTAs for the 72 MHz transponders provide 100 W at single carrier saturation. The spacecraft power subsystem will be sized to provide simultaneous operation of all the 36-MHz transponders at saturation and all of the 72-MHz transponders at 3 dB OBO for a minimum of 15 years with 100% eclipse operation.

5.1.2. Transponder Frequency and Polarization Plan

Both spatial isolation and linear polarization are used to obtain the frequency re-use. The overlapping NAFTA beams operate with Horizontal and Vertical polarization. Cross-polarization isolation within the coverage area will be a minimum of 30 dB. The South America beam is designed such that the minimum isolation to and from the co-polarization NAFTA beam is 26 dB. With the isolation performance described above, Loral expects the payload to operate with negligible self-interference.

Twenty of the transponders in the C-band NAFTA beam contain usable bandwidth of 36 MHz. The remaining two transponders in the C-band NAFTA beam and all six transponders in the South America beam have a usable bandwidth of 72 MHz. The C-band transponders will transmit (downlink) in the 3700 – 4200 MHz frequency range and receive (uplink) in the 5925 – 6425 MHz frequency range.

The proposed frequency and polarization plan is illustrated in Figures 5-1 and 5-2 and show:

1. Center frequency for each transponder
2. Bandwidth for each transponder
3. Polarization to be used for each transponder
4. Telecommand and telemetry frequencies

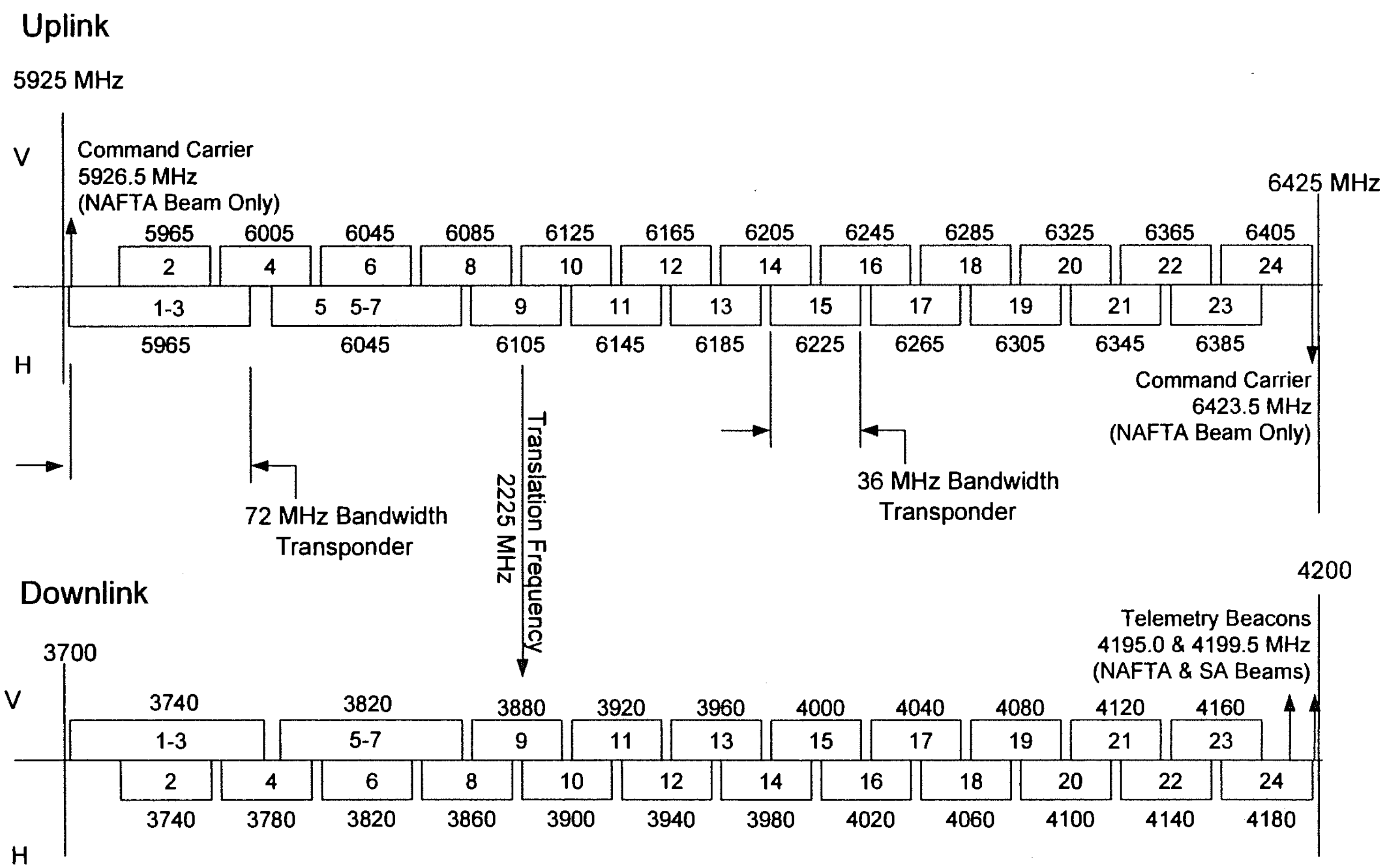


Figure 5-1. Frequency Plan for C-Band NAFTA Beam

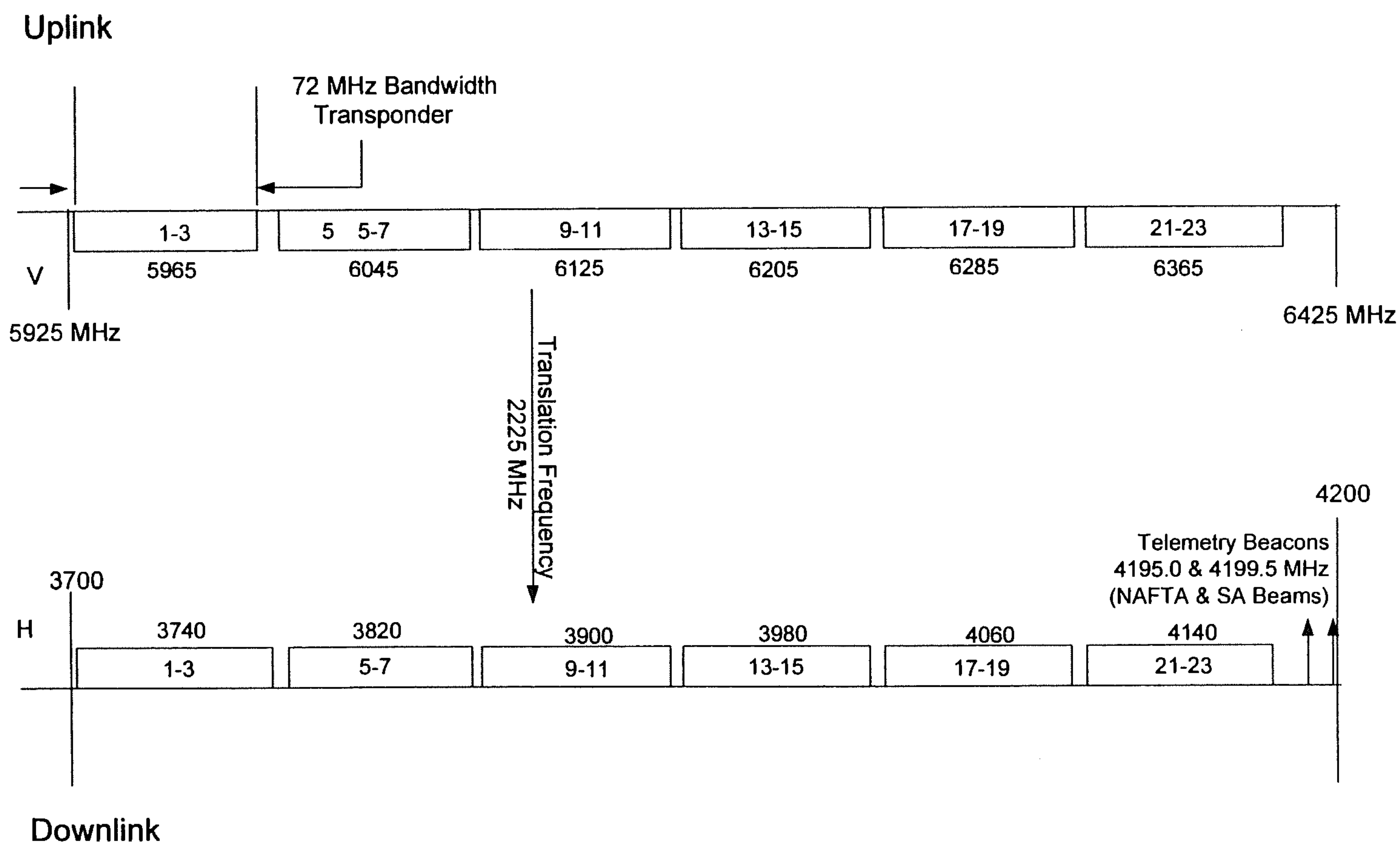


Figure 5-2. Frequency Plan for C-Band South America Beam

5.1.3. Types of Emissions

The 36- and 72-MHz transponders of the C-band payload are expected to handle a wide variety of digital traffic from narrowband data to wideband video. Some FM TV traffic is also expected to be loaded in the C-band transponders. Table 5-2 below provides some of the important characteristics of these signals.

Table 5-2. Emission Designators for C-Band

Signal	Emission Designators	Allocated Bandwidth
Wideband Digital	27M0G7W, 32M0G7W	32MHz, 36 MHz
Medium-band Digital	5M00G7W, 3M00G7W, 1M98G7W	6 MHz, 3.6 MHz, 2.4 MHz
Narrowband Digital Data	128KG7W, 44K1G1D	155 kHz, 55 kHz
FM-TV	32M0F9W, 27M0F9W	36 MHz, 32 MHz
Command	1M00F9D	1.5 MHz
Telemetry / Ranging	144KG9D, 200KG9D, 200KG8X	175 kHz, 240 kHz
Tracking	25K0NON, 144KG9D, 200KG9D	40 kHz, 175 kHz, 240 kHz

5.1.4. Subsytem Configuration

Figure 5-3 shows the block diagram of the C-Band communications subsystem.

A dual shaped-reflector directional antenna provides NAFTA coverage. The antenna uses two shaped reflectors, each with an associated dual-band (transmit and receive) feed horn. Each horn-reflector pair provides one of the orthogonal linear polarizations. The embedded grid on the front reflector provides high polarization isolation.

A single Gregorian antenna with dual polarization, a shaped main reflector, a shaped subflector, and a diplexer serves both the transmit and receive functions for the SA coverage. The reflector is deployable from the east face of the spacecraft. To enhance the performance of this antenna, the subreflector is shaped, in addition to the main reflector. The polarizing elements are derived from ortho-mode junctions, which provide horizontally and vertically polarized signals.

Low-noise receivers, arranged in a 5-for-3 redundancy ring, amplify each set of signals, which are subsequently mixed with a local oscillator (LO) signal at 2225 MHz, translating them to the 4-GHz common intermediate frequency (IF) band. After down conversion the signals are applied through a channel-dropping network to filters that demultiplex them into individual channels. The signals for channels 1-3 and 5-7 (for both the NAFTA and South America beams) are fed to network of switches and power splitters to provide inter-beam connectivity and broadcasting capability. The signals for channels 1-3 and 5-7 and all of the remaining channels are then routed to Channel Amplifiers and TWTAs through T-switches, which provide redundancy switching. The 37-W TWTAs are arranged in redundancy rings of 15 for 12 and 10 for 8. The 100-W TWTAs are arranged in an 11 for 8 redundancy ring. The channel Amplifiers provide corrections for the TWTA non-linearities and contain commandable attenuators that control channel gain and saturation flux density. The TWTA outputs are connected through R-switches to complete the redundancy rings and subsequently routed to one 12 channel OMUX (for NAFTA), one 10-channel OMUX (for NAFTA), and one 6-channel OMUX (for South America). The OMUXes combine the appropriate channels for each antenna port. After filtering in the OMUX, the signals are routed through test couplers to the transmit antennas.

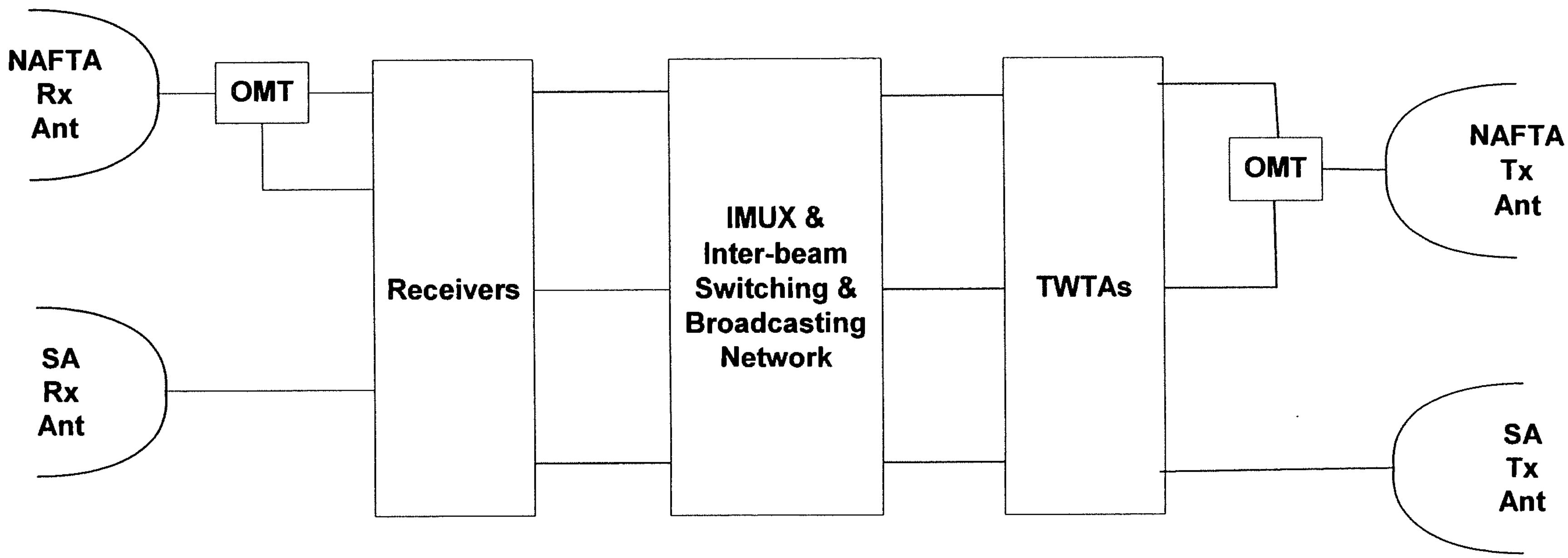


Figure 5-3. Block Diagram for C-Band Payload System

5.1.5. EIRP and G/T Parameters

Tables 5-3 through 5-6 provide summaries of the predicted EIRP and G/T performance respectively.

Table 5-3. EIRP Summary for the C-band NAFTA Beam

	NAFTA-Beam*						
	CONUS	Hawaii	Alaska	Canada	Mexico	Puerto Rico	Carib-bean
Amplifier Output Power (Watts)	37	37	37	37	37	37	37
Amplifier Output Power (dBW)	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Net Output Losses (dB)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Antenna Input Power (dBW)	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Antenna Gain at EOC (dBi)	26.0	20.5	22.5	22.5	20.5	21.5	21.5
EOC EIRP (dBW)	39.2	33.7	35.7	35.7	33.7	34.7	34.7

* Values shown for NAFTA beam are for 36 MHz transponders. For the 72 MHz transponders, the single carrier saturation EIRP levels are expected to be 4.5dB higher.

Table 5-4. EIRP Summary for the C-band South America Beam

	South America Beam
Amplifier Output Power (Watts)	100
Amplifier Output Power (dBW)	20
Net Output Losses (dB)	2.5
Antenna Input Power (dBW)	17.5
Antenna Gain at EOC (dBi)	24.5
EOC EIRP (dBW)	42.0

Table 5-5. G/T Summary for the C-band NAFTA Beam

	NAFTA-Beam						
	CONUS	Hawaii	Alaska	Canada	Mexico	Puerto Rico	Carib-bean
Antenna Gain at EOC (dBi)	26.0	26.0	26.0	20.0	20.0	22.0	20.0
Transponder Noise Temperature (K) *	735	735	735	735	735	735	735
Transponder Noise temperature (dBK)	28.7	28.7	28.7	28.7	28.7	28.7	28.7
EOC G/T (dB/K)	-2.7	-7.7	-6.7	-8.7	-8.7	-6.7	-8.7

* Worst-case temperature referenced at output of spacecraft receive antenna with earth Temp = 290 K.

Table 5-6. G/T Summary for the C-band South America Beam

	South America Beam
Antenna Gain at EOC (dBi)	24.4
Transponder Noise Temperature (K) *	735
Transponder Noise temperature (dBK)	28.7
EOC G/T (dB/K)	-4.3

* Worst-case temperature referenced at output of spacecraft receive antenna with earth Temp = 290 K.

5.1.6. Saturation Flux Density and Transponder Gain

The transponders have individual gain control that is set by command. Table 5-7 shows the channel gain settings and the corresponding saturation flux densities for the C-Band beams.

Table 5-7. C-Band Transponder Saturation Flux Density and Gain

NAFTA-Beam (CONUS EOC)								
Gain Step Attenuator setting (dB)	0	3	6	9	12	15	18	21
Transponder Saturation Gain[1,2,3] (dB)	117.5	114.5	111.5	108.5	105.5	102.5	99.5	96.5
Saturation Flux Density[3,4] (dBW/m^2)	-92.0	-89.0	-86.0	-83.0	-80.0	-77.0	-74.0	-71.0
SA-Beam (Brazil)								
Gain Step Attenuator setting (dB)	0	3	6	9	12	15	18	21
Transponder Saturation Gain[1,2,3] (dB)	122	119	116	113	110	107	104	101
Saturation Flux Density[3,4] (dBW/m^2)	-92.0	-89.0	-86.0	-83.0	-80.0	-77.0	-74.5	-71.0

(1) Gain is from output of receiving antenna to input of transmit antenna.
(2) Attenuator setting selectable by ground command
(3) Gains and Saturation Flux Densities rounded to the nearest 0.5 dB
(4) For the 72 MHz transponders, the SFD level corresponds to the 3 dB OBO level for the 100-W TWTAs.
(5) Gain is adjustable in 1 dB steps.

5.1.7. Transponder Receive Channel Filter Response Characteristics

The receive out of band response is defined as the response from the input antenna to the input of the final amplifier. The receive response will be a minimum of 20 dB below center frequency response for signals greater than ±23 MHz from center frequency and greater than 22 dB below center frequency for signals greater than ±30 MHz from center frequency.

5.1.8. Transponder Transmit Channel Filter Response Characteristics

The transmit response is defined as the response from the input of the final amplifier to the output of the transmit antenna. The transmit response will be greater than 10 dB below center frequency response for signals greater than ±23 MHz from center frequency and greater than 22 dB below center frequency for signals greater than ±30 MHz from center frequency.

5.2. KU-BAND COMMUNICATIONS SUBSYSTEM

The primary functions of the Ku-Band payload is to:

a) Receive a communications signal within a channel, amplify, frequency translate, and retransmit the signal without introducing significant distortion or noise. The payload functions as a "transparent" repeater.
b) Provide 36 transponders at Ku-Band, each with 36 MHz of usable bandwidth - twenty-four for the NAFTA beam and twelve for the South America beam. The total bandwidth of 1500MHz is derived by frequency reuse that in turn is enabled by using spatial and polarization separation of the beams. On-board switches provide the beam-to-beam interconnectivities. Each transponder will contain commandable gain-step attenuators and automatic gain control to mitigate the effect of uplink rain fade.
c) Upon ground command adjust repeater gain in 1 dB steps, switch between redundant units, and configure the payload to meet operational requirements.

5.2.1. Capacity

The 24 Ku-Band transponders for the NAFTA beam provide 864 MHz of usable bandwidth (1000 MHz including guard bands), while the 12 Ku-band transponders for the South America beam provide 432 MHz of usable bandwidth (500 MHz including guard bands). The TWTAs for each of these transponders provide 130 W at single-carrier saturation. The power subsystem for the spacecraft is sized to provide simultaneous operation of all transponders at saturation for a minimum of 15 years with 100% eclipse operation.

5.2.2. Transponder Frequency and Polarization Plan

Spatial and polarization isolation are used to obtain 3 times re-use of the Ku-band spectrum. The Ku-Band transponders for both the NAFTA and South America beams will transmit (downlink) in the 11700 – 12200 MHz frequency range and receive (uplink) in the 14000 – 14500 MHz frequency range. Thirty-six transponders each with a usable bandwidth of 36 MHz are provided.

The proposed frequency and polarization plan is illustrated in Figures 5-4 and 5-5 and show:

1. Center frequency for each transponder
2. Bandwidth for each transponder
3. Polarization to be used for each transponder
4. Beacon frequencies

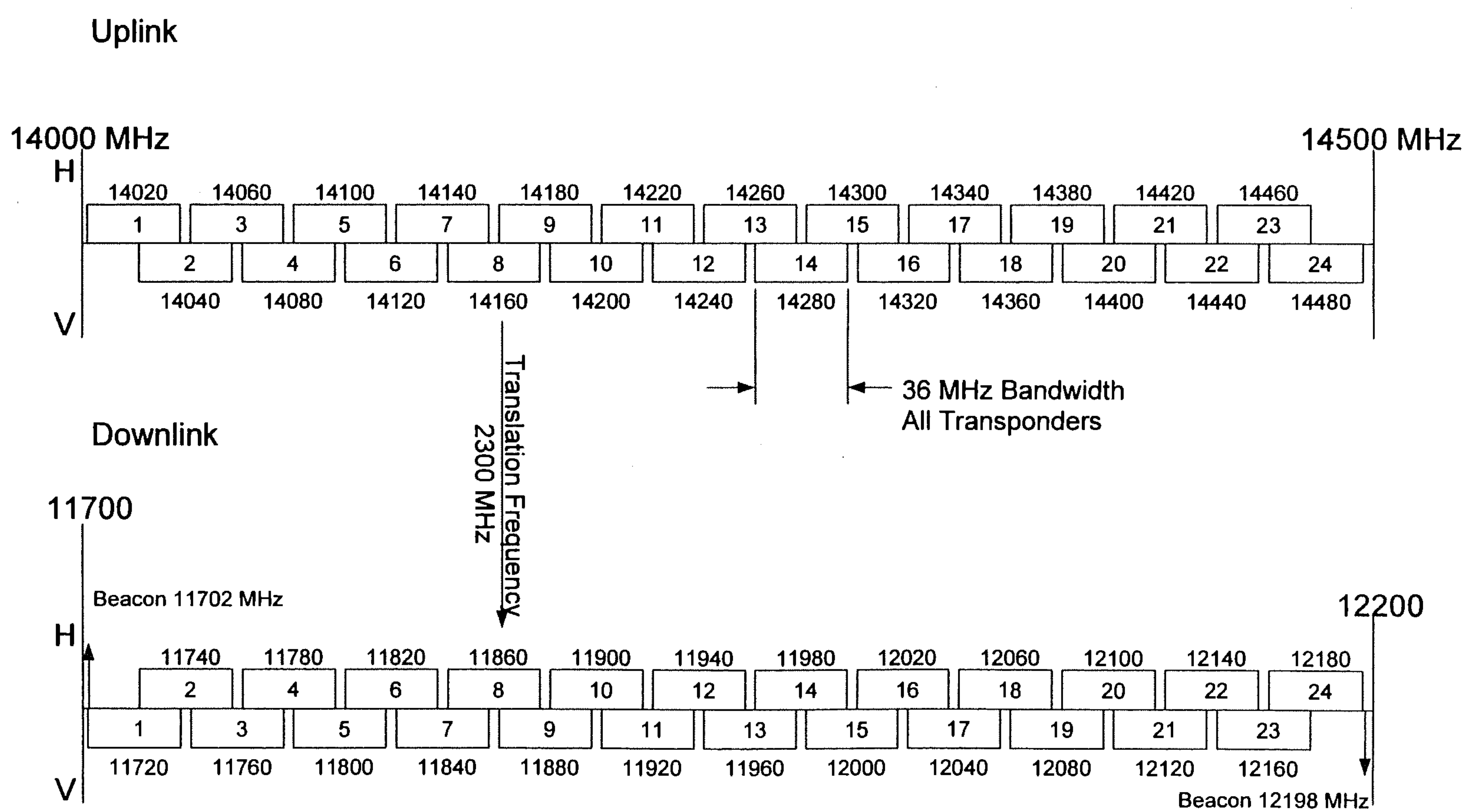


Figure 5-4. Frequency Plan for Ku-Band NAFTA Beam

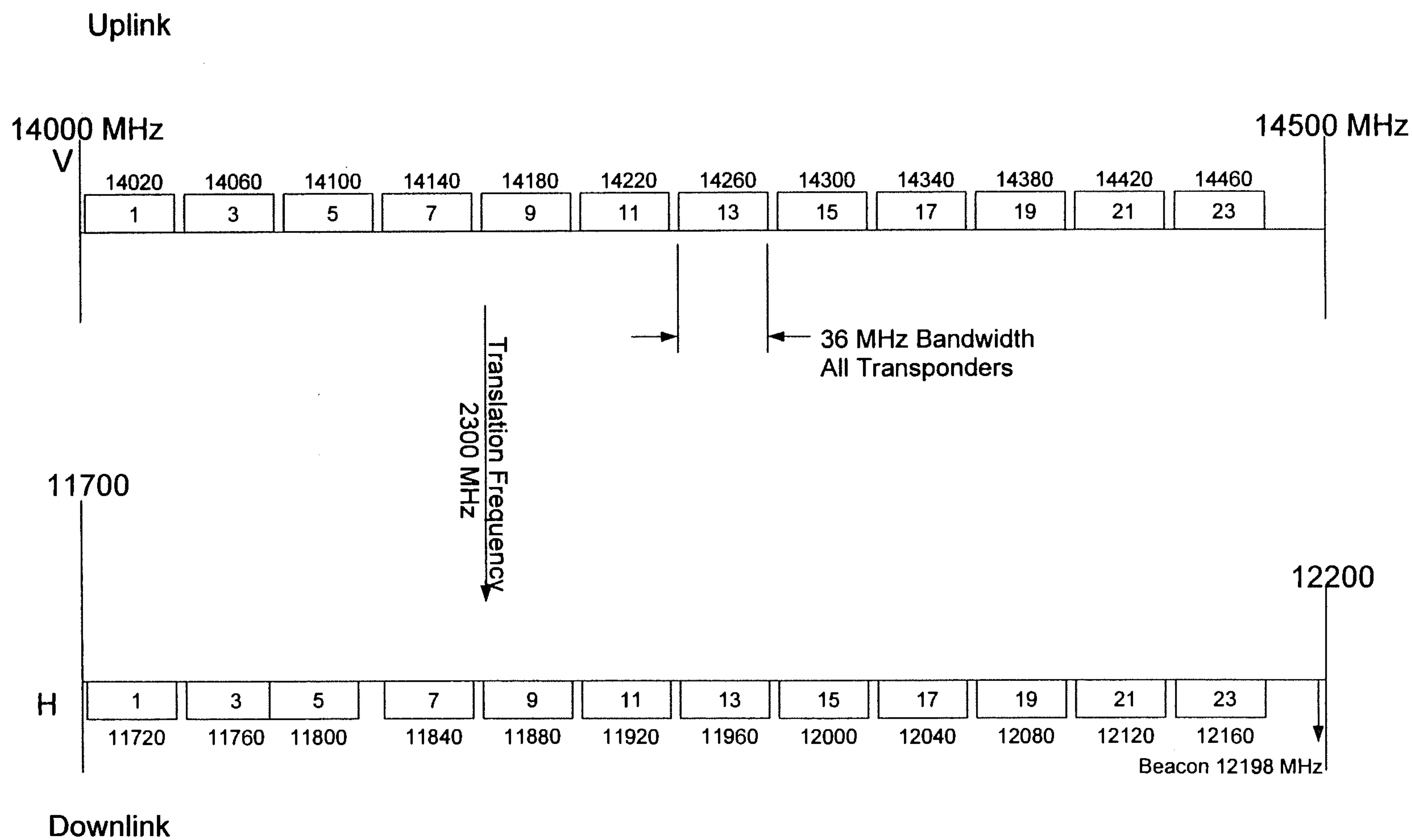


Figure 5-5. Frequency Plan for Ku-Band South America Beam

5.2.3. Types of Emissions

The 36-MHz transponders of the Ku-band payload are expected to handle a wide variety of digital traffic from narrowband data to wideband video. Some FM TV traffic is also expected to be loaded in the Ku-band transponders. Table 5-8 below provides some of the important characteristics of these signals.

Table 5-8. Emission Designators for Ku-band

Signal	Emission Designators	Allocated Bandwidth
Wideband Digital	27M0G7W, 32M0G7W	32.4 MHz, 36 MHz
Medium-band Digital	5M00G7W, 3M00G7W, 1M98G7W	6 MHz, 3.6 MHz, 2.4 MHz
Narrowband Digital Data	128KG7W, 44K1G1D	155 kHz, 55 kHz
FM-TV	32M0F9W, 27M0F9W	36 MHz, 32.4 MHz
Command	1M00F9D	1.5 MHz
Telemetry / Ranging	144KG9D, 200KG9D, 200KG8X	175 kHz, 240 kHz
Tracking	25K0NON, 144KG9D, 200KG9D	40 kHz, 175 kHz, 240 kHz

5.2.4. Ku-Band Subsystem Configuration

Figure 5-6 shows the block diagram of the Ku-Band communications subsystem.

A shaped-reflector Gregorian antenna provides NAFTA receive coverage. A similar antenna provides the NAFTA transmit coverage. The antennas have associated sub-reflectors, and corrugated horn antenna feeds that in turn are connected to dual-mode junctions. This approach provides nearly identical performance for both polarizations and excellent cross-polarization isolation performance.

A single Gregorian antenna with dual polarization whose main- and sub- reflectors are shaped serves both the transmit and receive functions for the South America coverage. The polarizing elements are derived from ortho-mode junctions, which provide horizontally and vertically polarized signals.

Low-noise receivers, arranged in a 5-for-3 redundancy ring, amplify each set of signals, which are subsequently mixed with a local oscillator (LO) signal at 2300 MHz, translating them to the 12-GHz common intermediate frequency (IF) band. After down conversion the signals are applied through a channel-dropping network to filters that demultiplex them into individual channels. Two NAFTA channels and two South America channels are fed into a network, which provides inter-beam connectivity and broadcasting capability. The signals for these and all of the remaining channels are then routed to Channel Amplifiers and TWTAs, which are configured in three redundancy rings of 15-for-12. The channel Amplifiers provide corrections for the TWTA non-linearities and contain commandable attenuators that control channel gain and saturation flux density. The TWTAs are connected through R-switches to the OMUXes, two of which are for the NAFTA beams and one of which is for the South America beam. The OMUXes are of a contiguous channel configuration, each containing the 12 channels for one polarization. After filtering in the OMUX, the signals are routed through test couplers to the transmit antennas.

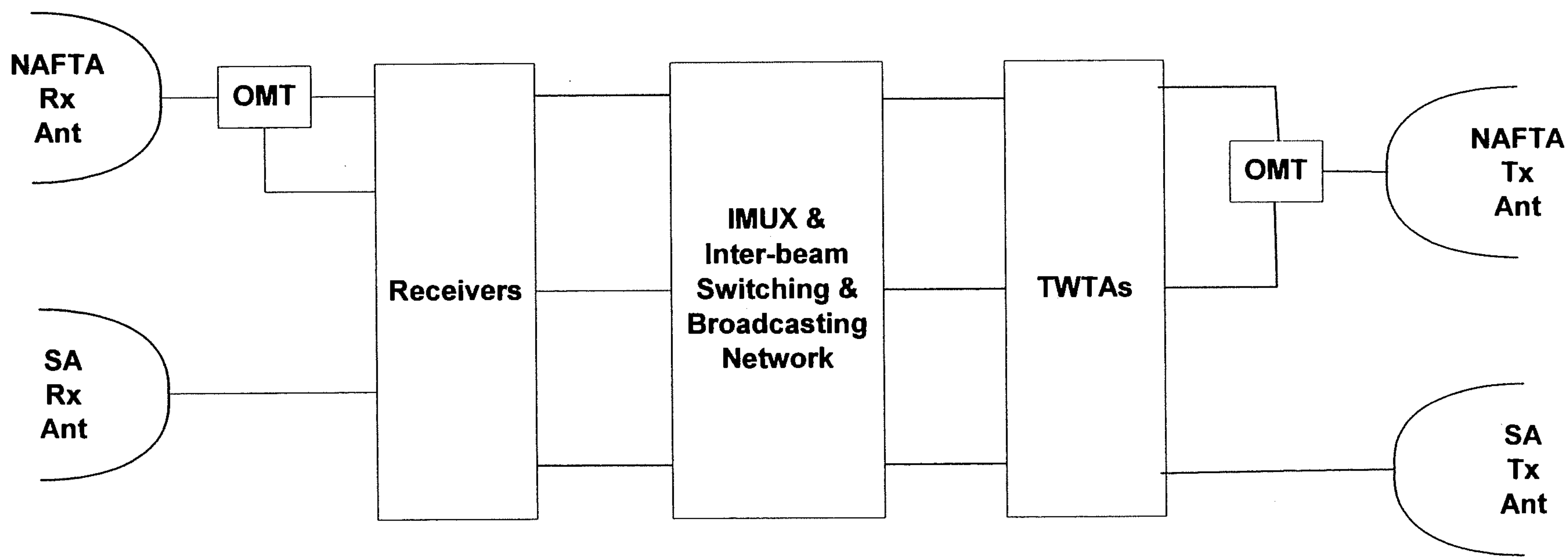


Figure 5-6. Block Diagram for Ku-Band Payload System

5.2.5. EIRP and G/T Parameters

Tables 5-9 through 5-12 provide summaries of the predicted EIRP and G/T performance, respectively.

Table 5-9. EIRP Summary for the Ku-band NAFTA Beam

	NAFTA-Beam							
	SE CONUS	CONUS	Hawaii	Alaska	Canada	Mexico	Puerto Rico	Carib-bean
Amplifier Output Power (Watts)	130	130	130	130	130	130	130	130
Amplifier Output power (dBW)	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Net Output Losses (dB)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Antenna Input Power (dBW)	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6
Antenna Gain at (EOC) (dBi)	31.4	29.0	26.0	23.0	24.0	24.0	25.0	24.0
EOC EIRP (dBW)	50.0	47.6	44.6	41.6	42.6	42.6	43.6	42.6

Table 5-10. EIRP Summary for the Ku-band South America Beam

	South America Beam	
	Brazil Coast	Interior
Amplifier Output Power (Watts)	130	130
Amplifier Output power (dBW)	21.1	21.1
Net Output Losses (dB)	2.5	2.5
Antenna Input Power (dBW)	18.6	18.6
Antenna Gain at (EOC) (dBi)	29.0	25.7
EOC EIRP (dBW)	47.6	44.3

Table 5-11. G/T Summary for the Ku-Band NAFTA Beam

	NAFTA-Beam							
	SE CONUS	CONUS	Hawaii	Alaska	Canada	Mexico	Puerto Rico	Carib-bean
Antenna Gain at EOC (dBi)	29.8	27.8	27.3	21.8	23.8	22.8	25.8	23.8
Transponder Noise Temperature (K) *	750	750	750	750	750	750	750	750
Transponder Noise temperature (dBK)	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
G/T (dB/K)	1.0	-1.0	-1.5	-7.0	-5.0	-6.0	-4.0	-6.0

* Worst-case temperature referenced at output of spacecraft receive antenna with earth Temp = 290 K.

Table 5-12. G/T Summary for the Ku-Band South America Beam

	South America Beam	
	Brazil Coast	Interior
Antenna Gain at EOC (dBi)	30.0	27.0
Transponder Noise Temperature (K) *	750	750
Transponder Noise temperature (dBK)	28.8	28.8
G/T (dB/K)	1.2	-1.8

* Worst-case temperature referenced at output of spacecraft receive antenna with earth Temp = 290 K.

5.2.6. Saturation Flux Density and Transponder Gain

The transponders have individual gain control that is set by command. Table 5-13, shows the channel gain settings and the corresponding saturation flux densities for the Ku-Band.

Table 5-13. Saturation Flux Density and Gain for NAFTA and South America Beams

NAFTA-Beam (CONUS EOC)								
Gain Step Attenuator setting (dB)	0	3	6	9	12	15	18	21
Transponder Saturation Gain[1,2,3] (dB)	134	131	128	125	122	119	116	113
Saturation Flux Density[3] (dBW/m^2)	-98.0	-95.0	-92.0	-89.0	-86.0	-83.0	-80.0	-77.0
South America Beam (EOC)								
Gain Step Attenuator setting (dB)	0	3	6	9	12	15	18	21
Transponder Saturation Gain[1,2,3] (dB)	135.0	132.0	129.0	126.0	123.0	120.0	117.0	114.0
Saturation Flux Density[3] (dBW/m^2)	-98.0	-95.0	-92.0	-89.0	-86.0	-83.0	-80.0	-77.0

(1) Gain is from output of receiving antenna to input of transmit antenna.
(2) Attenuator setting selectable by ground command
(3) Gains and Saturation Flux Densities rounded to the nearest 0.5 dB
(4) Gain is adjustable in 1 dB steps.

5.2.7. Transponder Receive Channel Filter Response Characteristics

The receive out-of-band response is defined as the response from the input antenna to the input of the final amplifier. The receive response will be a minimum of 20 dB below center frequency response for signals greater than ±23.5 MHz from center frequency and greater than 40 dB below center frequency for signals greater than ±42 MHz from center frequency.

5.2.8. Transponder Transmit Channel Filter Response Characteristics

The transmit response is defined as the response from the input of the final amplifier to the output of the transmit antenna. The transmit response will be greater than 3 dB below center frequency response for signals greater than ±27 MHz from center frequency and greater than 25 dB below center frequency for signals greater than ±40 MHz from center frequency.

5.3. KA-BAND COMMUNICATIONS SUBSYSTEM

The primary functions of the Ka-Band payload are to:

a) Receive a communications signal within a channel, amplify, frequency translate, and retransmit the signal without introducing significant distortion or noise. The payload functions as a "transparent" repeater.
b) For CONUS, provide 24 uplink spot beams, each with a bandwidth of 72 MHz and 4 downlink spot beams, each with a bandwidth of 500 MHz.
c) The total bandwidth of approximately 2000 MHz is derived by frequency reuse (4 X frequency reuse) that in turn is enabled by using spatial and polarization separation of the beams.
d) Upon ground command adjust repeater gain in 1 dB steps, switch between redundant units, and configure the payload to meet operational requirements.

5.3.1. Capacity

The Ka-Band transponders provide 1728 MHz of usable bandwidth for the CONUS spot beams (2000 MHz including guard bands). The TWTAs for each downlink beam are capable of 120 Watts at single-carrier saturation; if the Ka-band repeater is loaded with multi-carrier traffic, the TWTAs are expected to be operated at 3 to 5 dB OBO. The power subsystem will be sized to provide simultaneous operations of all transponders at 3 to 5 dB OBO for a minimum of 15 years with 100% eclipse operation.

5.3.2. Transponder Frequency and Polarization Plan

Spatial and polarization isolation are used to obtain 4 times re-use of the Ka-band spectrum across CONUS. The Ka-band transponders for both the CONUS beams will transmit (downlink) in the 19700 – 20200 MHz frequency range and receive (uplink) in the 29500 – 30000 MHz frequency range. Six of the uplink spot beams, each of which operates over a separate 72 MHz channel, are combined in a single downlink beam, whose bandwidth is 500 MHz. Thus, the 24 uplink beams are connected to the 4 downlink beams in groups of six.

The proposed frequency and polarization plan is illustrated in Figure 5-7 and show:

1. Center frequency for each transponder
2. Bandwidth for each transponder
3. Polarization to be used for each transponder
4. Beacon frequencies

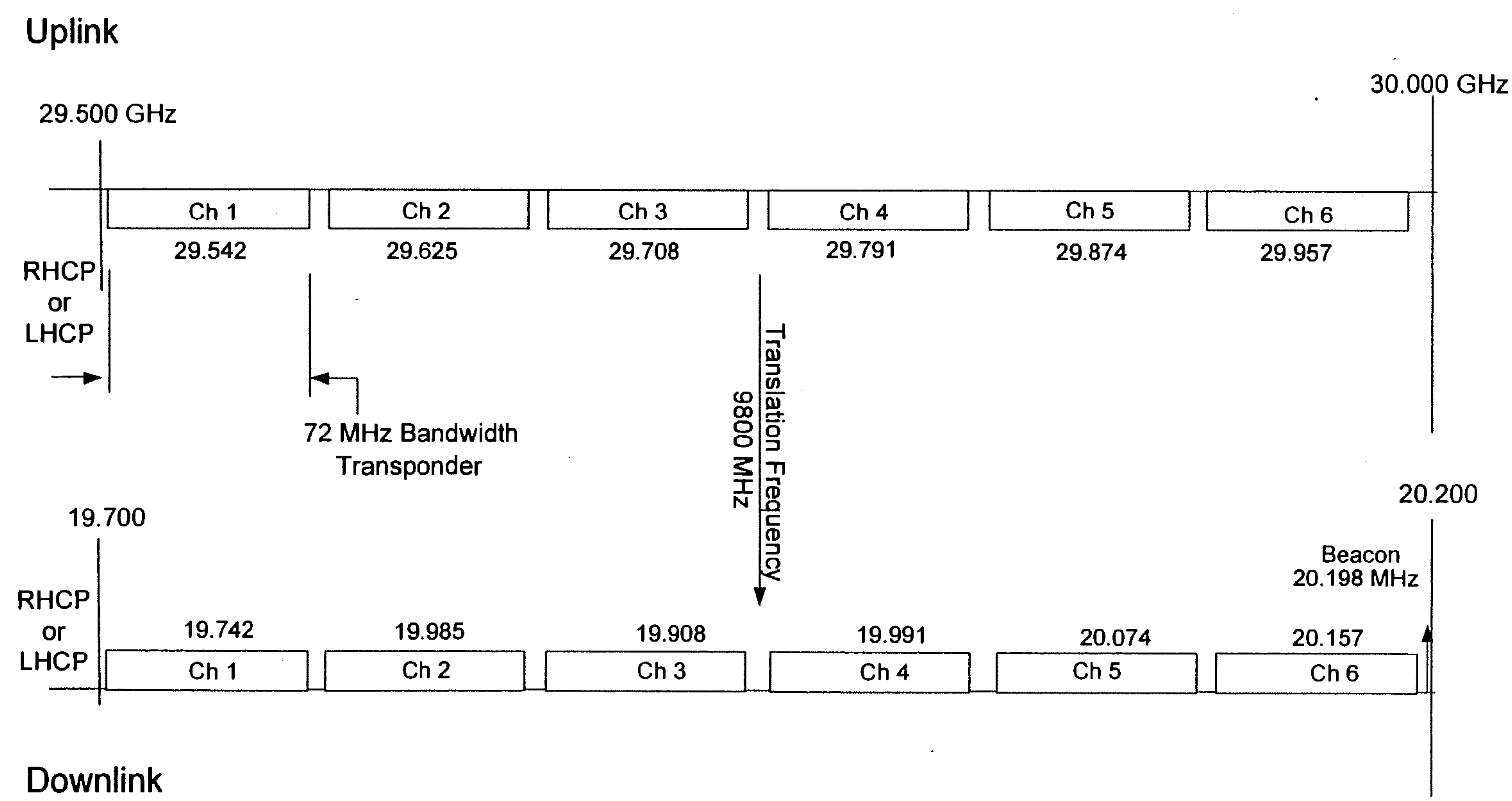


Figure 5-7. Frequency Plan for the Ka-Band Payload

5.3.3. Types of Emissions

The 72-MHz transponders of the Ku-band payload are expected to handle a wide variety of digital traffic from narrowband data to wideband video. Table 5-14 below provides some of the important characteristics of these signals.

Table 5-14. Emission Designators for Ka-band

Signal	Emission Designators	Allocated Bandwidth
Wideband Digital	27M0G7W, 30M0G7W, 60 M0G7W	32.4 MHz, 36 MHz, 72 MHz
Medium-band Digital	5M00G7W, 3M00G7W, 1M98G7W	6 MHz, 3.6 MHz, 2.4 MHz
Narrowband Digital Data	128KG7W, 64K0G7W, 44K1G1D	155 kHz, 76 kHz, 55 kHz
Tracking	25K0NON	40 kHz

5.3.4. Ka-Band Subsystem Configuration

Figure 5-8 shows the block diagram of the Ka-Band communications subsystem.

The 24 uplink spot beams covering CONUS are derived from 3 separate Gregorian antennas. The four downlink spot beams are generated by a fourth Gregorian antenna.

Low-noise amplifiers (LNAs), arranged in a 2-for-1 redundancy ring, are placed at the output of each feed. There are 24 active Ka-band LNAs – one for each uplink spot beam. After amplification, the signals are routed to four 6-channel multiplexers (MUXes), which combine six 72 MHz channels into a single 500 MHz channel. The output of the MUX is fed into a mixer along with a local oscillator (LO) signal at 9800 MHz for translation to the 19.7-20.2 GHz frequency range. After down conversion the signals are then routed to a wideband amplifiers and TWTAs, which are configured in a redundancy ring of 6-for-4. The wideband amplifiers provide corrections for the TWTA non-linearities and contain commandable attenuators that control transponder gain and saturation flux density. The TWTA outputs are connected through R-switches to the four transmit antenna ports.

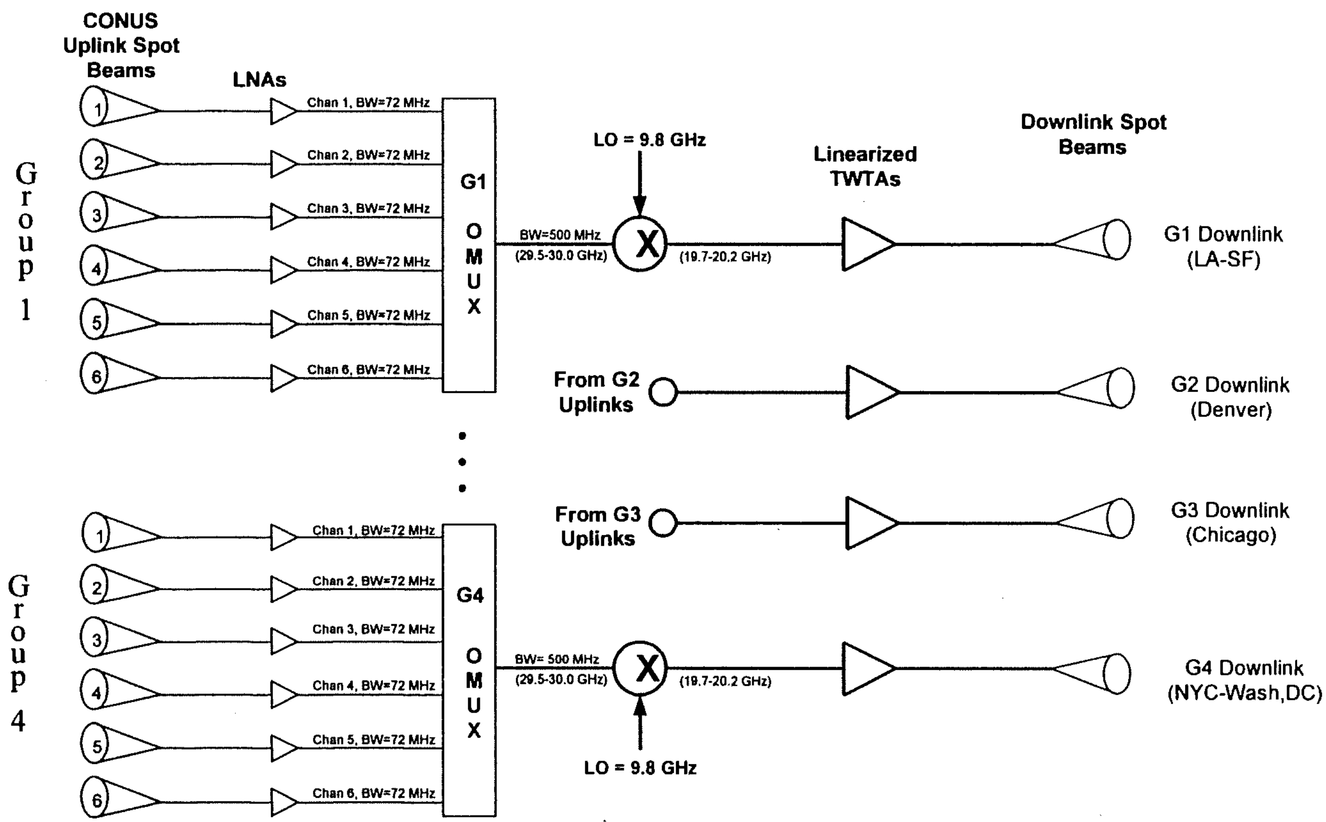


Figure 5-8. Block Diagram for Ku-Band Payload System

5.3.5. EIRP and G/T Parameters

Tables 5-15 and 5-16 provide summaries of the predicted EIRP and G/T performance, respectively.

Table 5-15. EIRP Summary for the Ka-band Spot Beams

	Ka-Band Downlink Beams			
	LA-SF	Denver	Chicago	NYC-WASH DC
Amplifier Output Power (Watts)	120	120	120	120
Amplifier Output power (dBW)	20.8	20.8	20.8	20.8
Net Output Losses (dB)	2.8	2.8	2.8	2.8
Antenna Input Power (dBW)	18.0	18.0	18.0	18.0
Antenna Gain at EOC* (dBi)	41.0	41.0	41.0	41.0
EOC EIRP (dBW)	59.0	59.0	59.0	59.0

* EOC defined here as gain contour which is 3 dB below beam peak.

Table 5-16. G/T Summary for the Ka-Band Spot Beams

	Uplink Ka-Band Spot Beam	
	Inner Coverage	Outer Coverage
Antenna Gain at Inner EOC (dBi)	40.8	38.8
Transponder Noise Temperature (K) *	750	750
Transponder Noise temperature (dBK)	28.8	28.8
G/T (dB/K)	12.0	10.0

* Worst-case temperature referenced at output of spacecraft receive antenna with earth Temp = 290 K.

5.3.6. Saturation Flux Density and Transponder Gain

The transponders have individual gain control that is set by command. Table 2-12, shows the channel gain settings and the corresponding saturation flux densities for the Ka-Band beams.

Table 5-17. Saturation Flux Density and Gain for the Ka-Band Spot Beams

Ka-Band Spot Beam (Inner EOC)								
Gain Step Attenuator setting (dB)	0	3	6	9	12	15	18	21
Transponder Saturation Gain[1,2,3] (dB)	131.0	128.0	125.0	122.0	119.0	116.0	113.0	110.0
Saturation Flux Density[3] (dBW/m^2)	-103.0	-100.0	-97.0	-94.0	-91.0	-88.0	-85.0	-82.0

(1) Gain is from output of receiving antenna to input of transmit antenna.
(2) Attenuator setting selectable by ground command
(3) Gains and Saturation Flux Densities rounded to the nearest 0.5 dB
(4) Gain is adjustable in 1 dB steps.

5.3.7. Transponder Receive Channel Filter Response Characteristics

The receive out-of-band response is defined as the response from the input antenna to the input of the final amplifier. The receive response will be a minimum of 20 dB below center frequency response for signals greater than ±23.5 MHz from center frequency and greater than 40 dB below center frequency for signals greater than ±42 MHz from center frequency.

5.3.8. Transponder Transmit Channel Filter Response Characteristics

The transmit response is defined as the response from the input of the final amplifier to the output of the transmit antenna. The transmit response will be greater than 3 dB below center frequency response for signals greater than ±27 MHz from center frequency and greater than 25 dB below center frequency for signals greater than ±40 MHz from center frequency.

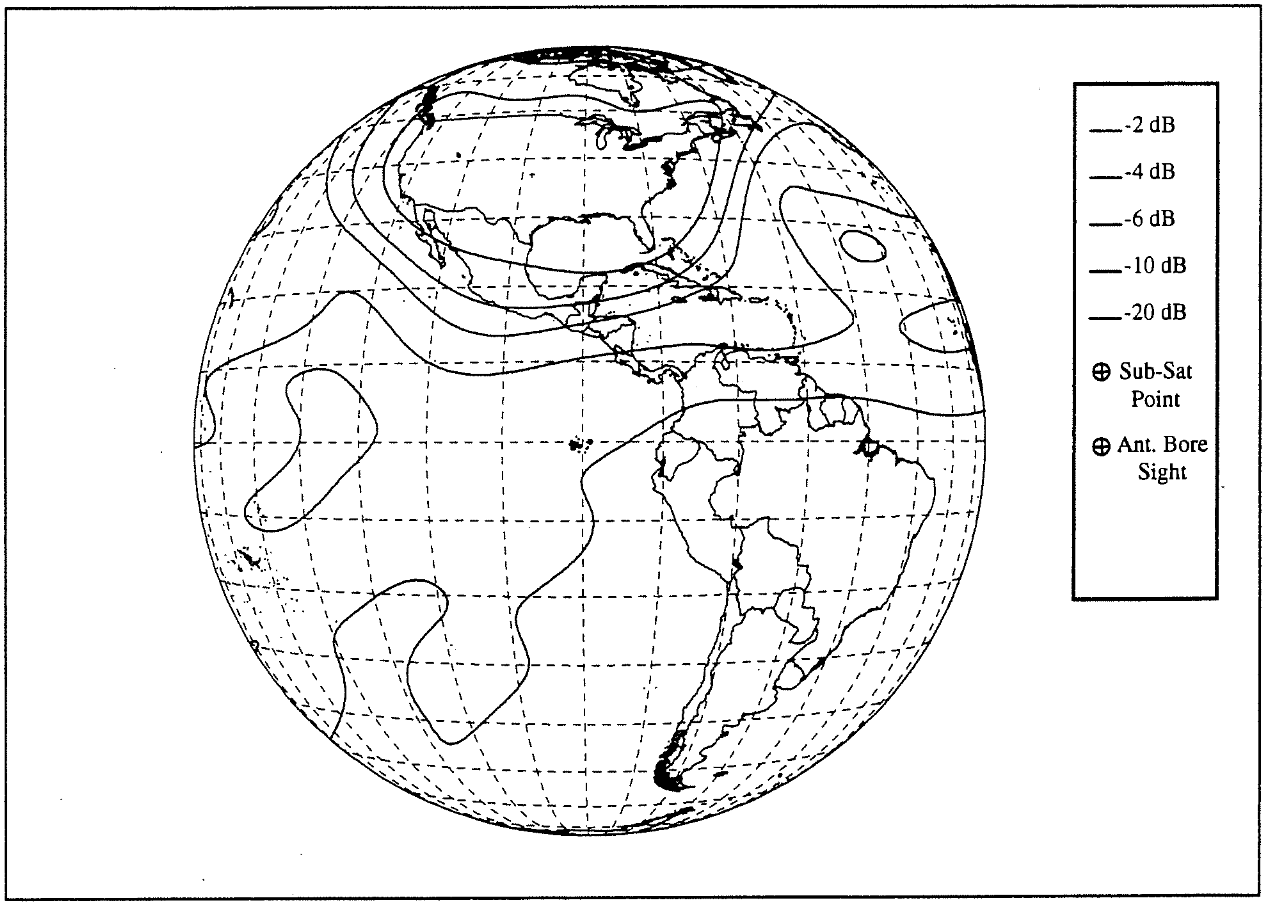
6. ORBITAL POSITION

The Telstar 8 satellite design is optimized for the 89° WL orbital slot, and all of the performance parameters provided herein are applicable when the spacecraft is stationed at 89° WL.

7. ANTENNA COVERAGE PATTERNS

Figures 7-1 through 7-14 show the receive and transmit antenna coverage patterns for the C-band, Ku-band, and Ka-band beams of the Telstar 8 spacecraft. For the C-band and Ku-band beams, the EIRP and G/T contours are presented at the –2 dB, -4 dB, -6 dB, -10 dB, and –20 dB levels. For the sake of clarity, a single G/T contour and a single EIRP contour are provided for the receive and transmit Ka-band spot beams. Inclusion of several contours for each of the beams would render the plot unreadable. Separate plots illustrating the gain roll-off of a single transmit Ka-band beam and a single receive Ka-band have been included.

Telstar 8 (89° W)
C-Band NAFTA EIRP Levels (H & V)
$EIRP_{max}$ = 41.2 dBW

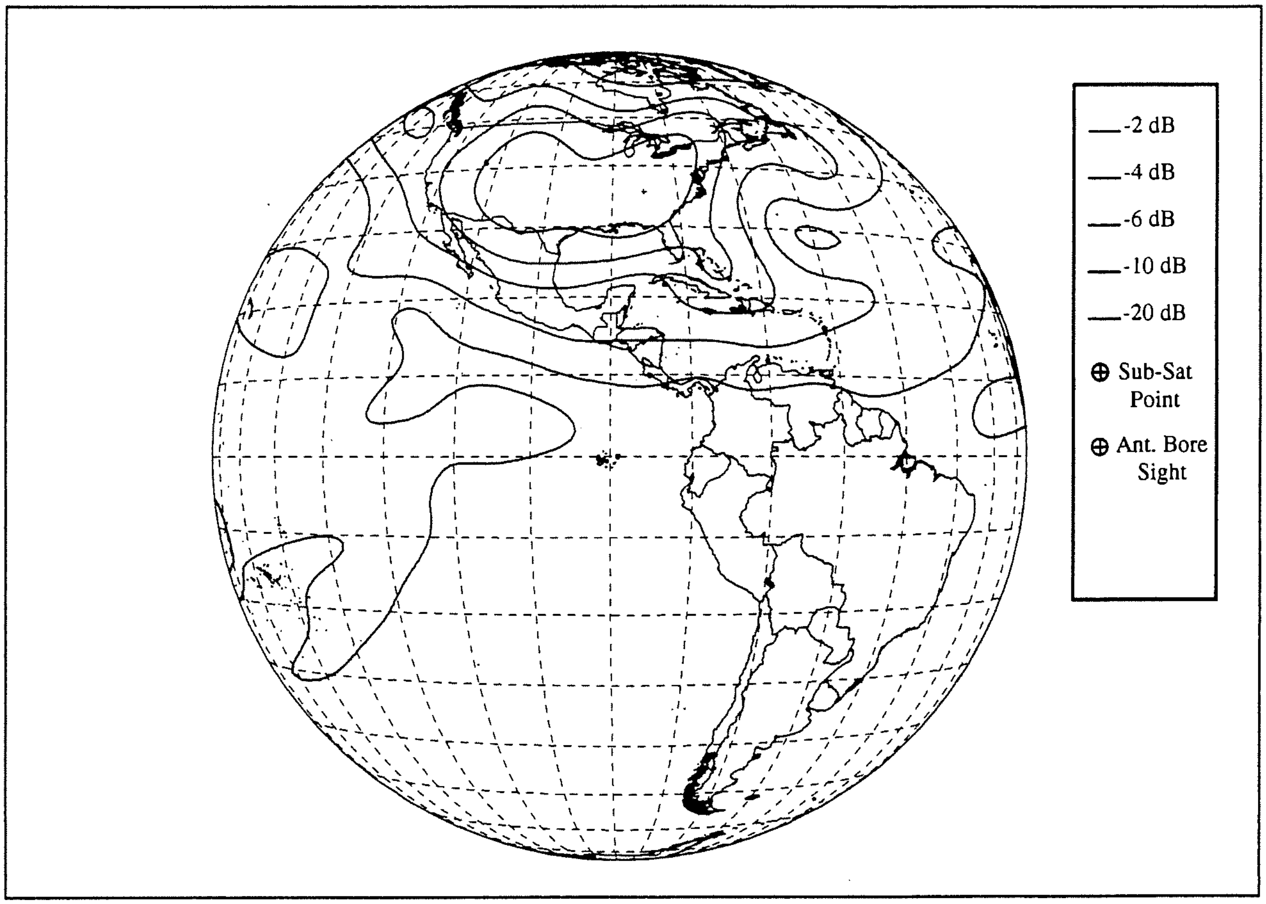


Space Station Transmit Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.
3. Maximum EIRP is 45.7 dBW.
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-1. EIRP Contours for the NAFTA C-band Beam (H & V)

Telstar 8 (89° W)
C-Band NAFTA G/T Levels (H & V)
G/T_{max} = +2.0 dB/K



Space Station Receive Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.

2. Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.

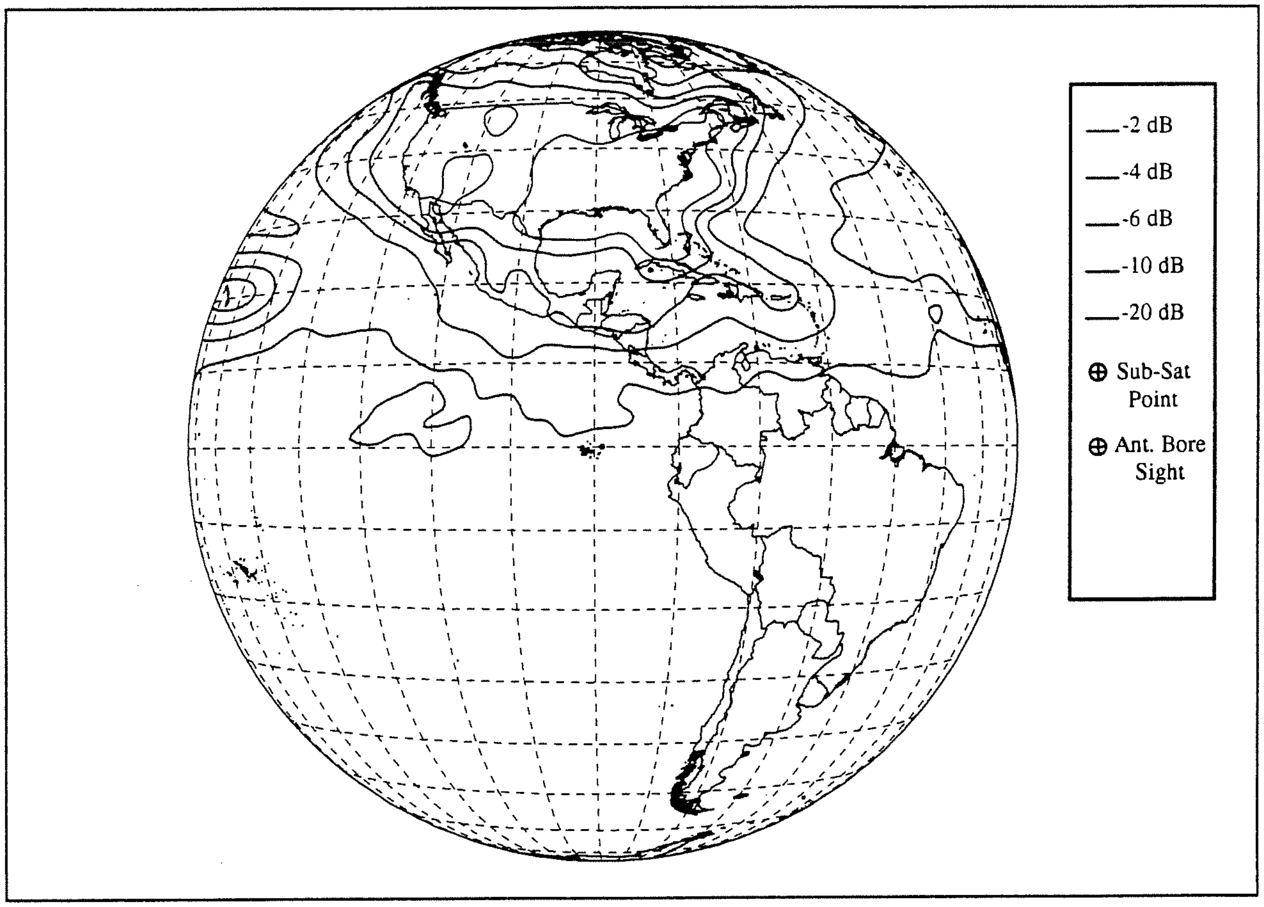
3. CONUS Beam Peak G/T is 2.0 dB/K.

4. Service area consists all visible areas within the -10 dB contour.

5. Does not include antenna pointing error.

Figure 7-2. G/T Contours for the NAFTA C-band Beam (H & V)

Telstar 8 (89° W)
Ku-Band NAFTA EIRP Contours (H & V)
$EIRP_{max}$ = 51.6 dBW

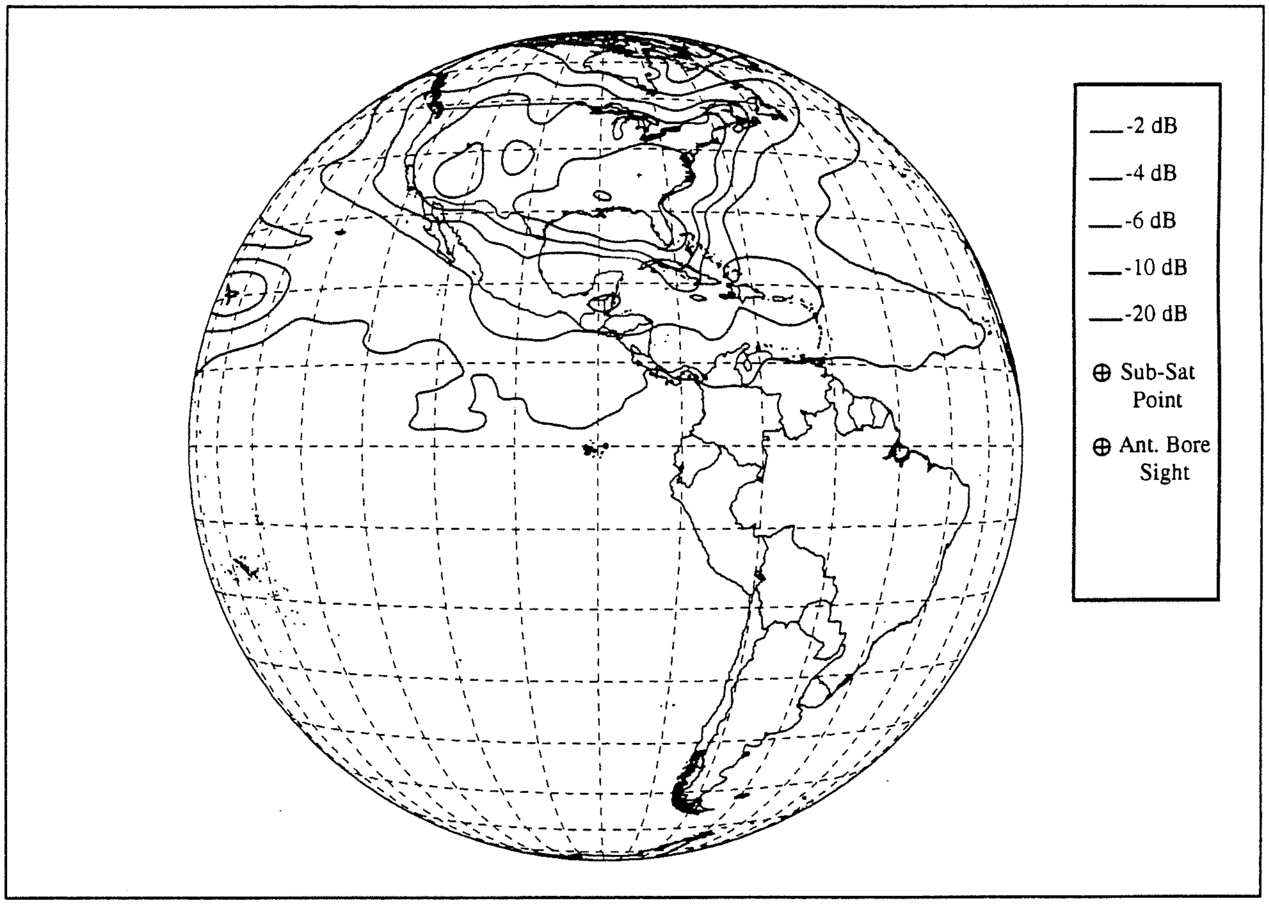


Space Station Transmit Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.
3. Maximum EIRP is 51.6 dBW.
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-3. EIRP Contours for the NAFTA Ku-band Beam (H & V)

Telstar 8 (89° W)
Ku-Band NAFTA G/T Contours (H & V)
G/T_{max} = +4.0 dB/K

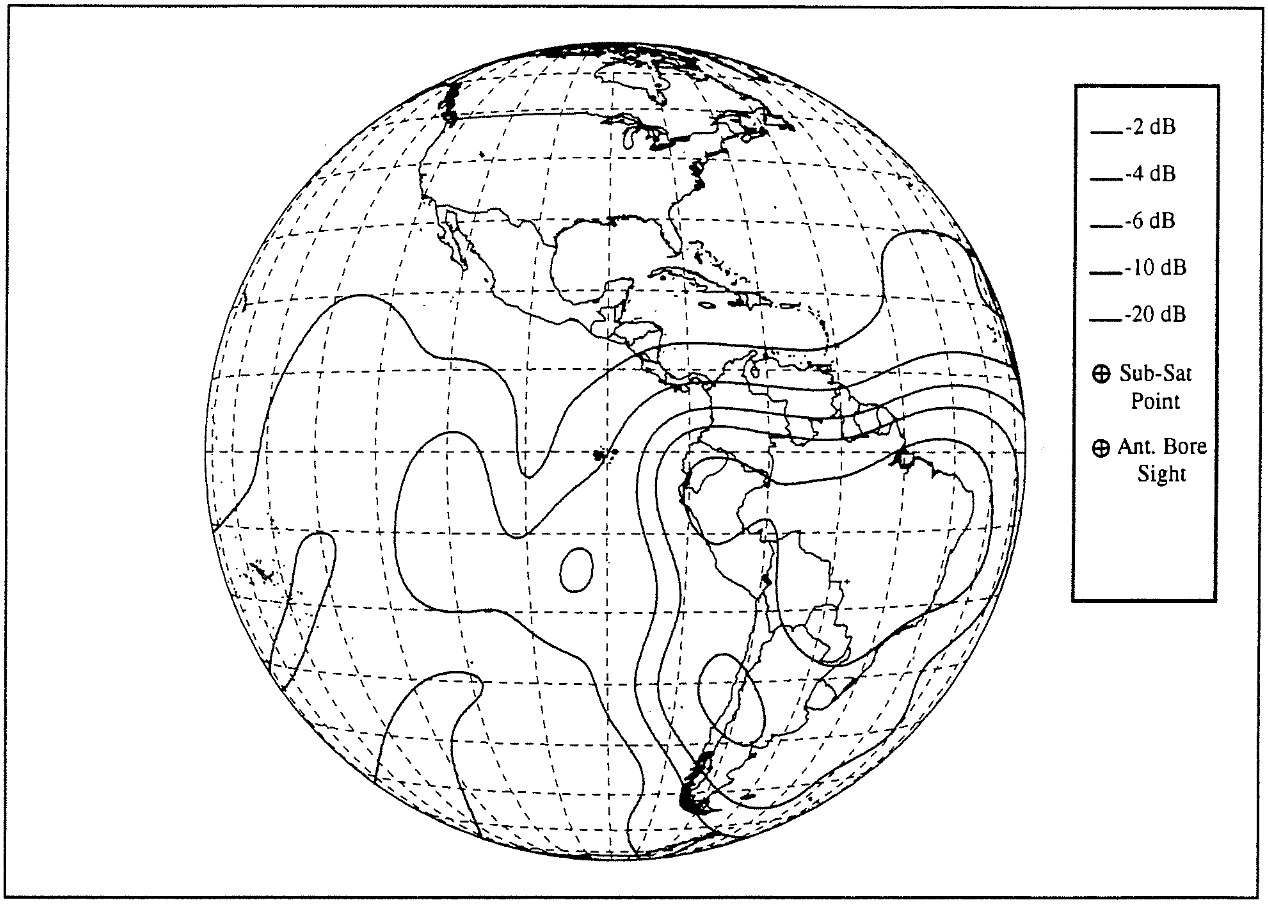


Space Station Receive Antenna
Gain Contours and Service Area

1. **Longitude and Latitude lines shown at 10 degree intervals.**
2. **Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.**
3. **Maximum G/T is 4.0 dB/K.**
4. **Service area consists all visible areas within the -10 dB contour.**
5. **Does not include antenna pointing error.**

Figure 7-4. G/T Contours for the NAFTA Ku-band Beam (H & V)

Telstar 8 (89° W)
C-Band SA Beam EIRP Contours (H)
$EIRP_{max}$ = 45.2 dBW

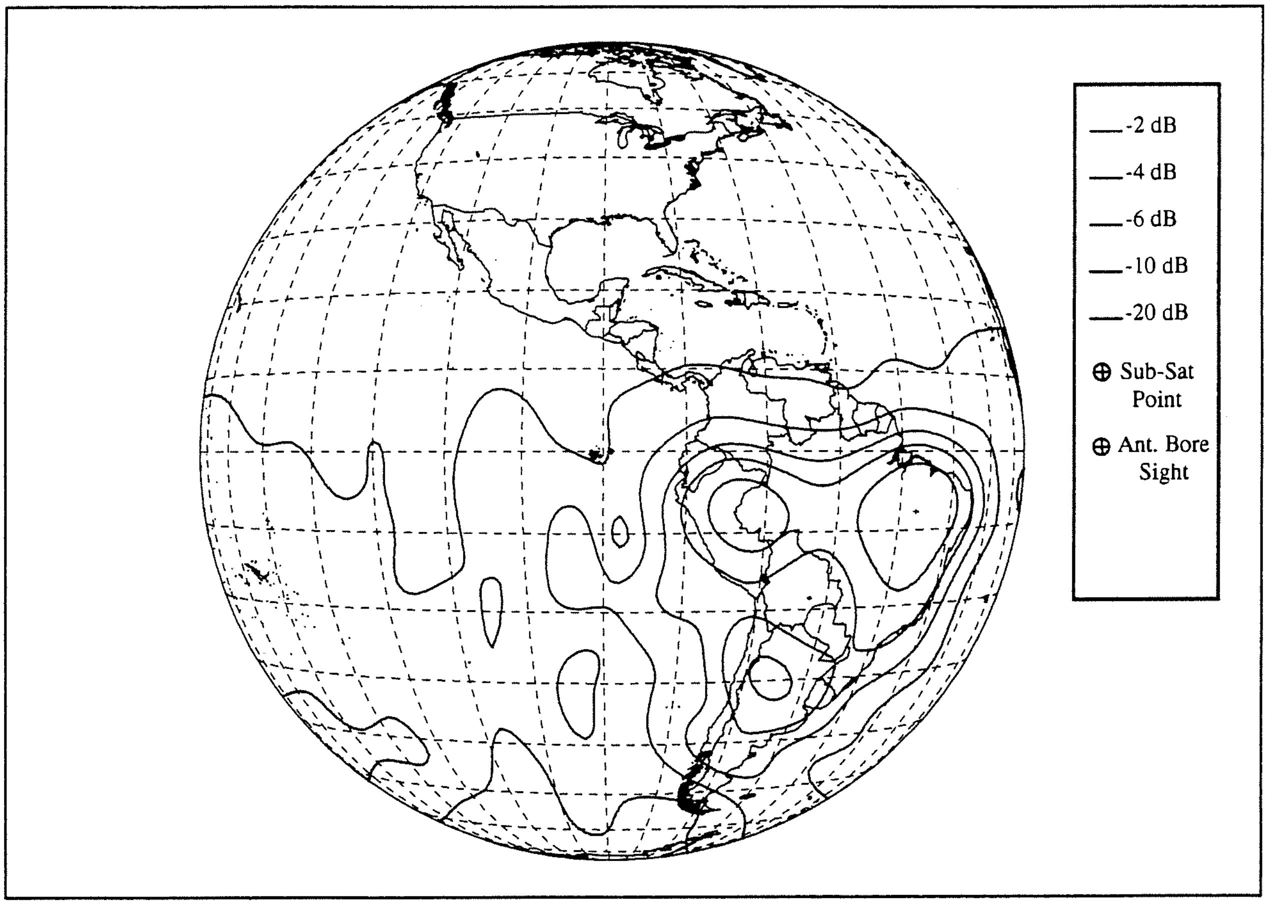


Space Station Transmit Antenna Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.
3. Maximum EIRP is 45.2 dBW.
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-5. EIRP Contours for the South America C-band Beam (H)

Telstar 8 (89° W)
C-Band SA Beam G/T Contours (V)
G/T_{max} = +2.0 dB/K

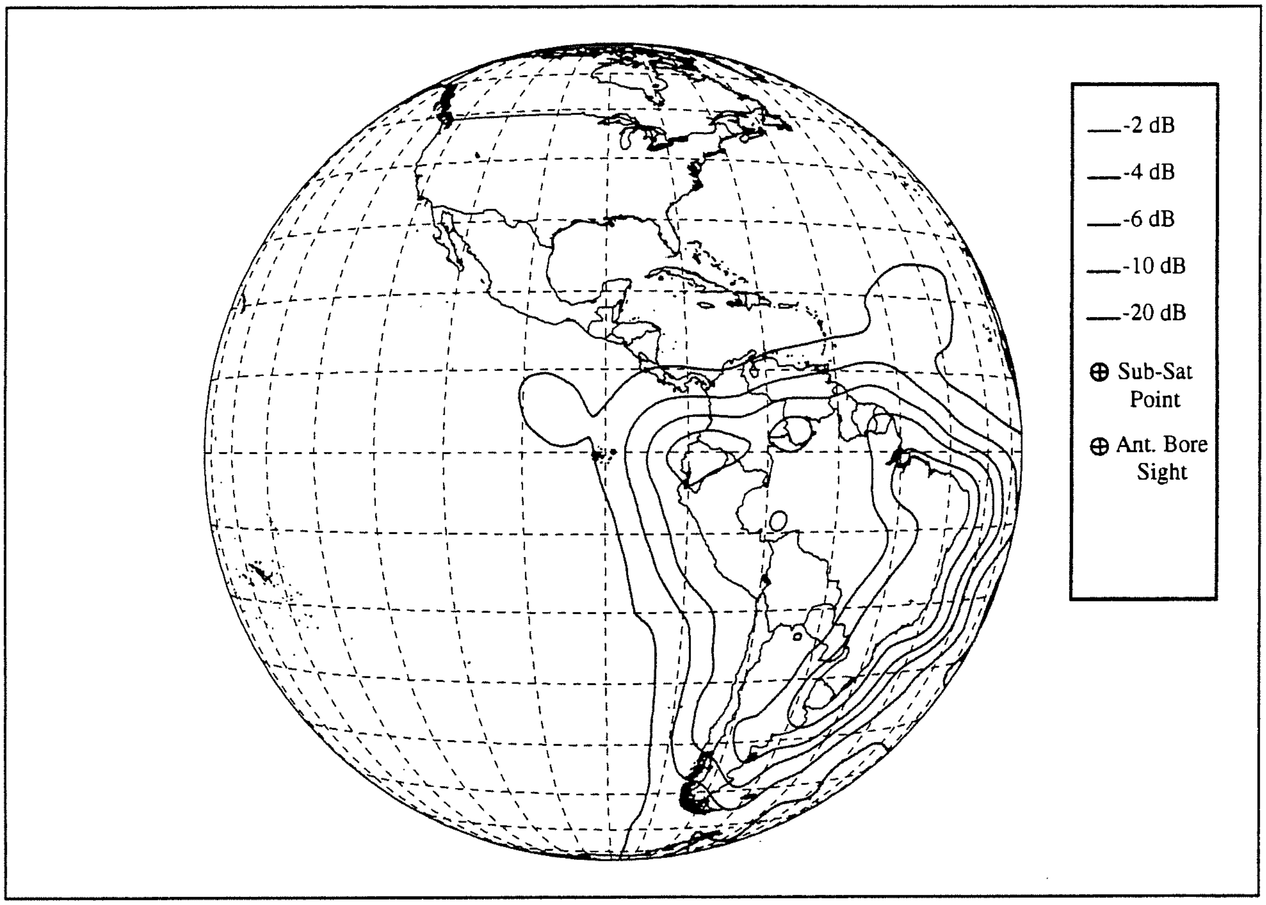


Space Station Transmit Antenna Gain Contours and Service Area

1. **Longitude and Latitude lines shown at 10 degree intervals.**
2. **Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.**
3. **Maximum G/T is 2.0 dB/K.**
4. **Service area consists all visible areas within the -10 dB contour.**
5. **Does not include antenna pointing error.**

Figure 7-6. G/T Contours for the South America C-band Beam (V)

Telstar 8 (89° W)
Ku-Band SA Beam EIRP Contours (H)
$EIRP_{max}$ = 51.6 dBW

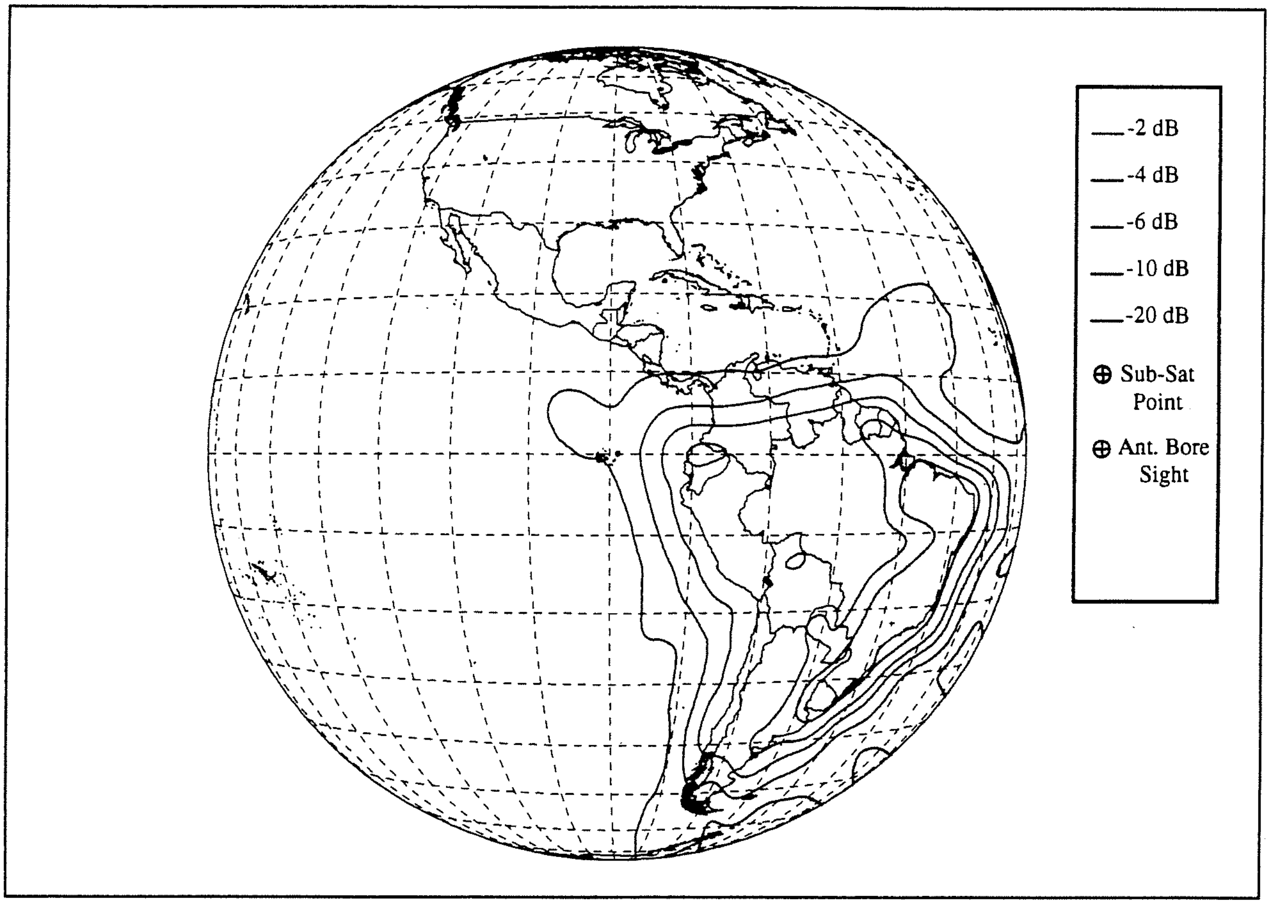


Space Station Transmit Antenna Gain Contours and Service Area

1. **Longitude and Latitude lines shown at 10 degree intervals.**
2. **Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.**
3. **Maximum EIRP is 51.6 dBW.**
4. **Service area consists all visible areas within the -10 dB contour.**
5. **Does not include antenna pointing error.**

Figure 7-7. EIRP Contours for the South America Ku-band Beam (H)

Telstar 8 (89° W)
Ku-Band SA Beam G/T Contours (V)
G/T_{max} = +4.0 dB/K

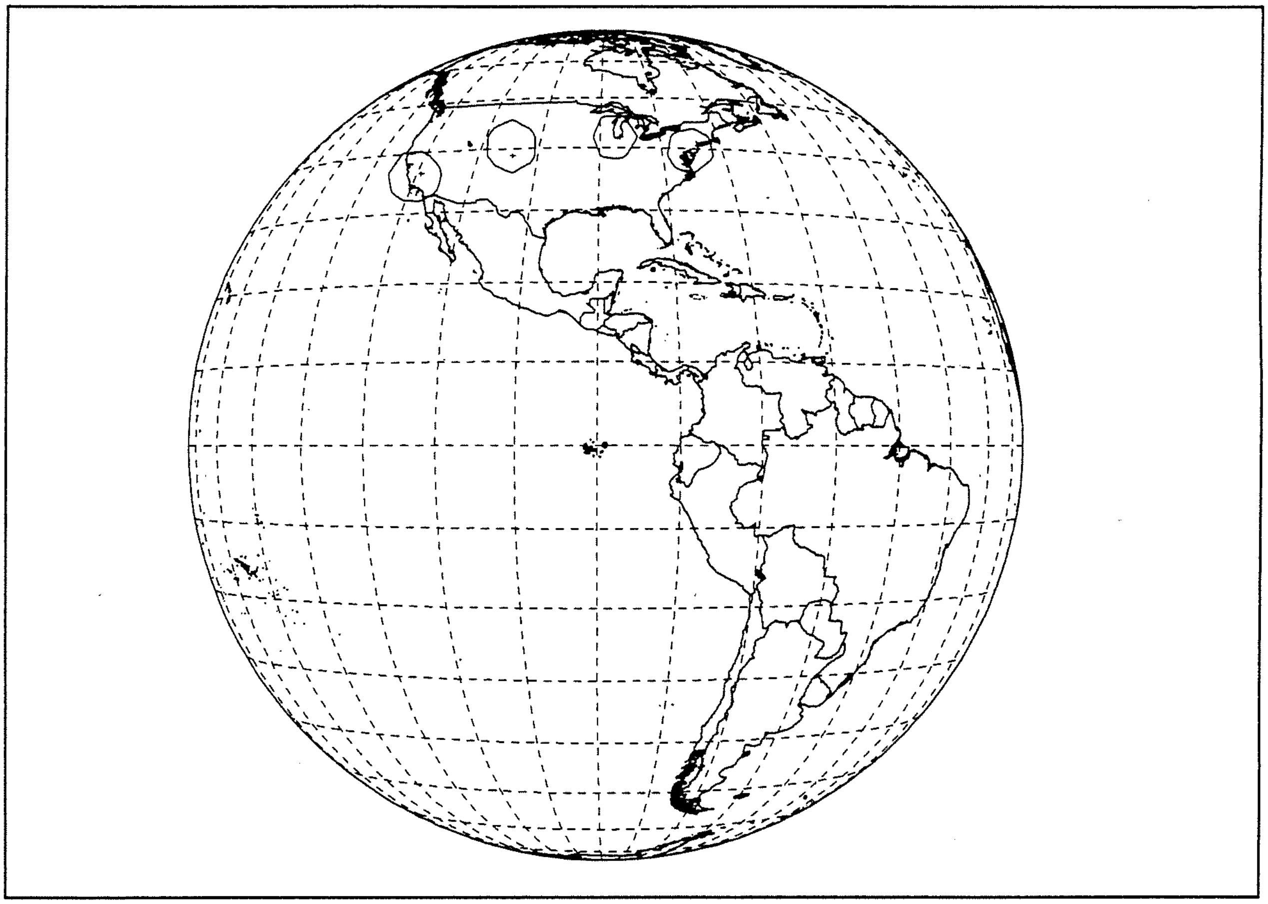


Space Station Receive Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contours shown are -2, -4, -6, -10, and -20 dB relative to maximum gain.
3. Maximum G/T is 4.0 dB/K.
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-8. G/T Contours for the South America Ku-band Beam (V)

Telstar 8 (89° W)
Ka-Band CONUS Beam -3 dB EIRP Contours
$EIRP_{max}$ = 62.0 dBW

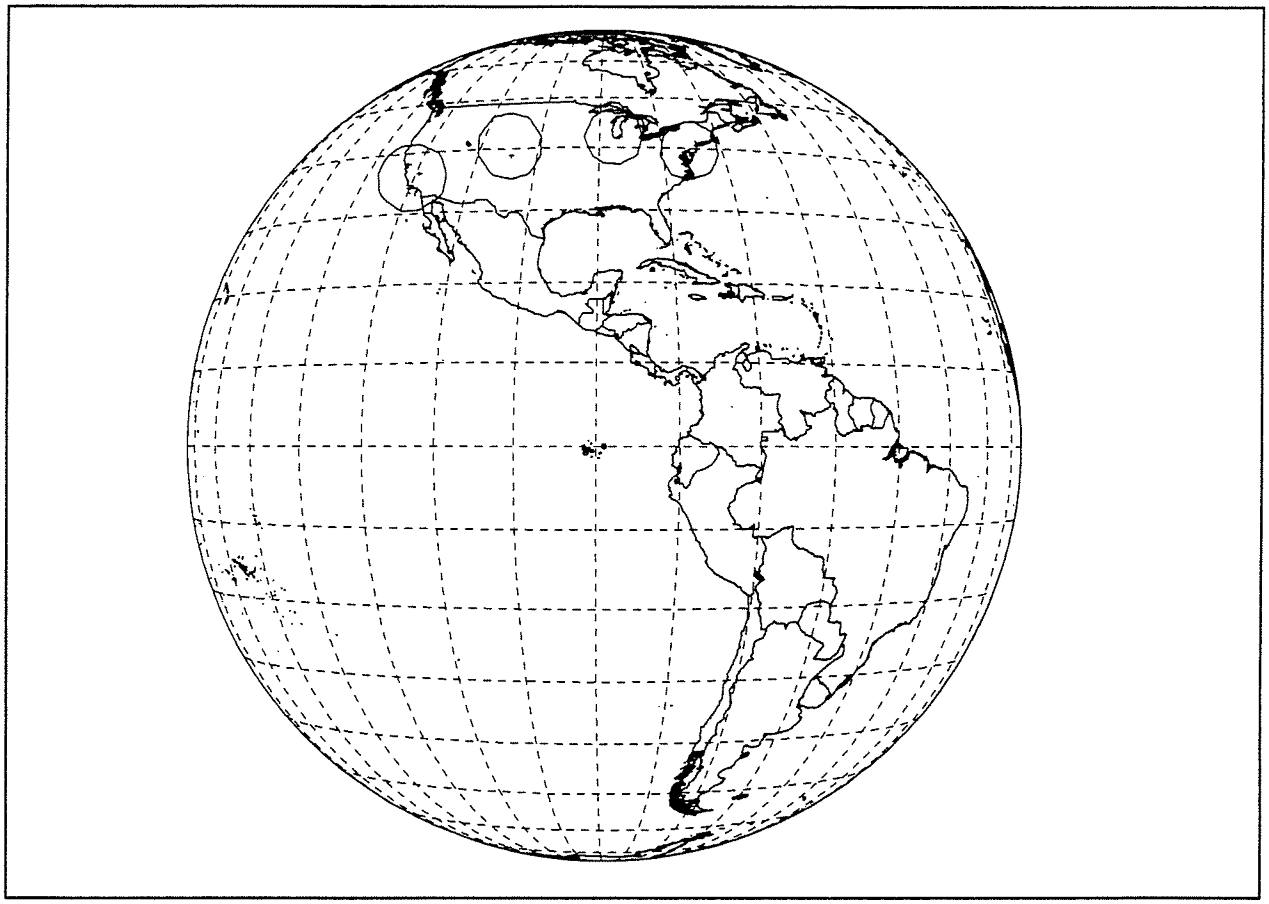


Space Station Receive Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contous shown are -3 dB relative to maximum gain for each spot beam.
3. Maximum EIRP is 62.0 dBW.
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-9. Plot Showing the -3 dB Contours for the Ka-band Transmit CONUS Beams (LHCP and RHCP)

Telstar 8 (89° W)
Ka-Band CONUS Beam -5 dB EIRP Contours
$EIRP_{max}$ = 62.0 dBW

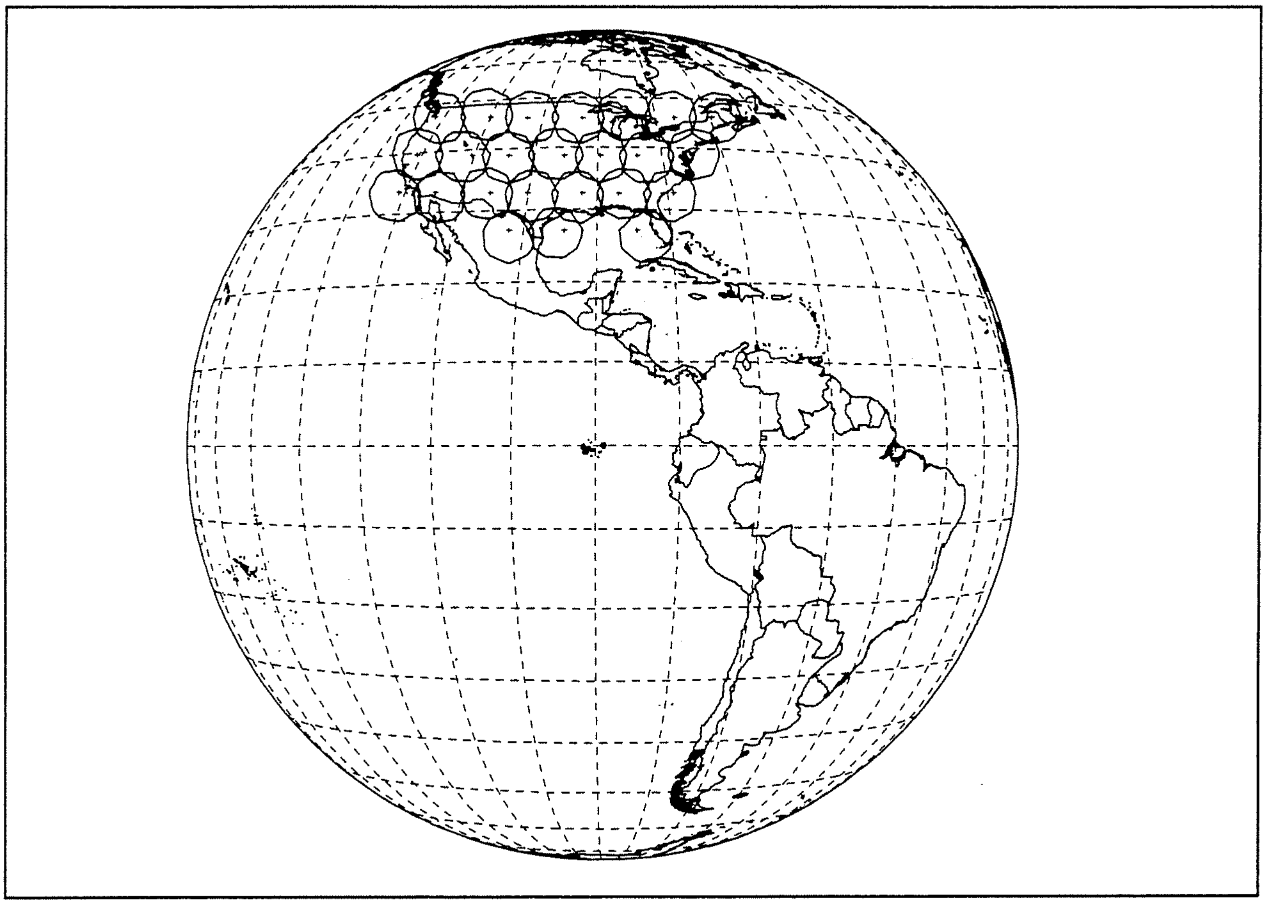


Space Station Receive Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contours shown are -5 dB relative to maximum gain for each spot beam.
3. Maximum EIRP is 62.0 dBW
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-10. Plot Showing the -5 dB Contours for the Ka-band Transmit CONUS Beams (LHCP and RHCP)

Telstar 8 (89° W)
Ka-Band CONUS Beam -3 dB G/T Contours
G/T_{max} = 15.0 dB/K

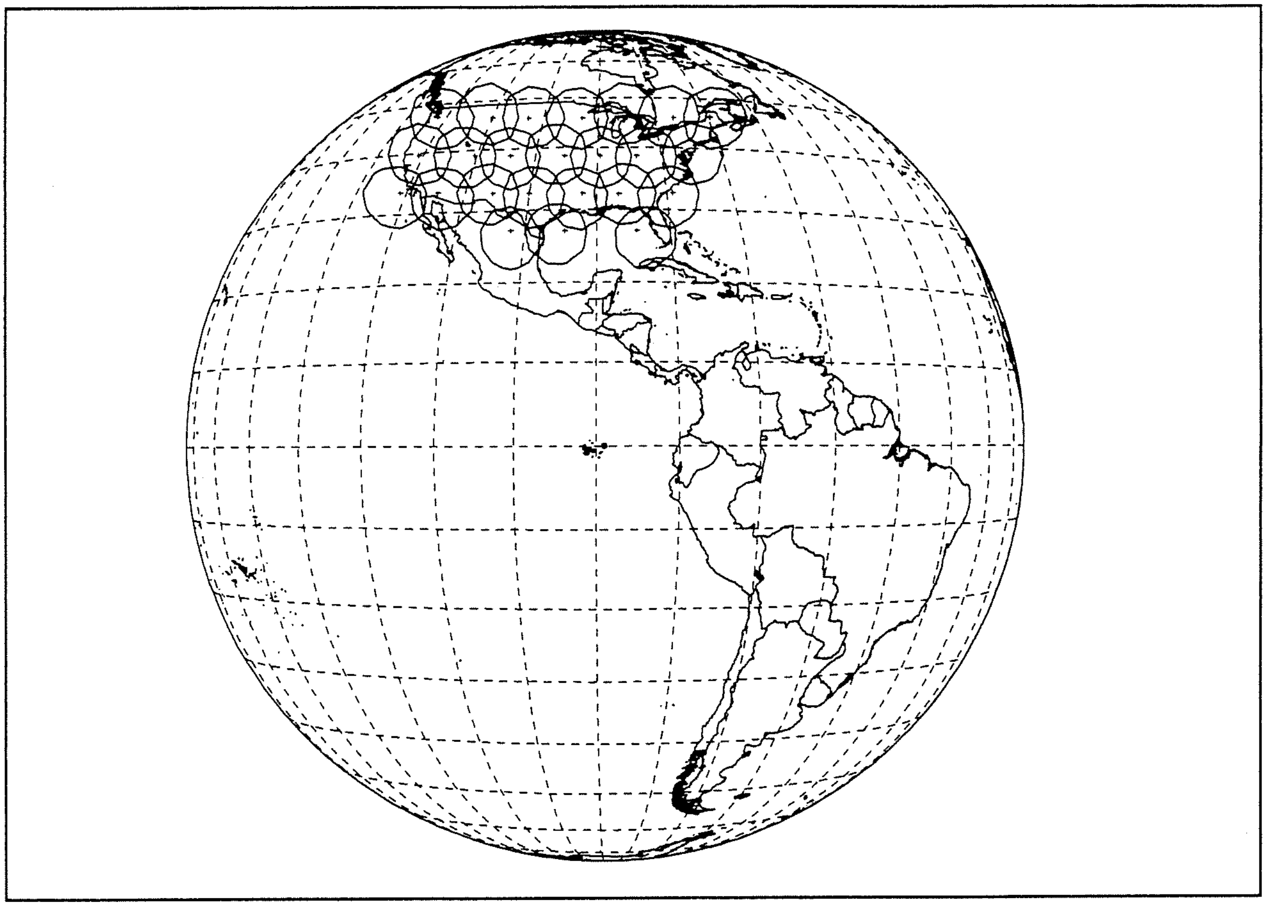


Space Station Receive Antenna
Gain Contours and Service Area

1. **Longitude and Latitude lines shown at 10 degree intervals.**
2. **Contours shown are -3 dB relative to maximum gain for each spot beam.**
3. **Maximum G/T is+15.0 dB/K**
4. **Service area consists all visible areas within the -10 dB contour.**
5. **Does not include antenna pointing error.**

Figure 7-11. Plot Showing the -3 dB Contours for the Ka-band Receive CONUS Beams (LHCP and RHCP)

Telstar 8 (89° W)
Ka-Band CONUS Beam -5 dB G/T Contours
G/T_{max} = 15.0 dB/K



Space Station Receive Antenna
Gain Contours and Service Area

1. Longitude and Latitude lines shown at 10 degree intervals.
2. Contours shown are -5 dB relative to maximum gain for each spot beam.
3. Maximum G/T is+15.0 dB/K
4. Service area consists all visible areas within the -10 dB contour.
5. Does not include antenna pointing error.

Figure 7-12. Plot Showing the -5 dB Contour for the Ka-band Receive CONUS Beams (LHCP and RHCP)