S&R

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C.

Application of

NATIONAL EXCHANGE, INC.

for a

Domestic Communications Satellite System

April 26, 1983

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April 26, 1983

RECEIVED
APR 26 1983
OFFICE OF THE SECRETARY
F.C.C.

Mr. William J. Tricarico, Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Dear Mr. Tricarico:

Submitted on behalf of National Exchange, Inc. ("NEX") is an application for authority to construct and operate a new domestic communications satellite system in the Fixed Satellite Service.

NEX's "SpotNet" satellite system will operate in the Ku-frequency band with 24 transponders feeding high-power spot beams serving small, receive/transmit, customer-premise earth stations.

The initial configuration takes advantage of the SpotNet system's intensive frequency reuse in that two satellites will be placed in each of two orbital locations. NEX has requested locations in the vicinity of 105° West Longitude and 80° West Longitude.

The application consists of three parts: Part I contains a public-interest showing and requisite showings of the applicant's legal and financial qualifications; Part II provides technical and operational details; and Part III contains five separate applications for four in-orbit satellites and one ground spare.

A grant of NEX's application will further the Commission's policy of encouraging new entrants to innovate in satellite communications in a competitive environment for the benefit of the public.

Any questions with respect to this application should be directed to the undersigned.

Respectfully submitted,

Henry Goldberg

Henry Goldberg

Attorney for
National Exchange, Inc.

APPLICATION OF

NATIONAL EXCHANGE, INC.

FOR A

DOMESTIC COMMUNICATIONS SATELLITE SYSTEM

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APRIL 26, 1983

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PART I

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I. PROPOSAL

1.0 PREFACE

In this Proposal and Application, National Exchange, Inc. ("NEX"), a new entrant to the telecommunications industry, is applying for authority to construct and operate a new kind of satellite system. The NEX satellite system, to be known as "SpotNet," represents a significant advance in the conception of satellite communication system design and use, thereby providing great benefits to customers of satellite services and the public at large. The key features that are unique to the SpotNet system are the use of high-powered satellite spot beams, extremely small, customer-premise transmit/receive earth stations, and multiple reuse of orbital frequencies. The SpotNet system design will allow two or more satellites, each with the capacity of a conventional satellite, at each of the two orbital locations NEX is requesting. These innovations make the SpotNet system capable of far more extensive and effective use of the orbital and frequency resources than any other domestic satellite system.

The SpotNet satellites will operate in the Ku-frequency band from two orbital positions, one in the vicinity of 105° West Longitude, for 50-state coverage, and one in the vicinity of 80° West Longitude, for CONUS coverage. The satellites will have encrypted telemetry, tracking, and command ("TT&C") circuits, and all signaling channels will be encrypted as well. The satellites will be designed to be launched on either the Shuttle or Ariane. NEX plans to launch its first satellite in early 1986.

Each satellite will carry 24 transponders, using spot beams covering all 50 states, with capacity concentrated over major population and business centers in the U.S., as illustrated on the map at Figure 1. The use of spot beams concentrates the power of each transponder into much smaller areas than conventional CONUS-wide beams, thus permitting frequency reuse in a cellular-like pattern covering all of the U.S., as well as very small, low-cost earth stations.

Each transponder will use a 20-watt TWTA and 36-MHz bandwidth, and one or more transponders will feed a spot beam. Each spot beam will cover an area from 250-400 miles across, with the exact dimensions and locations of each beam chosen to provide broad coverage with maximum capacity. The transponders will be linearly cross-polarized, 12 vertical and 12 horizontal, for 1000 MHz effective bandwidth for each satellite at each orbital location.

Because each of the frequencies used is concentrated into a spot beam, instead of covering the entire country, each frequency can be reused at each orbital position without objectionable interference. This is in addition to the doubling of frequency reuse through cross-polarization of the antenna arrays. At least two, and as many as four, satellites could be located at each orbital position, depending on the detailed trade-offs of design and beam coverage. The effective bandwidth of each orbital . position thus will be 2,000 MHz to 4,000 MHz, or two to four times as great as other satellite systems. Because of the orbital efficiency achieved through this frequency reuse, the

SpotNet system can grow incrementally to a considerable capacity as demand grows, using only the two orbital positions now being requested.

The four initial in-orbit satellites can generate 96 spot beams, located and shaped to place most of the beam power over areas of highest population and business density. The number of beams reaching a particular area will depend on the communications traffic of that area as described below.

The satellite antenna gain of the spot beams allows the earth stations to use very small antennas, much smaller than with present satellite systems, and to operate with a lower power transmitter, permitting all solid-state construction for high reliability, low cost, and low maintenance. In some applications, each earth station will have two antennas, to allow simultaneous operation with satellites in both orbital positions, enhance routing diversity, add reliability during rainstorms, and avoid sun-outage and eclipse interruptions. The SpotNet system thus offers flexibility of routing and redundancy that is innovative and responsive to customer needs.

There will be two fully redundant TT&C earth stations, with the primary TT&C earth station co-located with the Network Control Center ("NCC").

This Proposal and Application consists of three parts: Part I contains a public-interest showing and showings as to types of services, common carrier versus non-common carrier operation, and investment/operating costs and sources of funds. Part II provides a technical and operational description, and Part III contains five separate applications for the satellites comprising the space segment.

2.0 Public-Interest Considerations and Proposed Services

The essence of the Commission's successful open-entry policy for the domestic satellite industry is the desire

> to allow room and incentive for the development of innovative services and technologies. Orbit Deployment Plan-Domestic Satellite, 84 F.C.C.2d 584, 601 (1981).

While the FCC has known for some time that the use of multiple, narrow spot beams results in a highly efficient, high-capacity satellite design, it chose not to dictate particular designs, leaving such choice, instead, to entrepreneurs, who are in the best position to make the complex tradeoffs among "technical, economic, operational and marketing factors." Id. at 594. The Commission made clear, however, that the growing congestion of the orbital arc placed a premium on efficient use of available orbital locations, and that it would look carefully at system design in terms of satellite capacity at each such location. See id. at 595. In this regard, the NEX system proposal directly serves this Commission policy and the public interest.

NEX's system proposal represents a significant advance in the conception of satellite communication system design and use, promising great benefits to customers of satellite services and the public at large. At the same time, the NEX spot beam system design expands the communications capacity of the Ku-frequency band orbital arc available for domestic use. For example, because of the configuration of the frequency plan for the spot beams, NEX can achieve intensive geographic reuse of frequencies, thus doubling or tripling Ku-band usage at each orbital position compared to conventional satellite systems, and enabling NEX to locate several satellites at the same orbital location. Consequently, at a time of increasing demand on the orbital arc resource, NEX will be able to use and reuse as few as, and no more than, two orbital locations for its entire satellite system, which, when fully mature, could consist of four or more in-orbit satellites, each providing 1000 MHz of effective bandwidth at each location.

The spectrum and orbital efficiency that characterizes the SpotNet system also contributes to the substantial public benefit of offering the user small, low-cost, highly reliable, easily located customer-premise earth stations. In terms of cost to the user and operational flexibility, NEX's SpotNet represents a significant advance over any other present or presently proposed satellite system.

Moreover, the high degree of frequency reuse of the SpotNet system furthers the Commission's goals in the pending spacing inquiry (CC Docket No. 81-704). Depending on the characteristics of satellites the Commission locates adjacent to the SpotNet satellites, orbital spacing requirements of the adjacent satellites may be somewhat greater than for conventional Ku-band satellites. In any event, the SpotNet system will allow the use of more transponders and more communications capacity per degree of orbital arc than any other satellite system.

In a policy sense, the NEX application thus represents the fruition of the FCC's open-entry domestic satellite policy, in which new entrants are given the incentive to advance the state of the art of satellite communications to develop proposals that are efficient in both the spectrum and economic senses.

2.1 Proposed Services

The Commission explicitly has recognized "the difficulties of new entrants in specifying precise services." (*Id.* at 597.) Taking these difficulties into account, NEX has developed a marketing plan for the balance of the Eighties. As the American economy shifts toward new information technologies and more information-intensive industries in the next decade, there will be an accelerating increase in the need for communication systems capable of supporting those shifts. The expected use of electronic mail, teletext, video teleconferencing and other wideband information transmissions threatens to outpace the capacity of the existing telecommunications network. The current rapid growth of business and institutional use of mainframe computers, minicomputers, personal computers, digital terminals, local area networks (LAN's), digital PBX systems, and two-way cable TV confirms the need to expand the capabilities of existing telecommunication systems.

NEX's proposed communication system responds to this need. The SpotNet system will allow NEX to offer rates to private users that are highly competitive with current rates offered by carriers of intracompany information transmissions. The use of the system is expected to grow in tandem with the rapidly growing demand for wideband city-to-city communications originating and terminating at customer-premise earth stations that will occur in the next decade.

To meet this growth in demand, NEX intends to use all of its transponders to provide a full range of communication services on a private basis, as well as on a common carrier basis. The SpotNet system is intended primarily as a non-common carrier system, in that NEX will deal with its customers on a non-carrier basis, but some of its customers may well be communications common carriers, including a certificated carrier subsidiary of NEX itself. Although common carrier communication services thus will be offered to the public over the SpotNet system, they will not be offered by the applicant, NEX.[1/]

NEX anticipates that its satellite system will serve primarily business users in the information industries, where users will be attracted by the substantial cost savings and inherent flexibility associated with the SpotNet high-capacity spot beam design. No other satellite system provides the EIRP or antenna gain of the SpotNet system. Since NEX's Shuttle/Ariane spacecraft will cost about the same to build and launch as the current generation of Delta-class satellites, costs per transponder will be about the same. The spot beam design allows much less costly earth stations, however, thus allowing customers

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1/ Although it is too early to predict the exact mix of common carrier and non-common carrier services that will be provided over the SpotNet system, pursuant to Section 1.65 of the Rules of the Commission's decision in Domestic Fixed-Satellite Transponder Sales (90 F.C.C.2d 1238 (1982), NEX will update its application with that information as its business plan is implemented.

a lower overall circuit cost than other domestic satellite systems.

3.0 Orbital Arc Considerations

NEX is requesting authority to launch its first two satellites in 1986, and to procure satellites, earth stations, and launch services sufficiently in advance of that date. Given the increased need for a spot beam satellite to be near the center of the orbital arc for control of the spot beams, NEX is requesting assignment of a Ku-band orbital position in the vicinity of 105° West Longitude, to provide 50-state coverage, and a second position in the vicinity of 80° West Longitude, to provide CONUS coverage.[2/]

As the Commission has described in its orbital assignment policy for new entrants:

> New entrants relying on speculative satellite traffic are initially assigned the minimum number of orbital locations needed to establish market presence.

Orbital Deployment Plan-Domestic Satellite, supra, at 588. In this regard, the Commission has stated that it initially assigns "two orbital locations to each new entrant who relies on speculative satellite traffic." Id. at 603. Furthermore, the Commission has adopted a companion policy in which satellite operators are afforded "an opportunity to develop innovative

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2/ It should be noted that NEX's satellite antenna coverage patterns assume satellite locations at 120° and 60° West Longitude solely for purposes of analysis and to illustrate the distortion of the spot beams caused by satellite placement away from the center of the orbital arc. As demonstrated, NEX should be assigned positions near the center of the orbital arc.

services to all 50 states in an efficient manner over the same satellite." Id. at 605. This has meant that satellite operators have been assigned at least one 50-state coverage position.

Application of these policies to the NEX application and request for orbital positions would mean that NEX would receive one 50-state coverage position and one CONUS coverage position for its SpotNet satellite system. NEX's request thus is fully consistent with established FCC policy. Moreover, unlike other new entrants, and even established satellite companies, NEX's unique satellite system design means that the SpotNet system is unlikely ever to need more than those two locations to enable growth to full maturity.

4.0 Legal Qualifications

Included with this Part as Attachment A is an executed "Common Carrier and Satellite Radio Licensee Qualification Report" (FCC Form 430) regarding NEX. As described in the Form 430, NEX is a Delaware corporation, based in California. All of the issued and outstanding stock of NEX is owned by Clay T. Whitehead, formerly President of Hughes Communications, Inc., a satellite operating company, and of its subsidiaries. In that capacity, Mr. Whitehead's qualifications have been passed upon by the Commission. Moreover, Mr. Whitehead's expertise in satellite communications, in particular, and in the telecommunications industry, more broadly, is well known to the Commission.

5.0 Financial Qualifications

NEX has analyzed the costs associated with the satellites, TT&C, Network Control Center, marketing, and management of the initially-configured satellite communication system that is the subject of this application, as set out in Table 1-1. Each major component of the total system has been divided into logical subcomponents, with assigned costs based on established prices and published data. Based on this detailed analysis, the financial projections of the company have been determined.

The estimated total construction and pre-operational costs for the four in-orbit and one ground spare satellite system are as follows: space segment: $347 million, ground segment: $12 million, operating, engineering and administrative: $44.6 million. Annual operating costs exclusive of inflation beginning in 1989, when the four-satellite system will be operational, are projected to be $30.9 million.

Since NEX is a newly formed company, it has not yet made final its detailed plan of financing. Salomon Brothers, Inc however, has reviewed the financial arrangements proposed by NEX for the

SpotNet system, and will work with NEX "to attempt to raise the funds necessary for the company to execute its proposed business plan." A letter to this effect from Salomon Brothers is included as Attachment B.

Table 1-1
NEX Costs and Revenue Requirements
($M)

	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Expenses																
Operating & Maintenance	0	0.7	7.2	12.6	18.1	24.6	30.9	33.5	36.4	39.6	43.1	47.0	51.3	48.6	28.4	31.0
Research & Development	2	2	2	2	2											
Engineering & Marketing	4.6	10.7	15.4	18.2	20.6	21.1	23.2	25.5	28.0	30.8	33.8	37.2	40.9	39.6	16.8	18.5
On Orbit Insurance				4.5	6.0	9.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	7.5	6.0	3.0
Depreciation			15.2	29.1	42.9	64.6	64.6	49.4	35.6	21.7						
Capital Requirements																
Satellite Construction	19.5	26.0	39.0	45.5	39.0	26.0										
Satellite Launch Service	15.5	20.7	31.0	25.8	20.7	10.3										
Launch Insurance			7.0	7.0	7.0	7.0										
TT&C and NCC	1.8	3.0	2.6	1.1	2.0	1.5										
Revenue Requirements	-	-	-	26.5	100	162	225	296	352	365	369	367	364	220	176	85

6.0 Schedule of Implementation

A detailed schedule specifying concrete dates by which significant milestones in establishment of the SpotNet satellite system are planned to be achieved is included as Table 1-2.

TABLE 1-2

SCHEDULE OF IMPLEMENTATION

Negotiations Completed and Contracts Executed

a.	Spacecraft RFP Issued	6/83
b.	Spacecraft Contractor Selected	7/83
c.	Spacecraft Contract Executed	9/83
d.	Launch Services Contract Executed	9/83
e.	Financing Completed	9/83

Spacecraft Implementation

Satellite Due Date

Event	SpotNet 1	SpotNet 2	SpotNet 3	SpotNet 4
Spacecraft Construction Begun	9/83	3/84	9/84	3/85
Spacecraft Construction Complete	1/86	9/86	1/87	9/87
Spacecraft Launched	3/86	9/86	3/87	9/87
Spacecraft in Service	4/86	10/86	4/87	10/87

ATTACHMENT A
April 26, 1983

COMMON CARRIER AND

SATELLITE RADIO LICENSEE QUALIFICATION

REPORT

(FCC FORM 430)

ATTACHMENT A
April 26, 1983

FCC Form 430
February 1983

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D. C. 20554

Approved by OMB
3060-0105
Expires 1/31/84

COMMON CARRIER AND SATELLITE RADIO LICENSEE QUALIFICATION REPORT

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, D. C. 20554. If more than one radio service is listed in item 2, 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. Use "N/C" to indicate there has been no change to answers in a previously filed report (as identified in item 3).

D. Do *not* submit a fee with this report.

1. Business name and address (street number, city, state, ZIP Code) of Filer's principal office:

National Exchange, Inc.
Suite 1000
10850 Wilshire Boulevard
Los Angeles, California 90024

2. List the common carrier and satellite radio services in which Filer has applied or is a current licensee or permittee:

None

3. If this report supercedes a previously filed report, specify its date:

N/A

4. Filer is (check one):

☐ Individual ☐ Partnership ☒ Corporation

☐ Other *(Specify)*

5. If Filer is an individual (sole proprietorship) or partnership, answer the following:

a. Full legal name and residential address (street number, city, state & ZIP Code) of individual or partners:

N/A

	YES	NO
b. Is individual or each member of a partnership a citizen of the United States? N/A		
c. Is individual or any member of a partnership a representative of an alien or of a foreign government? N/A		

	YES	NO
d. If a partnership, under the laws of what State (or other jurisdiction) is it organized? N/A		
e. If a partnership, attach as Exhibit I, one copy of the partnership agreement.		
6. If Filer is a corporation, answer the following:		
a. Under laws of what State (or other jurisdiction) is it organized? Delaware		
b. Attach as Exhibit II, a copy of the Articles of Incorporation unless a current copy has been previously filed. (If previously filed, indicate the filing date: N/A .) See Exhibit II.		
c. Attach as Exhibit III the names, addresses, principal occupations, and citizenship of the 10 largest stockholders owning of record and/or voting the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or the class of beneficiaries. There are 100 shares of common stock issued and outstanding, all of which are owned by Clay T. Whitehead.		
d. List below, or attach in Exhibit IV, the names of the officers and directors of the Filer. Clay T. Whitehead, President, Chief Executive Officer Robert E. LaBlanc, Treasurer Edward J. Costello, Jr., Secretary		
e. Is the Filer directly or indirectly controlled by any other corporation?		X
If "Yes", attach as Exhibit V 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, citizenship, and principal occupations of the ten largest stockholders of the controlling corporation; (3) the approximate percentage of total voting stock held by each such shareholder; (4) the president and directors of the controlling corporation; and (5) the Articles of Incorporation for the controlling corporation.		
f. Is any officer or director of the Filer an alien?		X
g. Is more than one-fifth of the capital stock of the Filer 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?		X
h. 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?		X
i. If any answer to questions (f), (g) or (h) is "Yes", attach as Exhibit VI, a statement identifying the aliens or foreign entities, their nationality, their relationship to the Filer, and the percentage of stock they own or vote.		

7. a. Has the Filer or any person directly or indirectly controlling the Filer:	YES	NO
i. Had any application for any FCC authorization denied on grounds of qualifications or character?		X
ii. Had any radio station license or permit revoked by the FCC or any Federal Court?		X
iii. Been found guilty within the last 10 years by a court or administrative agency of any civil or criminal violations of the security or anti-trust laws of the United States or of any state, territorial, or local government?		X
iv. Been found guilty by any court of any felony or any other crime involving moral turpitude?		X
v. Been adjudged bankrupt or mentally incompetent by any court?		X
b. Is there now pending in any court or administrative body against the Filer, or any person or organization having final control, any action involving any of the matters referred to in the questions in (a) above?		X
c. If any of the answers to questions (a) or (b) are "Yes", submit as Exhibit VII a brief statement concerning the persons and matters involved, identifying the court or agency, the proceeding (by date, file number, or report citation), the facts upon which the proceeding is (or was) based, the nature of the offense committed or alleged, and the status or disposition of the matter.		
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 this Commission?		X
If "Yes", submit as Exhibit VIII, the name of each such licensee, the licensee's relation to the Filer, and the approximate number of stations authorized to the licensee in each radio service.		

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 hereof. 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 his (her) knowledge and belief, and are made in good faith.

Dated this 26 day of April, 1983.

Filer National Exchange, Inc.
(must correspond with that shown on page 1)

By Clay T. Whitehead (printed) [signature] (signed)

Title President

WILLFUL FALSE STATEMENTS MADE ON THIS APPLICATION ARE PUNISHABLE BY FINE AND 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)]

NOTICE TO INDIVIDUALS REQUIRED BY PRIVACY ACT OF 1974 AND THE PAPERWORK REDUCTION ACT OF 1980

The solicitation of personal information requested in this form is to determine if you are qualified to become a licensee in a 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. Response to the information requested is required to obtain the requested authorization.

ATTACHMENT A
EXHIBIT II
April 26, 1983

ARTICLES OF INCORPORATION

OF

NATIONAL EXCHANGE, INC.

ATTACHMENT A
EXHIBIT II
April 26, 1983

State of DELAWARE

Office of SECRETARY OF STATE

I, Glenn C. Kenton, Secretary of State of the State of Delaware, do hereby certify that the attached is a true and correct copy of Certificate of Incorporation filed in this office on April 25, 1983.

Glenn C. Kenton, Secretary of State

BY: ______________________

DATE: April 25, 1983

Form 130

ATTACHMENT A
EXHIBIT II
April 26, 1983

CERTIFICATE OF INCORPORATION

OF

NATIONAL EXCHANGE, INC.

I, the undersigned, for the purpose of incorporating and organizing a corporation under the General Corporation Law of the State of Delaware, do hereby certify as follows:

FIRST: The name of the corporation (hereinafter called the Corporation) is NATIONAL EXCHANGE, INC.

SECOND: The address of the Corporation's registered office in the State of Delaware is 100 West Tenth Street, City of Wilmington, County of New Castle. The name of the Corporation's registered agent at such address is The Corporation Trust Company.

THIRD: The purpose of the Corporation is to engage in the business of developing, designing, assembling, selling, leasing, installing and maintaining telecommunications office automation and information systems, as well as any other lawful act or activity for which corporations may be organized under the General Corporation Law of Delaware.

FOURTH: The total number of shares of common stock which the Corporation shall have authority to issue is one thousand (1,000) all such shares shall be of the par value of one cent ($.01) per share.

ATTACHMENT A
EXHIBIT II
April 26, 1983

FIFTH: The name and mailing address of the incorporator is:

John A. Buchman
1735 Eye Street, N.W.
Washington, D.C. 20006.

SIXTH: The names and mailing addresses of the persons who are to serve as directors of the Corporation until the first annual meeting of stockholders or until successors are elected and qualified are as follows:

NAME	MAILING ADDRESS
Clay T. Whitehead	2620 Mandeville Canyon Road Los Angeles, CA 90049
Robert E. LaBlanc	323 Highland Avenue Ridgewood, N.J. 07450
Edward J. Costello, Jr.	Suite 1000 10850 Wilshire Boulevard Los Angeles, CA 90024

SEVENTH: The board of directors of the Corporation shall have power to make, alter or amend By-Laws of the Corporation.

EIGHTH: The Corporation reserves the right at any time and from time to time to amend, alter, change or repeal any provision contained in this Certificate of Incorporation, and other provisions authorized by the laws of the State of Delaware at the time in force may be added or inserted, in the manner now or hereafter prescribed by law; and all rights, preferences and privileges or any other persons whomsoever

ATTACHMENT A
EXHIBIT II
April 26, 1983

by and pursuant to this Certificate of Incorporation in its present form or as hereafter amended are granted subject to the right reserved in this Article.

IN WITNESS WHEREOF, I the undersigned, being the incorporator hereinabove named, do hereby execute this Certificate of Incorporation this 21st day of April, 1983.

John A. Buchman

John A. Buchman

LETTER FROM SALOMON BROTHERS

REGARDING FINANCING

Member of the New York Stock Exchange, Inc.

One New York Plaza
New York, N.Y. 10004 (212) 747-7000

Salomon Brothers Inc

April 25, 1983

Mr. Clay T. Whitehead
President
National Exchange, Inc.
Suite 1000
10850 Wilshire Boulevard
Los Angeles, CA 90024

Dear Mr. Whitehead:

Salomon Brothers Inc has reviewed the business plan of National Exchange, Inc. (the "Company") dated April 1983. We understand that the Company intends to file in the near future an application with the Federal Communications Commission to obtain certain authorizations and licenses in order to implement that business plan.

Salomon Brothers is a leading international investment banking and securities firm. Our firm has been one of the leading banking firms serving companies in the telecommunications industry for several years. Salomon Brothers has been involved in offerings of equity and debt securities for a wide variety of telecommunications companies and ventures.

While a new venture of the type contemplated by National Exchange, Inc. is subject to significant business and financial risk and uncertainty, we believe that if the Company's business plan were effected as contemplated by the Company, its business could be appealing to various financial and industrial corporations. While the precise terms of any specific financing efforts would, of course, be subject to the Company's realization of its objectives and to market conditions at the time of any offerings, we would anticipate that there may be a number of potential investors who would seriously consider an equity investment in National Exchange, Inc. In addition, we believe that these potential investors could be supplemented by additional sources interested in obtaining various lease benefits or tax advantages.

On this basis, we are prepared to work with National Exchange, Inc. to attempt to raise the funds necessary for the Company to execute its proposed business plan.

Sincerely,

Denis A. Bovin

Denis A. Bovin
Managing Director

/rbb

PART II

TECHNICAL AND OPERATIONAL DESCRIPTION

APRIL 26, 1983

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TECHNICAL AND OPERATIONAL DESCRIPTION

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II. Technical and Operational Description

1.0 INTRODUCTION

With this Proposal and Application, NEX is seeking authority to implement an innovative Ku-band satellite system to operate in the Domestic Fixed Satellite Service. The innovative nature of the proposed system stems from the use of well-tested, state-of-the-art technology in an advanced network architecture.

The SpotNet system consists of a space segment and a ground segment. This Application deals only with the space segment. Separate applications for the ground segment, including TT&C stations and customer-premise earth stations, will be filed in the future. The use of 24 spot beams on each SpotNet satellite will allow multiple satellites to operate simultaneously on the same 12- and 14-GHz Ku-band channels from each orbital slot. The system will consist initially of four operational satellites, two operating simultaneously from each of two orbital positions, one position at about 80° West Longitude and one at about 105° West Longitude. The use of two orbital slots permits path diversity to be achieved through the use of dual earth stations at some sites. Such additional reliability is an important consideration at Ku-band.

Not only does the use of spot beams allow the placement of multiple satellites at a single orbital location, it also allows the transmitted power from each SpotNet transponder to be concentrated into a much smaller area than conventional country-wide beams. This concentrated power and the associated high antenna gain of the satellite is what permits the use of very small, low-cost earth stations.

The ground segment of the SpotNet system will consist of these small, transmit-receive earth stations, as well as, in some applications, small receive-only earth stations. The ground segment will also include a primary tracking, telemetry and control (TT&C) transmit-receive earth station to be located on the East Coast, and a secondary station to be located on the West Coast. A Network Control Center (NCC) will be co-located with the primary TT&C station.

Individual satellite applications are submitted in Part III, infra.

2.0 COMMUNICATION SYSTEM CHARACTERISTICS

2.1 Space Segment

The space segment of the SpotNet satellite system will consist of five satellites and four launch vehicles. Four of the satellites will be placed in orbit, while the fifth will serve as a ground spare to be launched in the event of a failure of one of the four operational satellites. The satellite specifications are such that either a Hughes Aircraft Company spin-stabilized or RCA Astro-Electronics three-axis stabilized standard satellite bus can be employed. The satellites will be compatible with a launch by the Space Transport System (Shuttle) or by Ariane.

The typical communications system performance of the SpotNet satellites is shown in Table 2-1.

TABLE 2-1

TYPICAL SATELLITE COMMUNICATIONS PERFORMANCE

G/T	Min. Size Beam	Max. Size Beam
Receive antenna gain (on-axis)	49.4	46.4 dB
System Noise Temperature	30.0	30.0 dBK
G/T	19.4	16.4 dB/K
EIRP		
TWTA output	13.0	13.0 dBW
Output losses	1.1	1.1 dB
Transmit antenna gain (on-axis)	48.0	45.0 dB
EIRP	59.9	56.9 dBW

2.2 Ground Segment

The ground segment of the SpotNet satellite system will consist of two TT&C earth stations for tracking, monitoring, range finding and command functions. Each TT&C station will include two 5.5-meter diameter antennas, and will operate in Ku-band. The TT&C station to be located on the East Coast will be designated the primary center, and will be co-located with the NCC facility. The NCC facility will handle the functions associated with the allocation, assignment, and adjustment of SpotNet system capacity and characteristics. The TT&C station to be located on the West Coast will be designated the secondary center, and will provide a redundant backup for all TT&C functions. All TT&C channels will be encrypted to avoid unauthorized access and possible harm to the satellites.

The vast majority of the SpotNet earth stations will be located on the premises of NEX's customers. Typical earth station characteristics for the 56 Kbps and 1.544 Mbps services are shown in Table 2-2.

2.3 Frequency and Coverage Plan

The SpotNet system will operate at Ku-band using frequencies in the 14-GHz band for uplink transmissions, and frequencies in the 12-GHz band for downlink transmissions. Each satellite will contain 24 active transponders. Each transponder will have a nominal bandwidth (channel spacing) of 40 MHz and a usable bandwidth of approximately 36 MHz. Twelve of the transponders will transmit vertically polarized signals, while the other 12 will be horizontally polarized. The transponders with the same polarization will be spaced on 40-MHz centers, and orthogonally

TABLE 2-2

TYPICAL EARTH STATION CHARACTERISTICS

	56 Kbps	1.5 Mbps
G/T		
Receive antenna gain (on-axis)	45.4	45.4 dB
Total system noise temperature	24.1	24.1 dBK
G/T	21.3	21.3 dB/K
EIRP		
Amplifier output (per carrier)	-11.0	3.0 dBW
Transmit losses	1.5	1.5 dB
Transmit antenna gain	46.9	46.9 dB
EIRP (per carrier)	34.4	48.4 dBW

polarized transponders will be interleaved so as to be spaced 20 MHz apart. The resulting isolation between polarization permits the 500 MHz total uplink and downlink bandwidth to be used twice within each satellite.

The antenna of each satellite will provide a number of receive and transmit spot beams. The number and geographic coverage of each beam will be chosen to cover major business and population centers at least once and, in some instances, more than once. Each of the transponders will be fed into one of the beams, with some beams being fed by several transponders as required by population, business density, and other factors affecting the expected traffic requirements. Because the energy in each spot beam channel is concentrated into a very narrow beam instead of a beam covering the entire U.S., each transponder frequency can be used in different beams at each orbital position without interference. In this manner, at least four satellites can be accommodated at each orbital position.

In its initial configuration, NEX plans to locate two SpotNet satellites at each orbital position. Since each satellite will reuse the frequencies twice through cross-polarization, and since the second satellite at each orbital location will be able to share the same frequencies by transmitting on spot beams, the 500 MHz of available uplink and downlink bandwidth will be reused four times in each slot. No other satellite system -- domestic or international, proposed or in operation -- obtains this intensity of frequency reuse or orbital efficiency.

2.4 Communications System Performance Specifications and Parameters

Typical use of the SpotNet satellite system will be low-cost transmission of 56 Kbps and 1.544 Mbps signals between and among customer locations.

The signals will be transmitted via the satellite between and among earth stations with characteristics similar to those shown in Table 2-2. Using earth stations of this type, each satellite transponder will be capable of handling more than 400 56 Kbps carriers or more than 16 1.544 Mbps carriers. The performance specifications for both types of signals are as follows:

Maximum Bit Error Rate	$1X10^{-6}$
Minimum Availability	99%

The corresponding system parameters for the transmission of digital signals at these two rates are as follows:

Parameter	56 Kbps	1.544 Mbps
Data Rate	56 Kbps	1.544 Mbps
Modulation	QPSK	QPSK
Coding Type	Convolutional	Convolutional
Rate	7/8	7/8
Eb/No for $1X10^{-6}$BER (With Coding)	7.8 dB	7.8 dB

The emission designators for the 56 Kbps and 1.544 Mbps services are 38F9Y and 1050F9Y, respectively.

2.5 Link Performance Analysis

Although NEX is requesting orbital positions at 80° and 105° West Longitude, it has performed its link performance and interference analyses for satellites at 60° and 120° West Longitude. These analyses represent extreme cases of beam shape distortion and other operating factors, and in that respect constitute worst-case analyses. The analyses illustrate why orbital locations closer to 80° and 105° are required for effective shaping and control of spot beams for frequency reuse.

2.5.1 56 Kbps Service

The link performance analysis for a New York City area spot beam is shown in Table 2-3. The typical SpotNet earth station providing this service will have a nominal transmitter power per carrier of 0.079 W (-11.0 dBW) and employ a two-meter antenna with 46.9 dB gain. After accounting for miscellaneous losses, the resulting EIRP per carrier is 34.4 dBW. The smallest possible spot beam on the satellite has an on-axis Figure of Merit (G/T) of approximately 19.5 dB/K, and a saturated EIRP of 59.9 dBW. An output backoff of 4.0 dB is assumed in the analysis.

In order to be conservative, NEX has analyzed the link budget based upon a spot beam that will cover an area twice as large as the minimum size possible. These larger beams may be used to cover more sparsely populated areas. For showing the worst-case link budget, the largest beam (which has 3 dB less gain) has been used, the transmit station has been placed on the -4 dB contour, and the receive station has been placed at the -3 dB point. (Hereafter, the larger size beam will be referred to

TABLE 2-3 56 KBPS SERVICE

NEW YORK TO SPOTNET AT 60 WEST - LINK BUDGET

UPLINK (AT 14.25 GHZ)

GROUND TRANSMITTER POWER TO SATURATE	21.7 DBW
NUMBER OF CARRIERS (400)	-26.0 DB
INPUT BACKOFF (CORRESPONDING TO 4 DB OPBO)	-6.7 DB
GROUND TRANSMITTER POWER/CARRIER (0.079 W)	-11.0 DBW
TRANSMIT LOSSES	-1.5 DB
GROUND ANTENNA GAIN (2M WITH 55% EFFICIENCY)	46.9 DB
EIRP PER CARRIER *	34.4 DBW
PATH LOSS (45 DEGREE ELEVATION ANGLE)	207.0 DB
SATELLITE G/T	12.5 DB/K
BOLTZMANN'S CONSTANT	-228.6 DBW/K-HZ
UPLINK CARRIER-TO-NOISE-POWER DENSITY (C/NO) - UP	68.5 DBW/HZ

DOWNLINK (AT 12 GHZ)

SATELLITE SATURATED EIRP	53.9 DBW
POWER SPLIT (400 CARRIERS)	-26.0 DB
OUTPUT BACKOFF	-4.0 DB
SATELLITE EIRP PER CARRIER	23.9 DBW
PATH LOSS (45 DEGREE ELEVATION ANGLE)	-205.5 DB
RAIN ATTENUATION (99% AVAILABILITY)	-1.2 DB
RECEIVING ANTENNA GAIN (2 M WITH 55% EFFICIENCY)	45.4 DB
RECEIVED CARRIER POWER	-137.4 DBW
BOLTZMANN'S CONSTANT	-228.6 DBW/K-HZ
RECEIVING SYSTEM NOISE TEMPERATURE	24.1 DBK
DOWNLINK NOISE DENSITY	-204.5 DBW/HZ
(C/NO) - DOWN	67.1 DB
DATA RATE (56 KBPS)	47.5 DB
(E B / N O) - UP	21.0 DB
(E B / N O) - DOWN	19.6 DB
C/IM	16.0 DB
(C/I) - UP (BASED ON USAT BEING THE INTERFEROR)	17.8 DB
TOTAL E B / N O, C/IM AND C/I - UP	12.2 DB
SYSTEM MARGIN	4.4 DB
EFFECTIVE E B / N O	7.8 DB
BIT ERROR RATE WITH CODING	10^{-6}

* THIS CORRESPONDS TO A POWER FLUX DENSITY OF -117.15 DBW/SQ M/MHZ AT THE SATELLITE.

as the maximum beam and the smaller size beam as the minimum beam.)

A 1.2-dB margin for rain loss has been assumed in the downlink calculations. This reflects the required time availability of 99 percent. The earth station transmitter will be operated under power control so that the EIRP can be increased by up to 2 dB. At the required level of availability, this will compensate for rain attenuation even in areas with relatively heavy precipitation. Therefore, no additional rain loss is shown in the uplink calculations.

The uplink carrier-to-interference ratio (C/I) is based on the calculations described in Section 2.7.1 and displayed in Table 2-3. The interference level used in the uplink performance analysis was calculated using the interference level produced by the USAT system with a 3-meter FDMA station. This value is the worst case of those considered. The downlink carrier-to-interference is negligible compared to the sum of the other noise and interference sources.

Using these values and assumptions, the remainder of the calculations are straightforward. The bit error rate (BER) objective of $1X10^{-6}$ is met with a system margin of 4.4 dB.

2.5.2 1.544 Mb/s Service

Table 2-4 shows analogous calculations for the T1 signal.

2.6 Service Availability

A single SpotNet satellite system link consists of the earth station transmitting chain including the encoder and modulator, the uplink path, the satellite itself, the downlink path, and the

TABLE 2-4 1.544 MBPS SERVICE

NEW YORK TO SPOTNET AT 60 WEST - LINK BUDGET

UPLINK (AT 14.25 GHZ)	
GROUND TRANSMITTER POWER TO SATURATE	21.7 DBW
NUMBER OF CARRIERS (16)	-12.0 DB
INPUT BACKOFF (CORRESPONDING TO 4 DB OPBO)	6.7 DB
GROUND TRANSMITTER POWER/CARRIER (2W)	3.0 DBW
TRANSMIT LOSSES	-1.5 DB
GROUND ANTENNA GAIN (2M WITH 55% EFFICIENCY)	46.9 DB
EIRP PER CARRIER *	48.4 DBW
PATH LOSS (45 DEGREE ELEVATION ANGLE)	207.0 DB
SATELLITE G/T	12.5 DB/K
BOLTZMANN'S CONSTANT	-228.6 DBW/K-HZ
UPLINK CARRIER-TO-NOISE-POWER DENSITY (C/NO) - UP	82.5 DBW/HZ
DOWNLINK (AT 12 GHZ)	
SATELLITE SATURATED EIRP	53.9 DBW
POWER SPLIT (16 CARRIERS)	-12.0 DB
OUTPUT BACKOFF	-4.0 DB
SATELLITE EIRP PER CARRIER	37.9 DBW
PATH LOSS (45 DEGREE ELEVATION ANGLE)	-205.5 DB
RAIN ATTENUATION (99% AVAILABILITY)	-1.2 DB
RECEIVING ANTENNA GAIN (2 M WITH 55% EFFICIENCY)	45.4 DB
RECEIVED CARRIER POWER	-123.4 DBW
BOLTZMANN'S CONSTANT	-228.6 DBW/K-HZ
RECEIVING SYSTEM NOISE TEMPERATURE	24.1 DBK
DOWNLINK NOISE DENSITY	-204.5 DBW/HZ
(C/NO) - DOWN	81.1 DB
DATA RATE (1.544 MBPS)	61.9 DB
(E B / N O) - UP	20.6 DB
(E B / N O) - DOWN	19.2 DB
C/IM	16.0 DB
(C/I) - UP (BASED ON FORD BEING THE INTERFEROR)	12.0 DB
TOTAL E B / N O, C/IM AND C/I - UP	9.7 DB
SYSTEM MARGIN	1.9 DB
EFFECTIVE E B / N O	7.8 DB
BIT ERROR RATE WITH CODING	10^{-6}

* THIS CORRESPONDS TO A POWER FLUX DENSITY OF -117.10 DBW/SQ M/MHZ AT THE SATELLITE.

associated control equipment. The overall availability of each link is enhanced by the four-satellite, two-orbit-location system, by the multiple- spot-beam coverage to major business and population centers, by designing the system to permit very small earth stations (which significantly lowers the cost of equipment and path redundancy at locations where it is required), by designing earth stations that can access any uplink channel, by incorporating both active and passive redundancy into the SpotNet satellite, by employing uplink power control at each earth station, and by a conservative approach to the specification of communications link performance.

Since outages can also result from failures of the power and attitude control subsystems of the satellite, active redundancy and standby redundancy will be employed in these two critical subsystems, respectively. Two orbital positions are necessary to permit continued system use during eclipse and solar outage. Eclipse and solar noise outage periods will be computed by NEX, and customers with access to only one orbital position will be notified well in advance of the anticipated outage times. Because NEX does not anticipate significant usage during eclipse periods, on-board battery capacity will be provided to power all required spacecraft functions, but for only partial power to the transponders. Continuous coverage will be provided only to customers who require it during the eclipse periods.

Customers who require uninterrupted service during solar noise outage periods can obtain such protection through the installation of dual antenna systems. Further protection from outages due to heavy rainfall or failure on a particular link can be achieved by application of fully redundant transmit/receive chains at the appropriate customer sites and transmitting the same information via two entirely separate links. Such redundancy is made possible by the small earth stations employed, as well as by the superior efficiency with which the SpotNet satellite system employs the geostationary orbit.

The satellite will be designed for an operational and mission life of 10 years, which is determined primarily by the amount of station-keeping propellant that is carried. The reliability of the channel amplifier TWTA's is such that a very high probability of continuous acceptable performance of all 24 transponder channels will be obtained by the 36-for-24 redundancy of the TWTA's. Life and reliability of the other components and subsystems will be maximized by using a proven satellite bus and proven reliability in the equipment design.

The ground segment TT&C equipment will also employ standard, proven-reliable designs with proven fail-safe capabilities and equipment redundancy to ensure a high level of availability. The use of two widely separated TT&C stations as described earlier will further add to the reliability.

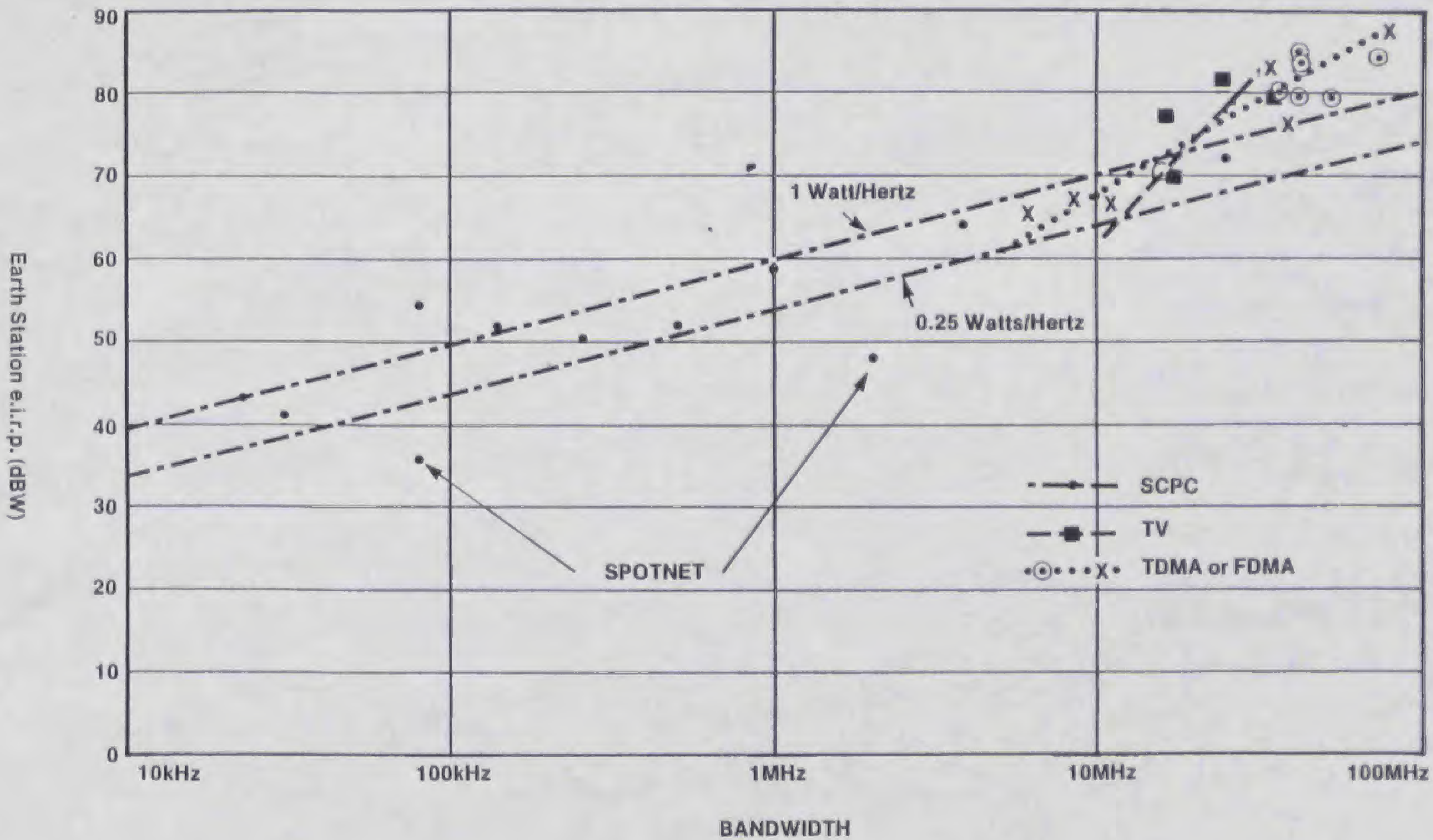
2.7 Orbital Interference Analysis

2.7.1. The Earth-to-Space Link Interference to/from SpotNet

In this section consideration is given to the interference of other satellite systems into a typical SpotNet satellite. Because of the high gain of the SpotNet satellite receiving antennas (and, therefore, the higher G/T), it is not anticipated that the relatively weak SpotNet earth stations will create objectionable interference to other systems. Figure 2-1 shows the typical earth station EIRP of the other systems as a function of bandwidth. The SpotNet earth stations have power levels about 10 dB below typical stations using the same bandwidth.

Tables 2-5 and 2-6 show the uplink 56 kb/s and 1.544 Mb/s interference analyses that were conducted for the SpotNet system. These tables provide an insight into the worst-case interference situation where the interferer has exactly the same frequency and polarization as SpotNet. It also assumes that all the interfering earth stations are located at the beam center where the gain is the highest. In reality, some will be scattered throughout the beam and produce a slightly lower interference level.

Since there is no way of knowing what satellites may be assigned orbit locations adjacent to SpotNet, the analysis includes the same representative set of satellites chosen for downlink analysis in the previous Section. The first column in the Tables identifies the filing and the form of communication. In the case of GSAT, the bandwidth has been normalized to 80 KHz and the EIRP has been adjusted accordingly. The transmitting earth station antenna diameter is identified in column 2. Assuming the antenna meets the current 32-25 log theta requirements, the off-axis pattern rejection is calculated for 3° satellite spacing using the same 20.1 dB employed by RCA Americom, Inc. in its April 1983 application (see RCA's Table IV, Angular Discrimination of Earth Station Antennas). The on-axis



Note: See Table 2 - 8 for identification of each point

FIGURE 2 -1 UPLINK EIRP VS BANDWIDTH

Table 2-5
Uplink Interference Into SpotNet

Representative System producing Interference	Earth Station eirp dBW	ant m	3° Rej	Net eirp dBW	Interference rel to SpotNet dB
Ford					
SCPC	43.5	3.5	30.1	13.4	-21
GSTAR					
64 kb/s	51.5	5.5	37.9	13.6	-20.8
USAT					
FDMA					
in 10 MHz	67.9				
in 80 kHz	46.9	5	34.9	12	-22.6
	46.9	3	30.3	16.6	-17.8

Assumptions:
1) SpotNet service: 56kb/s in 80 kHz with 34.4 dBW from its earth station
2) 32-25 log theta
3) Exact frequency interference

Note: Use of transmitting antennas with 29-32 log theta will improve the values shown by 3 dB.

Table 2-6
Uplink Interference Into SpotNet

Representative System producing Interference	Earth eirp dBW	Station ant m	3° Rej	Net eirp dBW	Interference rel to SpotNet dB
Ford					
FDM/FM					
in 36 MHz	83				
in 2 MHz	70.4	7	36.1	34.3	-14.1
in 36 MHz	76.3				
in 2 MHz	63.7	2.5	27.3	36.4	-12
GSTAR					
TDMA or FM/TV					
in 36.3 MHz	79.5				
in 2 MHz	66.9	5.5	34.6	32.3	-16.1
USAT					
FDMA					
in 10 MHz	67.9				
in 2 MHz	55.3	5	34.9	20.4	-28
	55.3	3	30.3	25	-23.4

Assumptions:
1) SpotNet service: 1.544 Mb/s in 2 MHz with 48.4 dBW from its earth station
2) 32-25 log theta
3) Exact frequency interference

Note: Use of transmitting antennas with 29-32 log theta will improve the values shown by 3 dB.

EIRP is reduced by the off-axis rejection of the earth station antenna to produce the net EIRP directed towards the SpotNet satellite (column 4). This level is compared to the 34.4 dBW from a SpotNet earth station (for 56 kb/s or 48.4 dBW for T1). The final column shows the interference into SpotNet from another earth station located adjacent to the desired station.

It has been assumed that the interfering carriers coincide exactly with the SpotNet carrier and that no frequency coordination has been attempted. Substantial protection ratio values have been reported if this is done. See, for example, CCIR Preparatory Meeting SAT-R2, Document A/35-E, Protection Ratios for Planning at RARC-83, Joint Meeting, Study Groups 4, 5, 9, 10 and 11, Geneva, 1982 (submitted by the United States). Spectrum spreading has not been used. The reality that all of the interfering earth stations will not be exactly colocated with the center of the SpotNet beam further reduces the true level of interference.

2.7.2 Space-to-Earth Link Interference to/from Spotnet

Table 2-7 shows the downlink interference from a SpotNet satellite into other satellite system's earth stations, which may located at the center of SpotNet's antenna pattern in New York.

As there are a wide variety of satellites and antenna patterns three cases have been selected. The Ford Aerospace satellite's eastern beam represents a high EIRP case. Its on-axis gain is shown as 51 dBW and New York is located at the -1 dB contour (50 dBW). USAT's Conus coverage beam represents a low EIRP case. the GTE GSTAR eastern beam represents an intermediate

TABLE 2-7
Downlink Interference from SpotNet

Representative Satellite Interfered With	Estimated EIRP for NYC dBW	on axis	C/I Ratio (dB) 3m NY	ant axis	5m NY	ant axis
Ford-East Beam	50	51	23	24	27.4	28.4
GSTAR-East Beam	45	47.9	18	20.9	22.4	25.3
USAT-Conus	41	43	14	16	18.4	20.4

situation. These satellites are typical of the remaining U.S. domestic applicants that may be adjacent to a SpotNet satellite. It is unlikely that there will be two SpotNets (one on the immediate east and the other to the immediate west) of the desired satellite.

The C/I ratio of the downlink has again been calculated using the RCA Americom Ku-band satellite application material referenced in Section 2.7.1 above, and for an orbital separation of three degrees and then 32-35 log theta antennas. Data is provided for both 3.05 and 5 meter antennas located in New York and at the center of the satellites' antenna patterns. The downlink carrier-to-interference from other satellites into the SpotNet earth station is negligible compared to other noise and interference sources.

3.0 SPACE SEGMENT DESCRIPTION

3.1 General

This section (Section 3.0) provides a technical description of the satellites that will comprise the space segment of the SpotNet satellite system. Four satellites with identical capabilities will be launched, and a fifth will be held as a ground spare. The communications payload of each satellite will consist of 24 Ku-band transponders. The satellites will be either three-axis stabilized or spin-stabilized, with the actual technique being selected during the satellite process. NEX plans to use an existing flight-proven satellite bus such as the Hughes spin-stabilized bus or the RCA Satcom three-axis stabilized bus. The final choice of the satellite manufacturer and launch system will be made during the procurement process.

A summary of the space segment parameters is provided in Table 2-8.

3.2 Satellite Launch

The NEX satellites will be compatible with a launch by either the Space Shuttle or by Ariane. Each launch vehicle alternative has distinct advantages and disadvantages, and the final selection will depend upon reliability, scheduling/availability, cost, and spacecraft configuration tradeoffs.

Launch support arrangements have not been completed, since they depend in part upon the launch vehicle chosen, exact scheduling and other factors. During the launch phase, TT&C facilities may be leased throughout the United States and other parts of the world. After positioning into the geostationary orbit, the TT&C functions will be accomplished from NEX's own TT&C facilities.

3.3 Satellite Useful Lifetime

Each satellite will be designed for an on-orbit and minimum mission life of 10 years. These goals will be achieved by careful evaluation of the effects of the space environment on the solar array, the effects of charge and discharge cycling on the satellite batteries, and wear-out characteristics of the 24 primary and 12 spare TWTA's. Materials and processes will be selected so that aging or wearing effects will not adversely affect spacecraft performance over the estimated life. A complete failure mode and effects analysis will be required of

TABLE 2-8. OPERATIONAL SATELLITE CHARACTERISTICS

Parameter	Type of Value
Launch vehicle	STS (Shuttle) or Ariane
Launch date	Early 1986
Satellite mission life/ design life	10 years
North-south stationkeeping accuracy	0.05°
East-west stationkeeping accuracy	0.05°
Eclipse capability	50% (12 of 24 channels)
Stabilization	Spin or 3-axis stabilized
RF output power per TWTA	20 watts
Communications channelization channels	24 operational 36 MHz
Communications EIRP per transponder	Min. Size Beam 59.9 dBW Max. Size Beam 56.9 dBW
Communications receive G/T	Min. Size Beam 19.4 dB/K Max. Size Beam 16.4 dB/K
Communications receive SFP (at 0 dB gain step)	$-95.4/-102.4$ dBW/m^2 (See Section 3.5.3)
Commandable gain steps	4 ; 0, -3, -6, -9 dB (Min.)
12/14 communications frequencies -	
Transmit	11.700 to 12.200 GHz
Receive	14.000 to 14.500 GHz
TT&C EIRP	To be determined (TBD) TBD
TT&C receive flux density	TBD TBD
TT&C frequencies -	
Telemetry	TBD
Command	TBD
Communications polarization -	
Transmit	12 channel linear horizontal, 12 channel linear vertical
Receive	12 channel linear vertical, 12 channel linear horizontal
TT&C polarization -	
Telemetry	TBD
Command	TBD

the spacecraft manufacturer, and both active and passive redundancy will be employed to assure that the objectives are met. Further assurance of obtaining the useful life and reliability goals will be achieved by relying upon a space-proven satellite bus.

The propulsion subsystem will be sized for and loaded with sufficient propellant to maintain operational attitude and stationkeeping control for at least 10 years. Additional propellant will also be incorporated to provide correction of the initial orbit, initial attitude acquisition, satellite spin or despin if required, and at least one orbital repositioning maneuver at a drift rate of 1° per day during the lifetime of the satellite. Sufficient propellant will also be reserved for removing the spacecraft from orbit after its mission is complete.

3.4 Satellite Housekeeping Subsystems

3.4.1 Attitude Control and Stationkeeping

The satellites will include an attitude control subsystem to provide pointing accuracies consistent with the achievement of the specified communications performance and inclusive of all error sources (e.g. attitude perturbations, thermal-induced distortions, misalignments, orbital tolerances, and perturbations produced by stationkeeping maneuvers).

The NEX satellites will be designed to maintain the inclination of the orbit to ± 0.05 degrees or less and the longitude position within ± 0.05 degrees.

3.4.2 Electrical Power

The electrical power subsystem will be designed so that at the end of the spacecraft life, sufficient power will be available to operate all 24 active transponder channels and the housekeeping loads. Sufficient battery capacity will be provided to provide power for all housekeeping functions, and approximately half-power for the transponders during the eclipse periods at end of life.

The primary source of power will be solar cells with energy-storage batteries for eclipse operation. No single failure in the electrical energy system will cause spacecraft failure.

3.4.3 Telemetry, Tracking and Control ("TT&C")

The TT&C subsystem will perform the monitoring and command functions necessary to control the spacecraft during transfer-orbit maneuvers, near-geostationary drift orbit and attitude acquisition phases, normal on-station conditions, and any unanticipated periods of attitude instability. The TT&C signals will occupy parts of the 11.7-12.2-GHz and 14.0-14.5-GHz bands, using frequencies and polarizations that are not occupied by the normal communications signals. The exact command frequencies, polarizations, and transmission characteristics will be specified when the TT&C station applications are filed.

The telemetry portion of the TT&C subsystem provides a continuous stream of data concerning the status of the spacecraft, its attitude and its performance. The telemetry transmitter also will serve as the downlink transmitter for ranging tones and to indicate the successful receipt and execution of ground-initiated commands. The primary telemetry mode will be PCM. The telemetry and command subsystems will utilize antennas with both omni-directional and narrow-beam capabilities. For normal on-station operation, the telemetry transmitters will be connected to the narrow beam-antennas. During the transfer-orbit phase, and as an emergency backup on station, the telemetry transmitters can be connected to the omni-directional antenna.

The command portion of the TT&C subsystem will control the operations of the spacecraft and its communications payloads throughout all phases of the mission. It will receive, decode and distribute all command signals, and will do so with a high probability of success and low probability of errors. The omni-directional command antenna will be used during the transfer-orbit phase and for on-station backup. The narrow beam antenna will be used for normal operation.

The command and telemetry elements will also be used to carry out the ranging and tracking functions. The command system will serve as the uplink receiver for ranging codes of multiple tones and for providing closed-loop tracking and ground beacon for spacecraft pointing. As noted above, the telemetry transmitter also will serve as the downlink transmitter for retransmission of the ranging tones. The TT&C earth stations will derive range data from these tones and derive angular tracking information from the carrier.

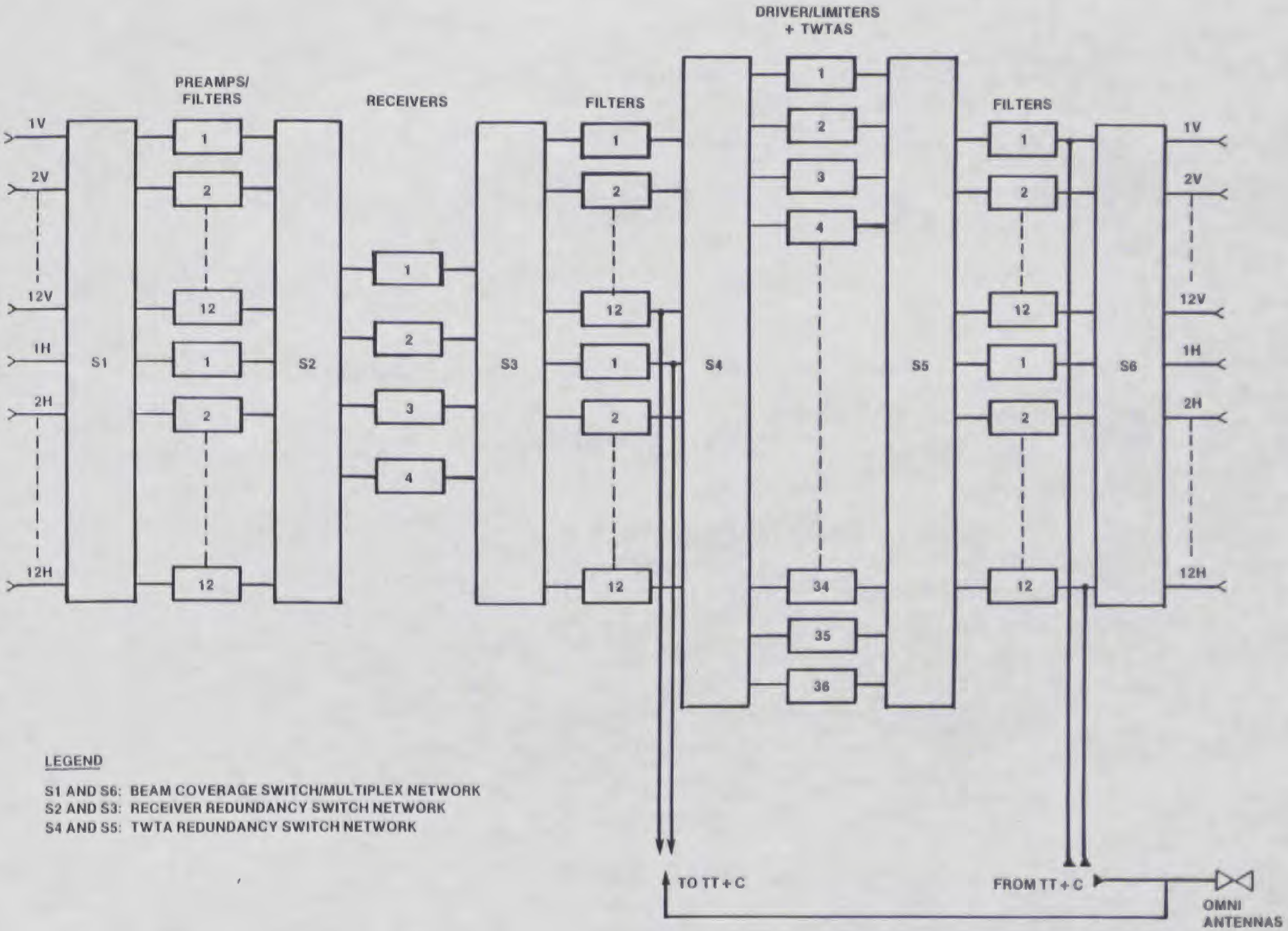
The TT&C subsystem will include appropriate circuitry to assure immediate cessation of all RF emissions from the satellite upon command from the TT&C earth station.

3.5 Satellite Communication Subsystem

3.5.1. Overall

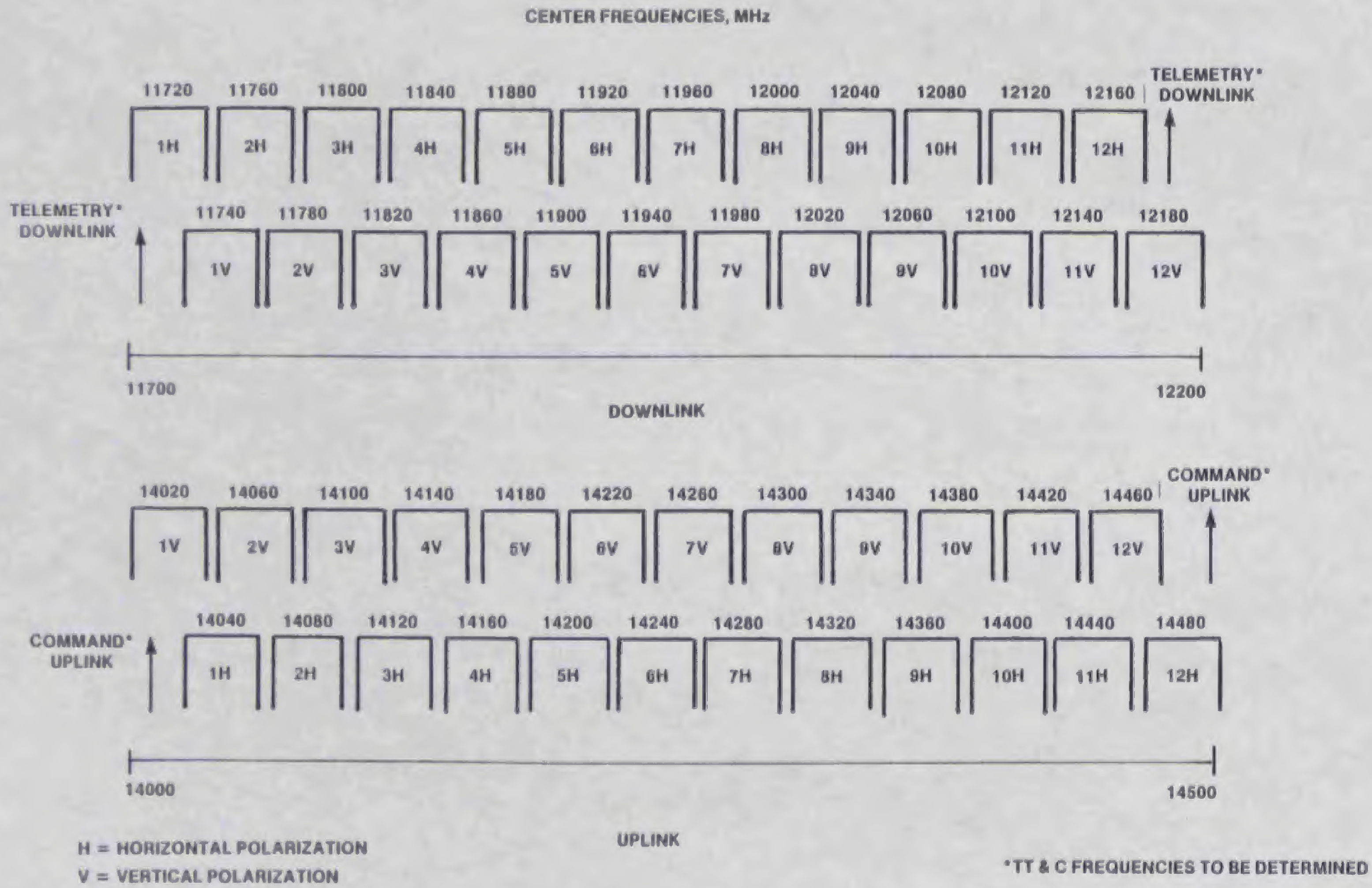
A representative block diagram of the satellite communication subsystem is shown in Figure 3-1. The final configuration will depend to some extent upon the satellite vendor selected during the procurement process and the resultant options for implementing the desired performance characteristics. The overall frequency/polarization plan is displayed in Figure 3-2. The four in-orbit satellites and the ground spare will be identical in design and construction except for different antenna configuration for different geographic coverage and for the frequencies of the spot beams to avoid interference and obtain frequency reuse.

An illustrative frequency/polarization/coverage plan for the downlink frequencies for two SpotNet co-located satellites is shown in Figure 3-3. An overall frequency/polarization plan like that shown in Figure 3-2 is not sufficient when considering the SpotNet system, since co-located satellites can use the same frequencies and polarization as long as different (and sufficiently separated) beams are used. The overall frequency and coverage plan in Figure 3-3 illustrates a total of 24 geographical coverage areas labelled A through X. The beams from a single SpotNet satellite could cover essentially all of the continental United States, as well as the offshore points of Hawaii and Alaska, orbit location permitting. With a total of 48 transponders at a single orbital slot, each area A through X could be served by an average of about two transponders. In



SPOTNET SATELLITE COMMUNICATIONS SUBSYSTEM

FIGURE 3-1



FREQUENCY AND POLARIZATION PLAN

FIGURE 3-2

FIGURE 3-3

ILLUSTRATIVE DOWNLINK FREQUENCY REUSE PLAN
FOR ONE ORBIT POSITION

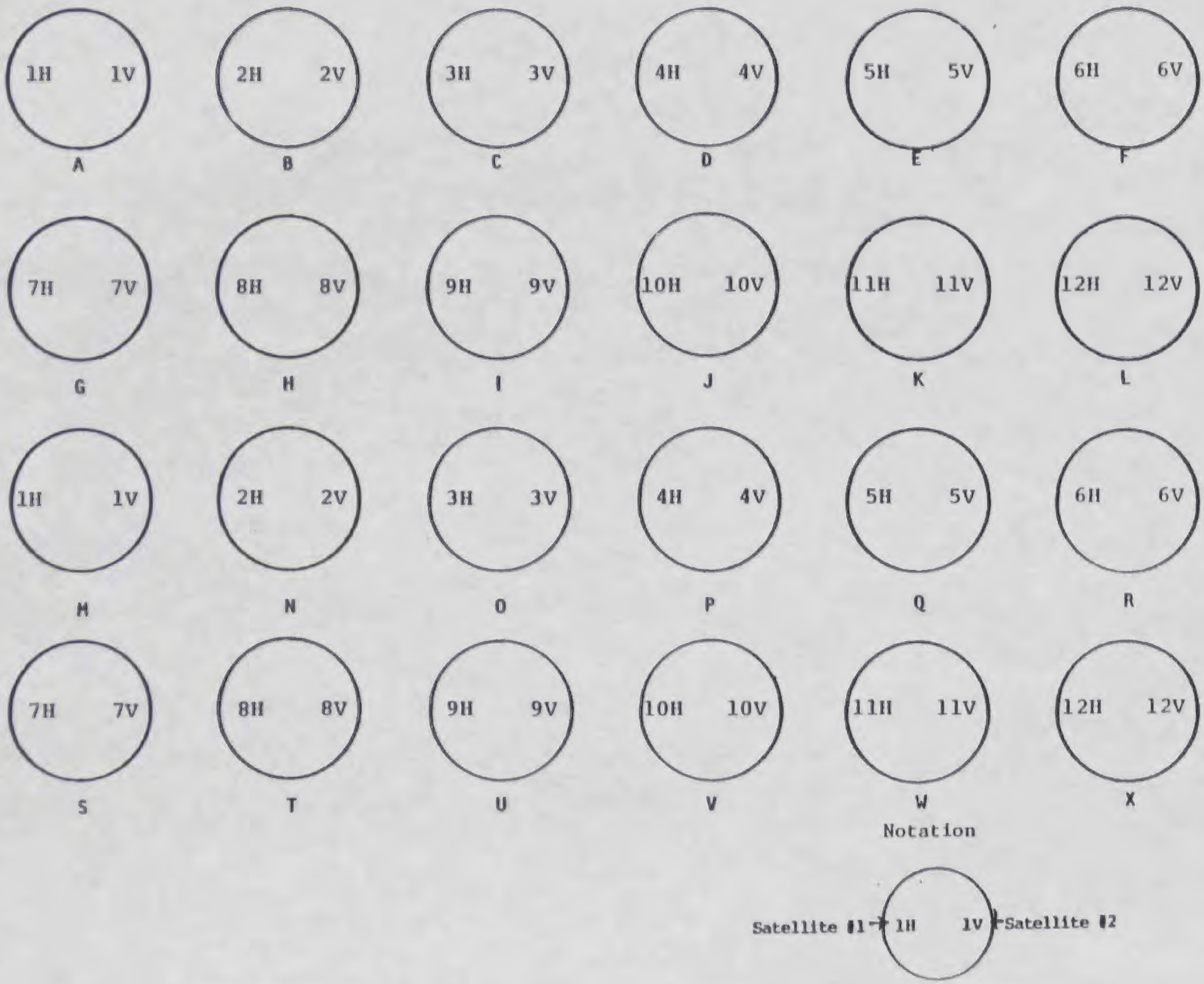


Figure 3-3, for example, location A is served by two transponders from a single orbital location. It is served by channel 1H (horizontally polarized) on SpotNet 1, and channel 1V (vertically polarized) on SpotNet 2. Spots that are sufficiently separated can reuse the same frequency and polarization. Figure 3-3 shows reuse of each polarization and frequency twice at each orbital location. In the example, channels 1V and 1H are used again at location M. Such reuse is easily attainable given the narrow beam width produced by a modestly large (10-foot) satellite antenna at Ku-band. With 48 transponders at each of two such orbital locations, each area A through X can be served by an average of four transponders.

In practice, the actual distribution of spots will differ from this stylized plan although the same principles apply. The individual coverage areas will vary depending on location relative to the satellite, and some spots may be enlarged to provide wider coverage in more sparsely populated areas. Likewise, in practice, some locations will be served by more than four spots, while others will be served by fewer. The actual configuration will depend upon the geographic distribution of market demand and the orbital slots assigned to NEX by the Commission. The net result, however, will be that each satellite will reuse the available 500 MHz of uplink and downlink spectrum twice through cross-polarization, and the second satellite at each orbital location will use the same frequencies and polarizations still another time. <u>Thus the available band width will be reused a total of at least four times at each slot, for</u>

an effective bandwidth of 2000-3000 MHz or more at each slot.

As shown in Figure 3-1, each spot beam is associated with a separate feedhorn. Twelve of the transponders are vertically polarized and 12 are horizontally polarized as described earlier.

Figure 3-1 shows each transponder beam as a separate feedhorn for conceptual clarity consistent with Figure 3-3; diplexers are not shown for the same reason. As indicated above, however, some spot beams will be associated with more than one transponder frequency. There will be limited capability to switch some transponders to alternate spot beams, thereby affording a measure of in-orbit reconfiguration to adjust for actual traffic patterns among the beam areas. This will be particularly useful at the time each successive satellite is launched. This combination and reconfiguration of transponders is shown as the S1/S6 switch/multiplex network.

An uplink signal is received on one of the spot beams, fed through a diplexer, and the S1 switch/multiplex network, and then amplified in a low-noise amplifier, filtered and translated to the downlink frequency. The pre-amplifiers and filters between the antenna inputs and the receivers are necessary to achieve frequency reuse of the uplink frequencies on each polarization by different satellites at the same orbital position. Switches S2 and S3 provide 4-for-2 redundancy of the receivers, with one operational receiver required for each polarization.

The signal from the receiver is fed through an input multiplexer and filtered to a 36-for-24 ring redundant TWTA switch network, S4. From there it is fed to a driver amplifer, TWTA, another ring redundant switch network, S5, a final bank of filters and the associated S6 output multiplexer/switch network, and finally through a diplexer (again not shown) to the associated antenna spot beam.

3.5.2. Effective Isotropic Radiated Power (EIRP) and Figure of Merit (G/T)

The saturated power output of each TWTA will be 20W (13 dBW). The 13 dBW of saturated transponder output power coupled with 1.1 dB of internal losses between the TWTA and the antenna feed produces an output power of 15.5 W (11.9 dBW) at the antenna. As discussed in more detail below, the satellite antenna will have an on-axis gain of 48 dB for the minimum sized beam and 45 dB for the largest. Thus the downlink-saturated EIRP will be 59.9 and 56.9 dBW, respectively.

The peak uplink gain of the spacecraft antenna will be approximately 49.4 and 46.4 dB for the smallest and largest beams respectively, and the receiving system noise temperature will be approximately 30 dB/K. This produces Figure of Merits (G/T) of about 19.4 and 16.4 dB/K for the two cases.

These communication system performance parameters are summarized in Table 3-1.

3.5.3 Saturated Flux Density (SFD)

The SFD required to drive a transponder to maximum will be -95.4 dBW/m^2 for the conditions for which the link budget of Section 2-5 were developed. For a location at the center of the smallest uplink beam, the corresponding value needed to saturate the transponder would be -102.4 dBW/m^2.

3.5.4 Transponder Channel Gain

The gain of each transponder channel (from receive antenna port to transmit antenna port) will be approximately 109.4 dB at the 0 dB setting of the step attenuator and saturated transponder outputs. Each transponder channel will be equipped with a commandable step attenuator which will allow the gain to be adjusted from over an appropriate range.

3.5.5 Satellite Emission Limitations

Satellite output filtering serves to limit both both limit the adjacent channel interference within the satellite and the out-of-band spurious signals, harmonics and noise radiated by the satellite. Since NEX has not chosen a satellite vendor, the exact filter characteristics cannot be specified at this time. However, the SpotNet satellites will be designed to meet all applicable rules and standards of good engineering practice regarding such emissions.

3.5.6 Antenna Characteristics

The antenna pattern for each satellite will provide spot beams covering locations as described above in the continental U.S. and, orbit location permitting, Alaska and Hawaii. The cross-polarization isolation of the antenna will be at least 33 dB in both the transmit and receive modes.

An assembly of horns to create the desired spot beams will feed a parabolic reflector with a nominal diameter of 10 feet. The parabolic reflector will consist of two polarization-selective gridded offset paraboloids. As noted above, the maximum uplink and downlink gains will be approximately 49.4 dB and 48.0 dB, respectively. The minimum half-power beamwidth for each spot will be approximately 0.67° for the downlink at 12.0 GHz and 0.57° for the uplink at 14.25 GHz. Typically, the interbeam isolation for beams employing the same frequencies and polarizations from the same orbital location will be over 20 dB at an angular separation of .8° as viewed from the satellite.

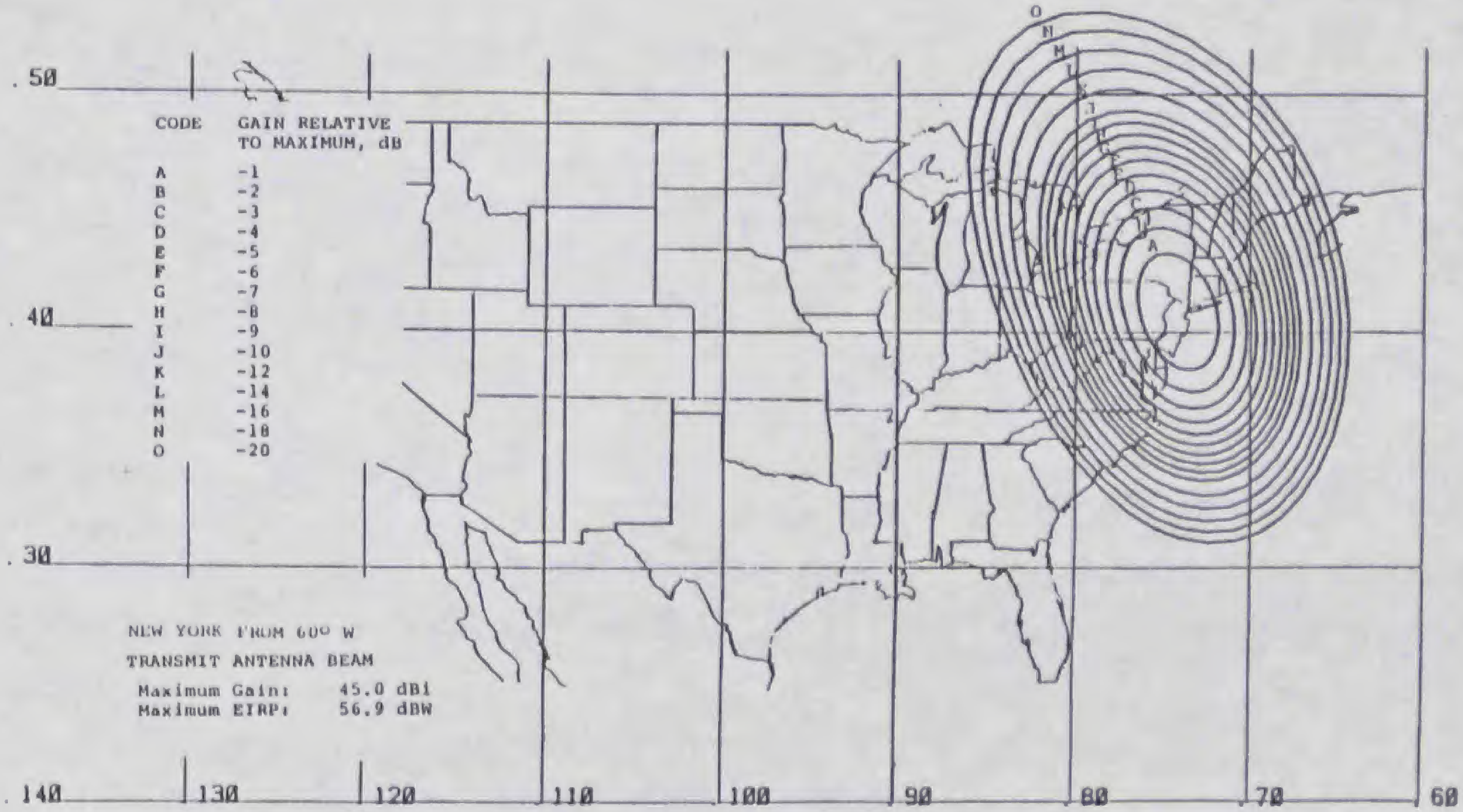
3.5.7 Antenna Coverage Patterns

Representative coverage patterns showing nominal EIRP and G/T contour for individual spot beams from two satellites located at approximately 60° West and 120° West are shown in Figures 3-4 through 3-9. All of these sample contours assume the larger-sized beam. The contours can be issued to compute nominal antenna gain and saturated flux density contours using the relationships provided earlier. Each SpotNet satellite will produce 24 such spots. Because the exact coverage will depend upon the orbital positions assigned to NEX by the Commission, physical constraints imposed on feedhorn locations, and geographic distribution of market demand, coverage contours for each spot for each satellite are not being supplied at this time.

3.5.8 Orbital Arc Considerations

The NEX SpotNet satellite system will require the assignment of two orbital slots. Because of SpotNet's unique spot beam design, NEX will be able to add additional satellites at the initial orbital locations. There are two major considerations that bear on the choice of the initial orbital locations. The first consideration is that of 50-state average. NEX intends to provide coverage to Alaska and Hawaii, and will do so if the Commission assigns the requested 105° West Longitude or similar location. The second consideration is

Figure 3-4



Representative Coverage Pattern
New York from 60° West
(EIRP)

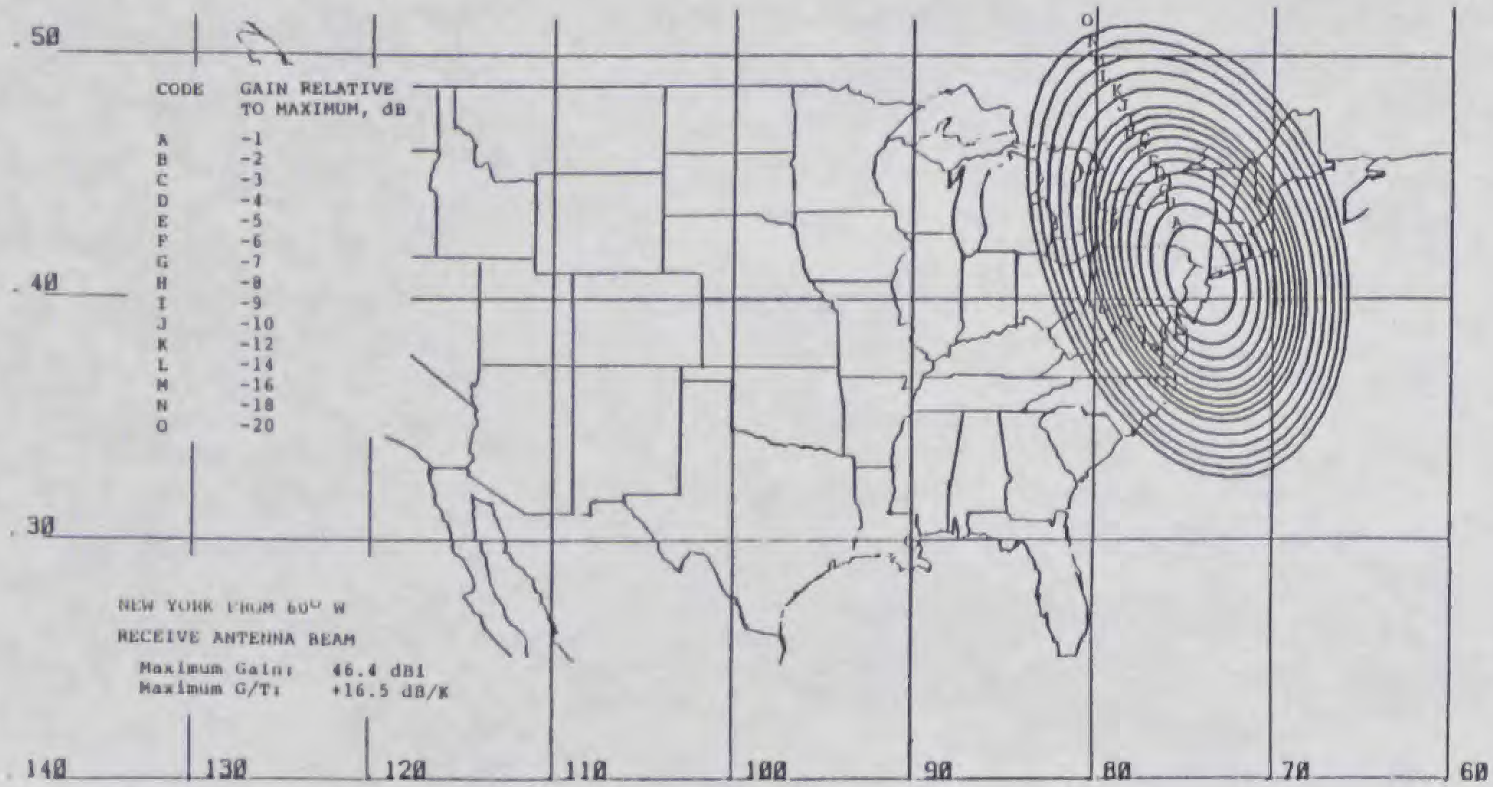
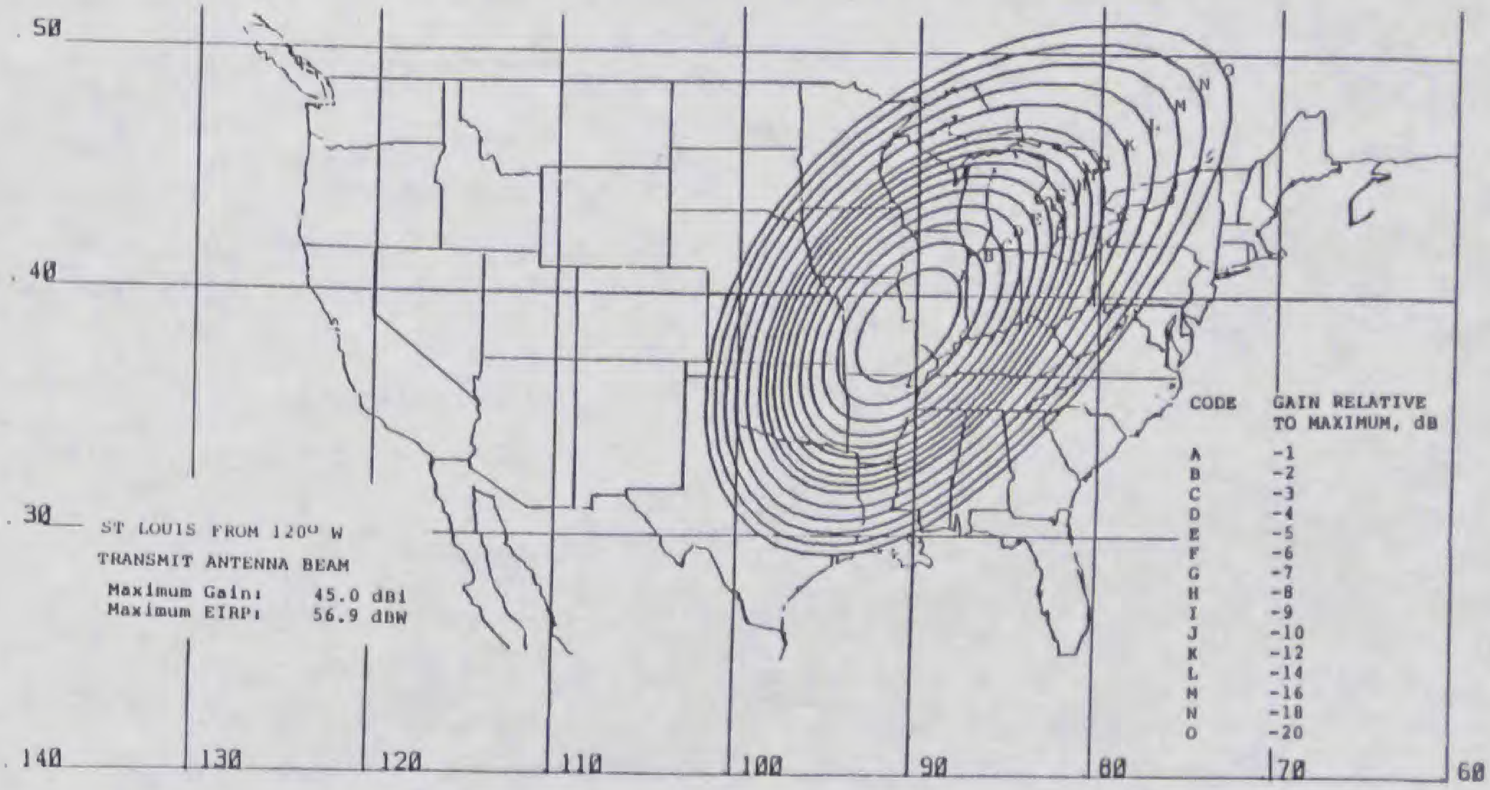


Figure 3-5

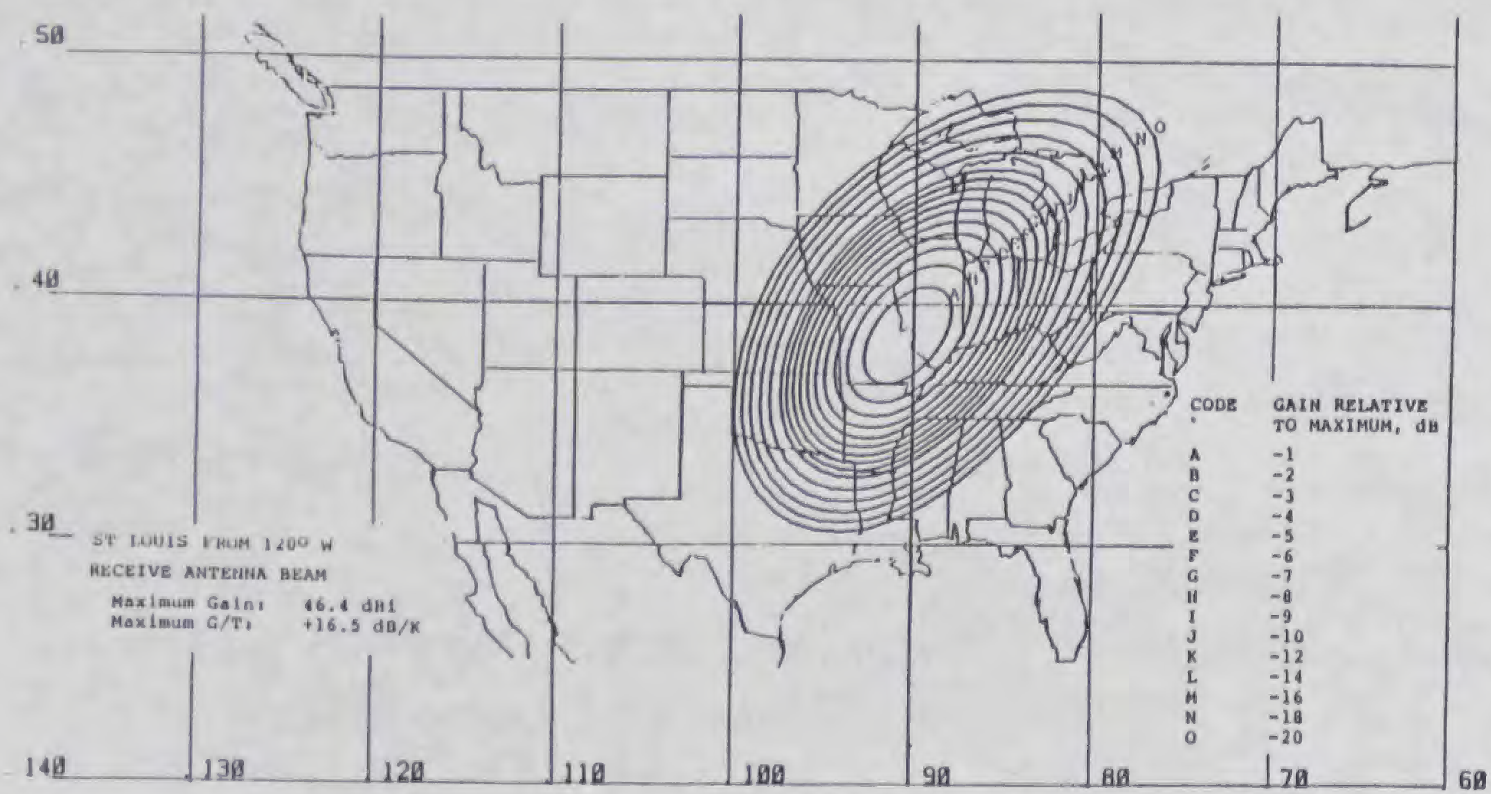
Representative Coverage Pattern
New York from 60° West
(G/T)

Figure 3-6



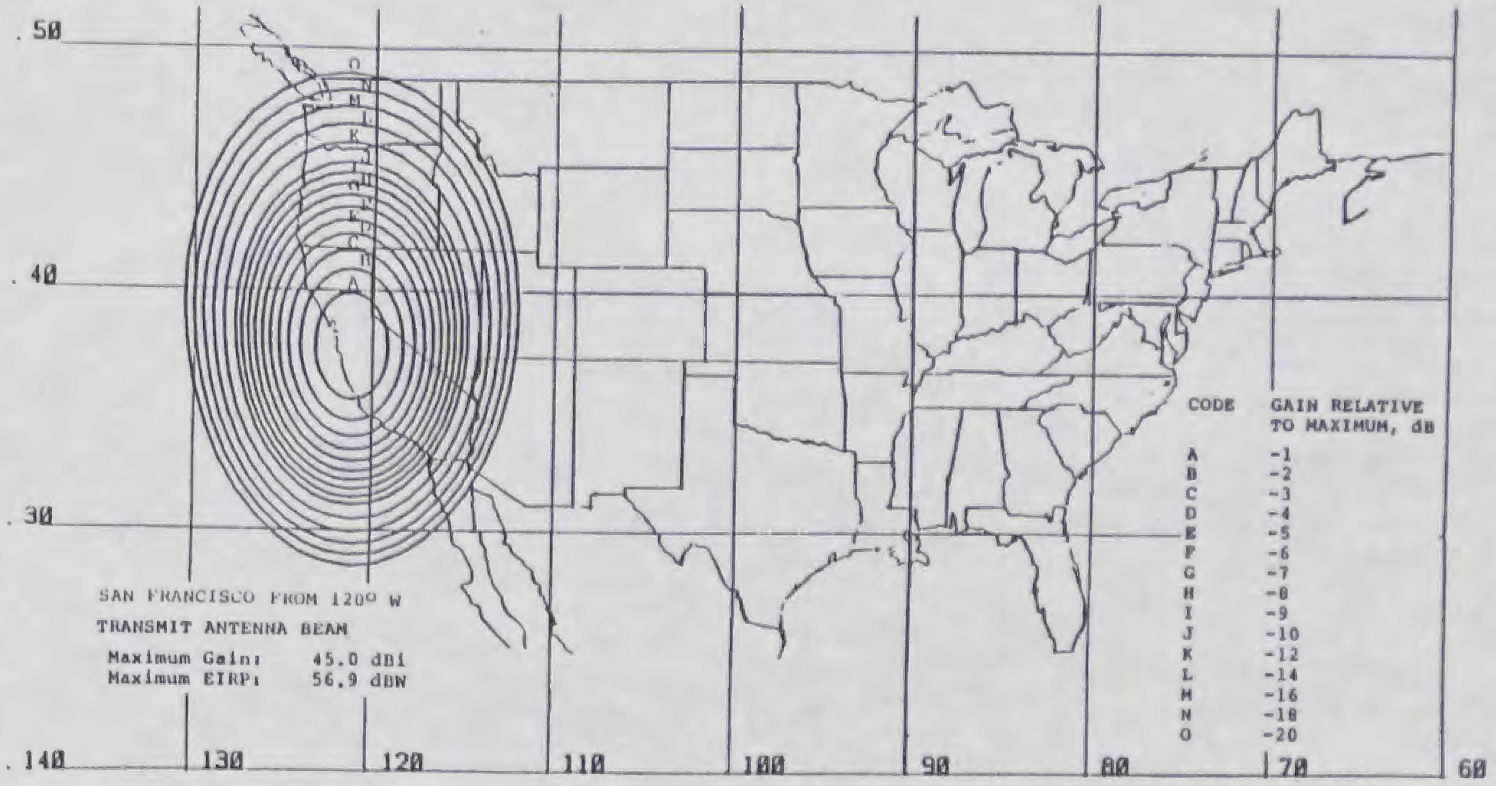
Representative Coverage Pattern
St. Louis from 120° West
(EIRP)

Figure 3-7



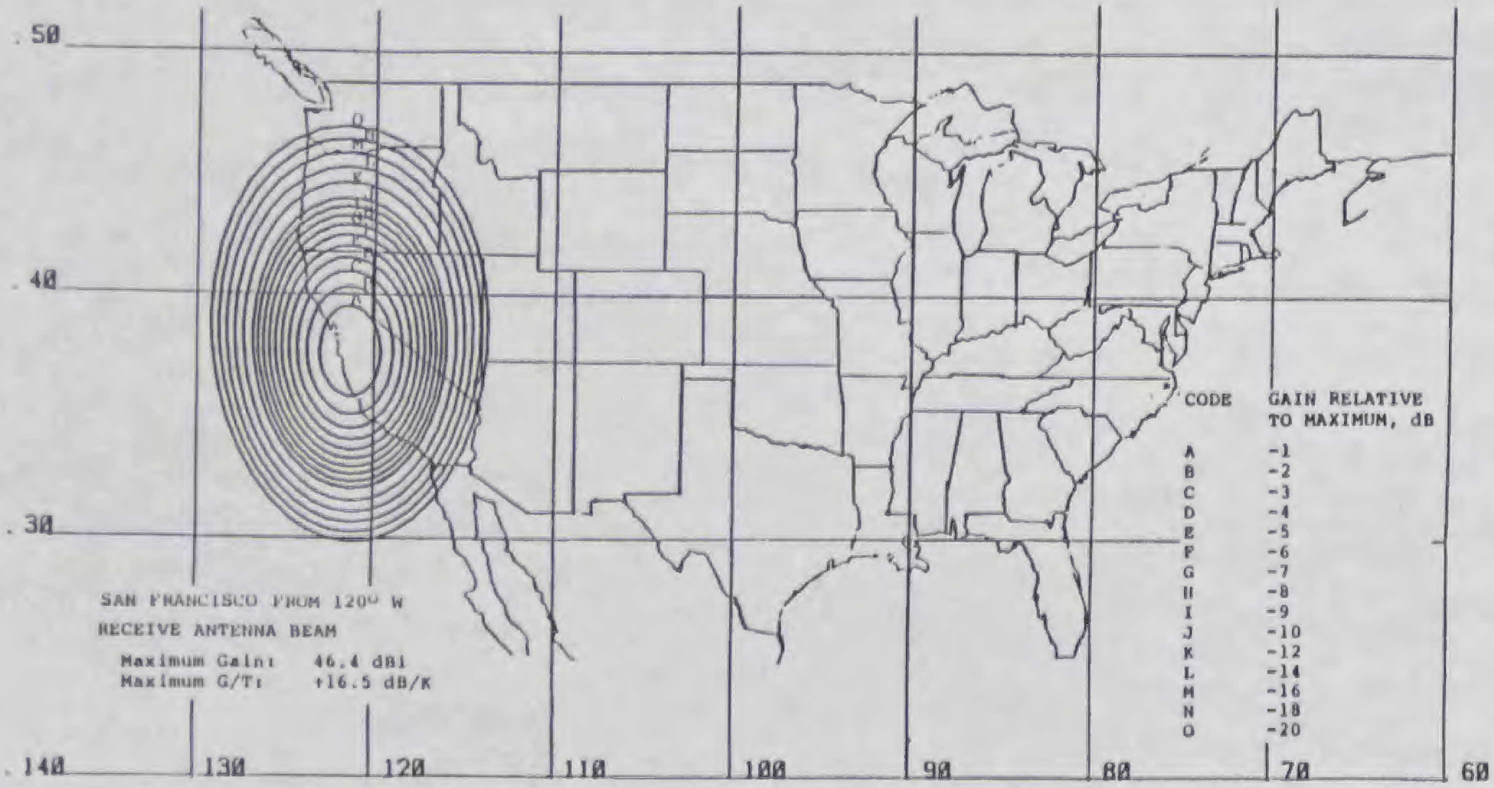
Representative Coverage Pattern
St. Louis from 120° W
(G/T)

Figure 3-8



Representative Coverage Pattern
San Francisco from 120° West
(EIRP)

Figure 3-9



Representative Coverage Pattern
San Francisco from 120° W
(G/T)

the adverse effects of heavy rain on Ku-band operations, particularly in the eastern and southeastern regions of the country. This means that orbital locations toward the center of the domestic geostationary arc are necessary to permit high elevation angles that minimize rainfall attenuation and depolarization effects. A final consideration is that since SpotNet will have less flexibility in beam shaping than satellites with CONUS or regional coverage beams employed by other applicants, locations near the center of the arc are desirable in order to allow coverage to be controlled more readily. Controlled coverage is an important factor in achieving intensive frequency reuse. Therefore, NEX is seeking as its second orbital position, 80° West Longitude, which is acceptable for CONUS coverage.

In view of the inherent public benefits flowing from the intense frequency reuse in the SpotNet system, and because of the public benefits associated with providing innovative services to Alaska and Hawaii, NEX requests that the locations assigned be near the middle portion of the arc at the requested 105° and 80° West Longitude positions.

4.0 GROUND SEGMENT DESCRIPTION

4.1 General

This section describes in general terms the earth station segment of the SpotNet satellite system. Specific applications for customer-premise earth stations will be filed in the future.

4.2 Typical Earth Stations

A typical earth station for providing 1.544 Mbps service with the SpotNet system would have a 2.0-meter antenna, a 4-W power amplifier operating nominally in clear-sky conditions at 2-W, and a receiving system noise temperature of about 24 dBK. With these characteristics, the earth stations would produce a nominal EIRP of 48.4 dBW, and would have figure of merit (G/T) of 21.3 dB/K. Such an earth station would be capable of handling one T1 (1.544 Mbps) signal. A typical station for providing 54 Kbps service would consist of a 2.0-meter antenna, a .016 W power amplifier operating nominally at only 0.08 W per carrier and the same receive noise system temperature. For this station, the nominal EIRP would be 34.4 dBW, and the G/T would be the same 21.3 dB/K.

4.3 Tracking, Telemetry, and Control ("TT&C") and Network Control Center ("NCC")

The ground segment of the SpotNet system will include a primary TT&C/NCC facility to be located on the East Coast, and a secondary or backup facility to be located on the West Coast. Each TT&C station will include two 5.5 meter-diameter antennas, and will operate at Ku-band. These facilities will be staffed around the clock, and they will have the responsibility for assuring the proper operation of the satellites using the tracking, monitoring, range finding and command functions associated with the TT&C system. They will also have the responsibilities associated with the allocation, assignment, and adjustment of SpotNet communications capacity and characteristics. These ground segment facilities will employ standard, proven, reliable designs with proven fail-safe capabilities and equipment redundacy to ensure a high level of availability.

Specific locations, exact frequencies, polarizations and transmission equipment parameters for the two NEX-owned TT&C

stations will be specified to the Commission in the appropriate applications to be filed at a later time.

PART III

SATELLITE APPLICATIONS

APRIL 26, 1983

PART III

PART III

LIST OF FIGURES

LIST OF TABLES

1.1

<u>Application for Authority to Construct and Launch a Domestic Communications Satellite to be Fixed at Orbital Position 80° West Longitude</u>

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of the Application of	)	
NATIONAL EXCHANGE, INC.	)	File No. ________________
For Authority to Construct, Launch and Operate a Domestic Communications Satellite to be Fixed in Geosynchronous Orbit at 80° West Longitude	)	

APPLICATION

National Exchange, Inc. ("NEX"), pursuant to Sections 308, 309 and 319 of the Communications Act of 1934, as amended, hereby applies for authority to construct, launch and operate a domestic communications satellite that will function in the 12- and 14-GHz frequency bands. NEX requests that the Commission reserve a geosynchronous orbital position in the vicinity of 80° West Longitude for this satellite, as well as for a second satellite that will be co-located with this satellite and which is the subject of a separate application being submitted simultaneously with this application. In support of this application, NEX respectfully states:

1. The satellite for which construction, launch and operating authority is requested herein is an integral part of the SpotNet domestic communications satellite system that is

being proposed by NEX. The satellite will perform communications and tracking, telemetry and command (TT&C) functions in the 12-GHz (downlink) and 14-GHz (uplink) frequency bands. The satellite is one of four in-orbit satellites that NEX proposes to construct, launch and position at two orbital locations to comprise its initial satellite system.

2. The satellite's technical characteristics are summarized in Table 3-1. Figure 3-1 shows the satellite frequency plan.

3. The antenna design of the satellite provides for spot beams covering an area from 250 to 400 miles across, with the exact dimensions of each beam chosen to reach as many customers as possible. Representative service contours are shown in Figures 3-2 and 3-3 for the orbital position of 60° West Longitude.

4. The satellite will be equipped with 24 operational transponder channels. The communications subsystem block diagram is shown in Figure 3-4. The satellite will be designed for a mission and orbital life of 10 years.

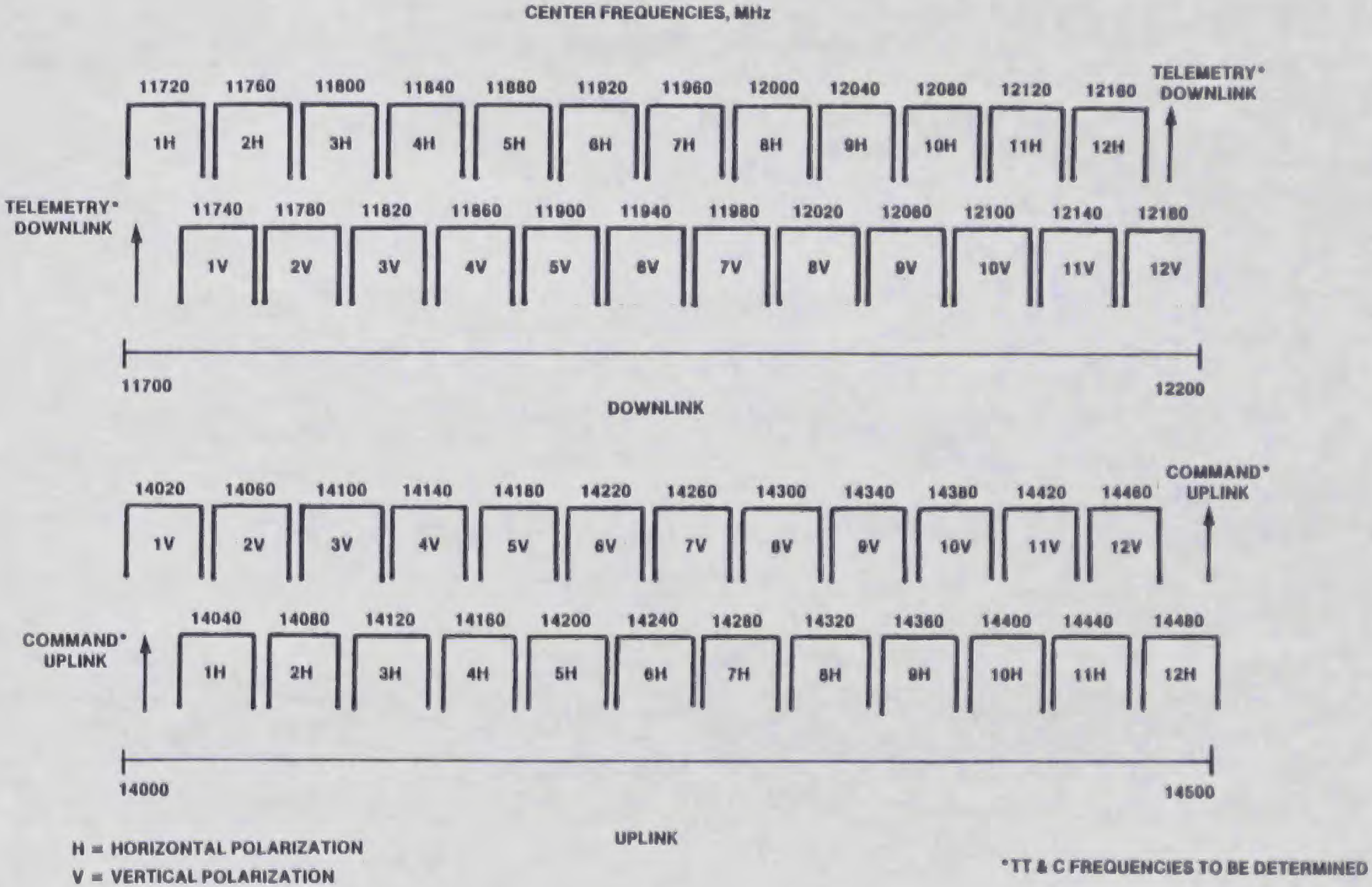
5. The satellite's TT&C signals will occupy parts of the 11.7-12.2-GHz and 14.0-14.5-GHz bands, using frequencies and polarizations that are not occupied by the normal communications signals. The exact command frequencies, polarizations, and transmission characteristics will be specified in a separate letter to the Commission at a later time.

6. An analysis of potential harmful inter-satellite interference due to the satellite's operation is included in Part II, Section 2.7, of the application for overall system authority

TABLE 3.1 OPERATIONAL SATELLITE CHARACTERISTICS

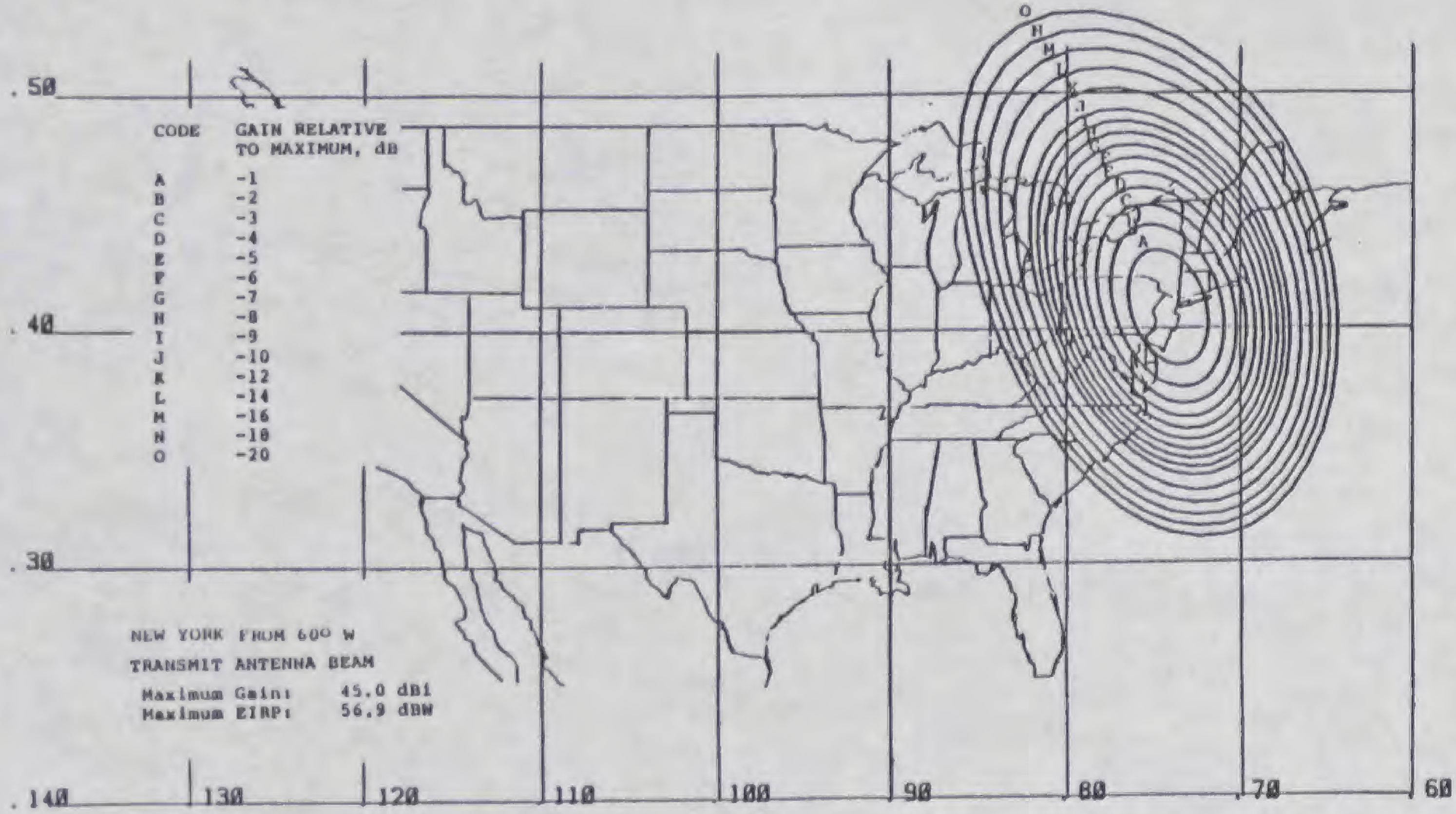
Parameter	Type of Value
Launch vehicle	STS (Shuttle) or Ariane
Launch date	Early 1986
Satellite mission life/ design life	10 years
North-south stationkeeping accuracy	0.05°
East-west stationkeeping accuracy	0.05°
Eclipse capability	50% (12 of 24 channels)
Stabilization	Spin or 3-axis stabilized
RF output power per TWTA	20 watts
Communications channelization channels	24 operational 36 MHz
Communications EIRP per transponder	Min. Size Beam 59.9 dBW Max. Size Beam 56.9 dBW
Communications receive G/T	Min. Size Beam 19.4 dB/K Max. Size Beam 16.4 dB/K
Communications receive SFP (at 0 dB gain step)	$-95.4/-102.4$ dBW/m^2 (See Section 3.5.3)
Commandable gain steps	4 ; 0, -3, -6, -9 dB (Min.)
12/14 communications frequencies -	
Transmit	11.700 to 12.200 GHz
Receive	14.000 to 14.500 GHz
TT&C EIRP	To be determined (TBD) TBD
TT&C receive flux density	TBD TBD
TT&C frequencies -	
Telemetry	TBD
Command	TBD
Communications polarization -	
Transmit	12 channel linear horizontal, 12 channel linear vertical
Receive	12 channel linear vertical, 12 channel linear horizontal
TT&C polarization -	
Telemetry	TBD
Command	TBD

FIGURE 3-1



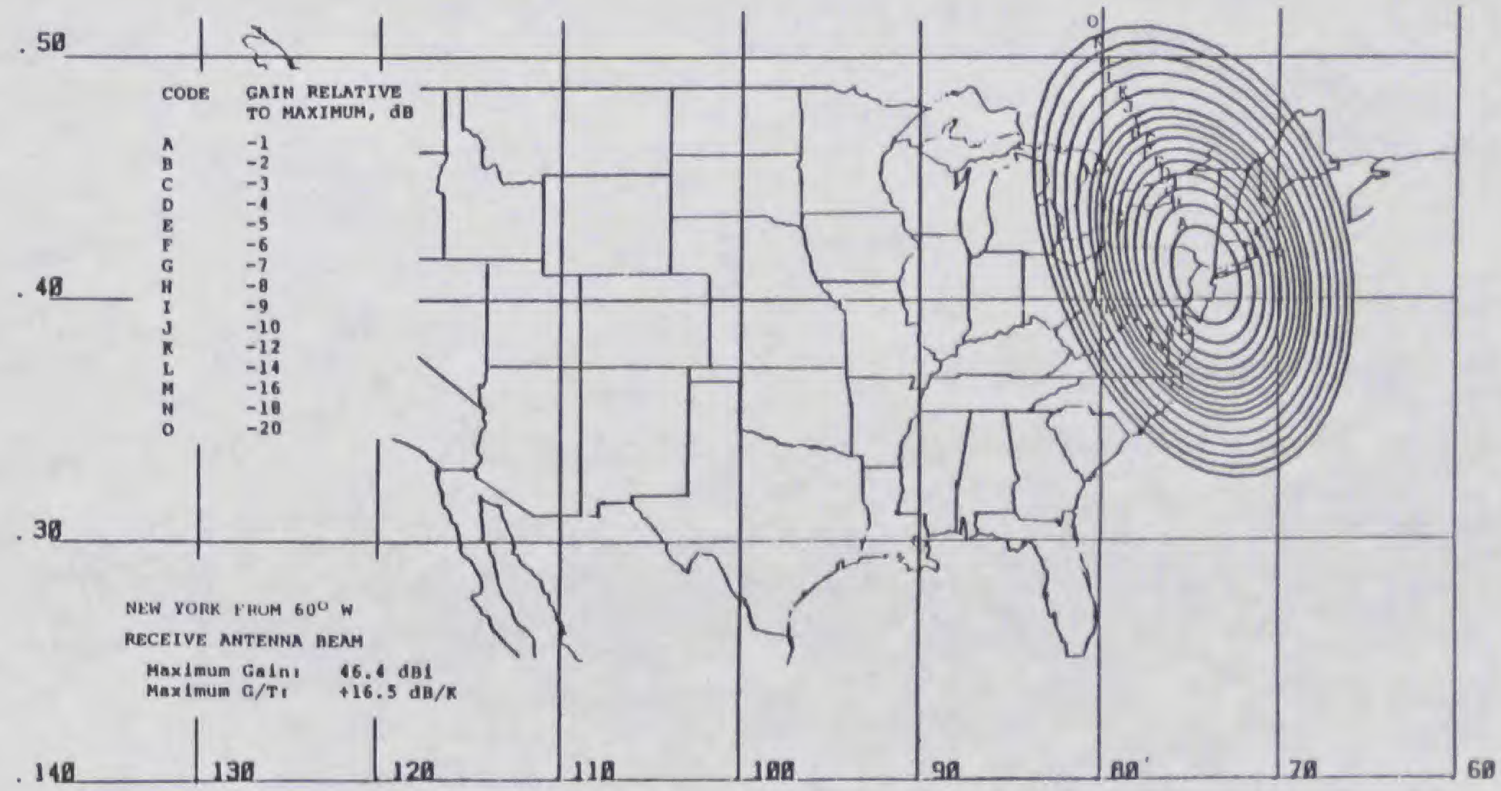
FREQUENCY AND POLARIZATION PLAN

FIGURE 3-2

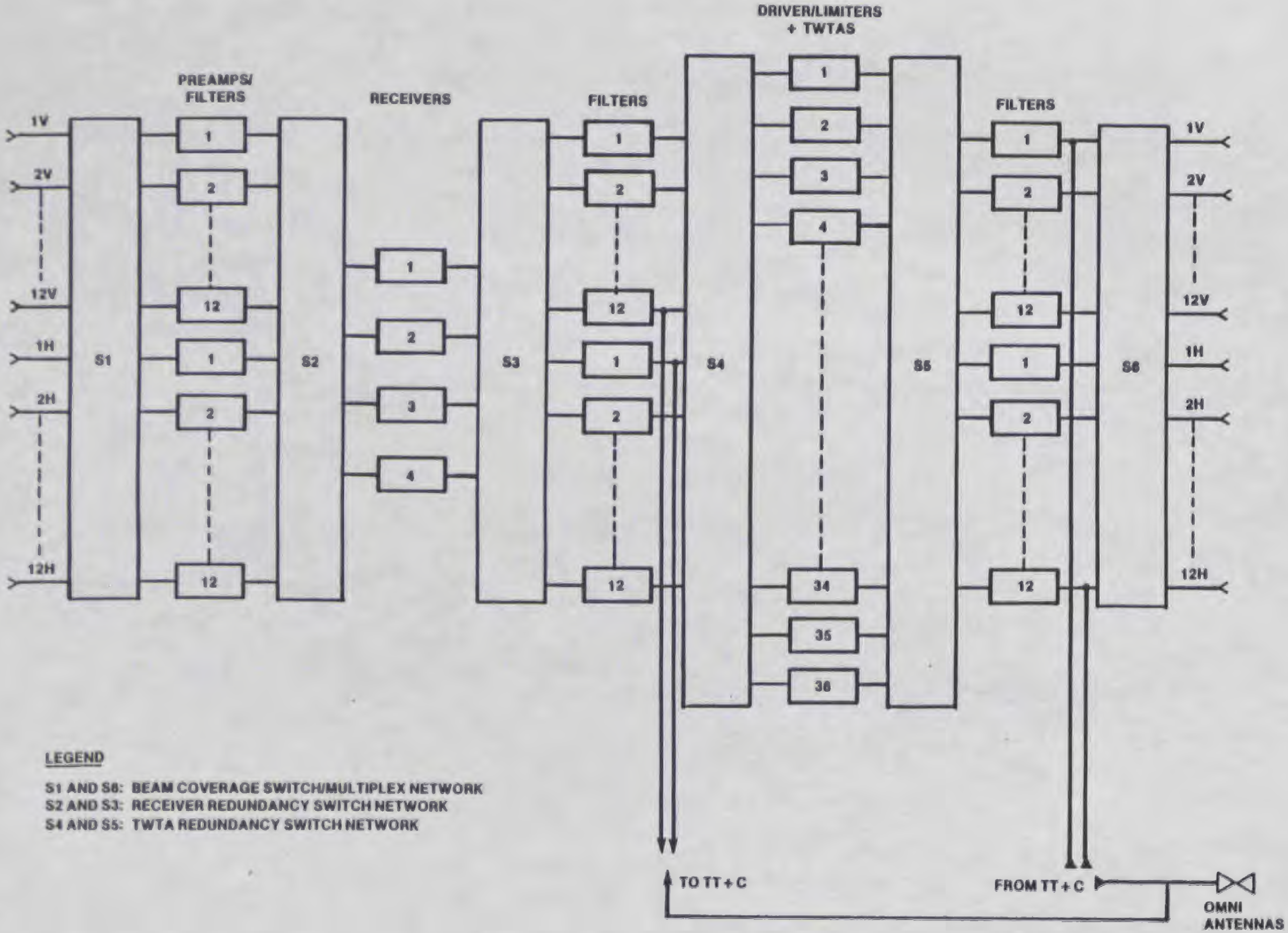


Representative Coverage Patterns
New York from 60° West
(EIRP)

FIGURE 3-3



Representative Coverage Patterns
New York from 60° West
(G/T)



LEGEND

S1 AND S6: BEAM COVERAGE SWITCH/MULTIPLEX NETWORK
S2 AND S3: RECEIVER REDUNDANCY SWITCH NETWORK
S4 AND S5: TWTA REDUNDANCY SWITCH NETWORK

SPOTNET SATELLITE COMMUNICATIONS SUBSYSTEM

FIGURE 3-4

of which this application is a part, and is incorporated herein by reference.

7. The costs of this satellite and NEX's four other proposed satellites, four launch vehicles, and launch service for four launches -- all of which comprise the space segment -- are provided in Part I, Section 5.0, of the NEX satellite system proposal referenced above.

8. Correspondence with respect to this application may be addressed to the following:

Clay T. Whitehead
President
Network Exchange, Inc.
Suite 1000
10850 Wilshire Boulevard
Los Angeles, California 90024

with a copy to

Henry Goldberg, Esq.
Verner, Liipfert, Bernhard
and McPherson, Chartered
Suite 1100
1660 L Street, N.W.
Washington, D.C. 20036
(202) 452-7440

9. The Applicant waives any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests construction and launch authority in accordance with this application. All statements made in the attached exhibits are a material part hereof, and are incorporated herein as if set out in full in this application.

10. Parts I and II of NEX's application set forth the public interest considerations and the financial, legal and

technical qualifications of the Applicant, as well as other information pertinent to this application, and are incorporated herein by reference.

11. The undersigned certifies individually and for NEX that the statements made in this application are true, complete, and correct to the best of his knowledge and belief, and are made in good faith.

Wherefore, NEX requests that the Commission grant this application.

Respectfully submitted,

NATIONAL EXCHANGE, INC.

By ______________________
Clay T. Whitehead
President

DATED: April 26, 1983

CERTIFICATION OF PERSON RESPONSIBLE
FOR PREPARING ENGINEERING INFORMATION
SUBMITTED IN THIS APPLICATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, and that I am familiar with Part 25 of the Commission's Rules. In preparing this application I relied upon the expertise of Walter L. Morgan, Consultant, Communications Center of Clarksburg, for certain information. Mr. Morgan worked under my supervision. I certify that this application is complete and accurate to the best of my knowledge.

By Dale N. Hatfield

Dale N. Hatfield
Technical Consultant
NATIONAL EXCHANGE, INC.

DATED: April 26, 1983

1.2

<u>Application for Authority to Construct and Launch a Domestic Communications Satellite to be Fixed at Orbital Position 80° West Longitude</u>

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of the Application of NATIONAL EXCHANGE, INC. For Authority to Construct, Launch and Operate a Domestic Communications Satellite to be Fixed in Geosynchronous Orbit at 80° West Longitude	)))))))))))	File No. ______________

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3. The antenna design of the satellite provides for spot beams covering an area from 250 to 400 miles across, with the exact dimensions of each beam chosen to reach as many customers as possible. Representative service contours are shown in Figures 3-2 and 3-3 for the orbital position of 60° West Longitude.

4. The satellite will be equipped with 24 operational transponder channels. The communications subsystem block diagram is shown in Figure 3-4. The satellite will be designed for a mission and orbital life of 10 years.

5. The satellite's TT&C signals will occupy parts of the 11.7-12.2-GHz and 14.0-14.5-GHz bands, using frequencies and polarizations that are not occupied by the normal communications signals. The exact command frequencies, polarizations, and transmission characteristics will be specified in a separate letter to the Commission at a later time.

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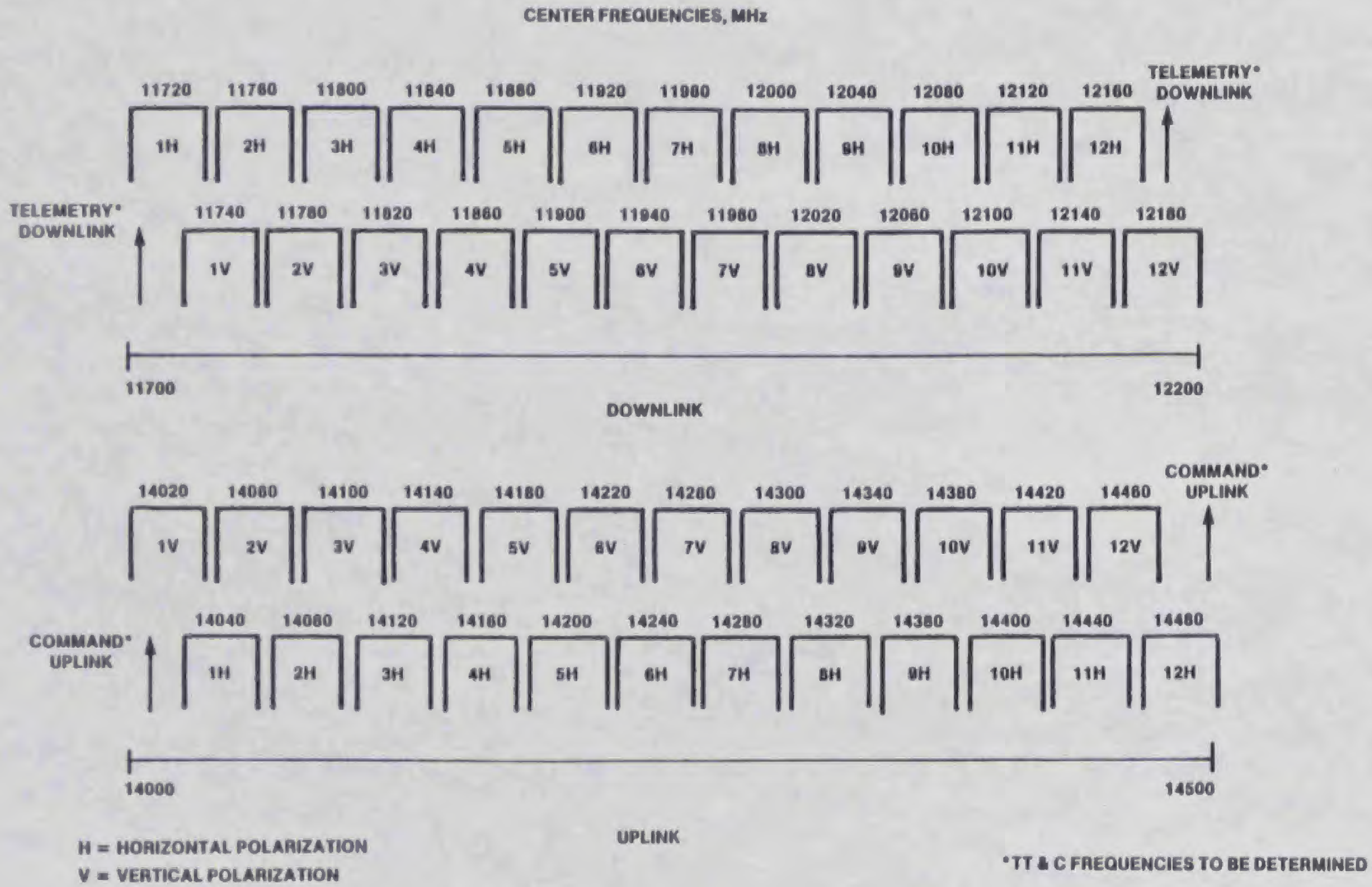
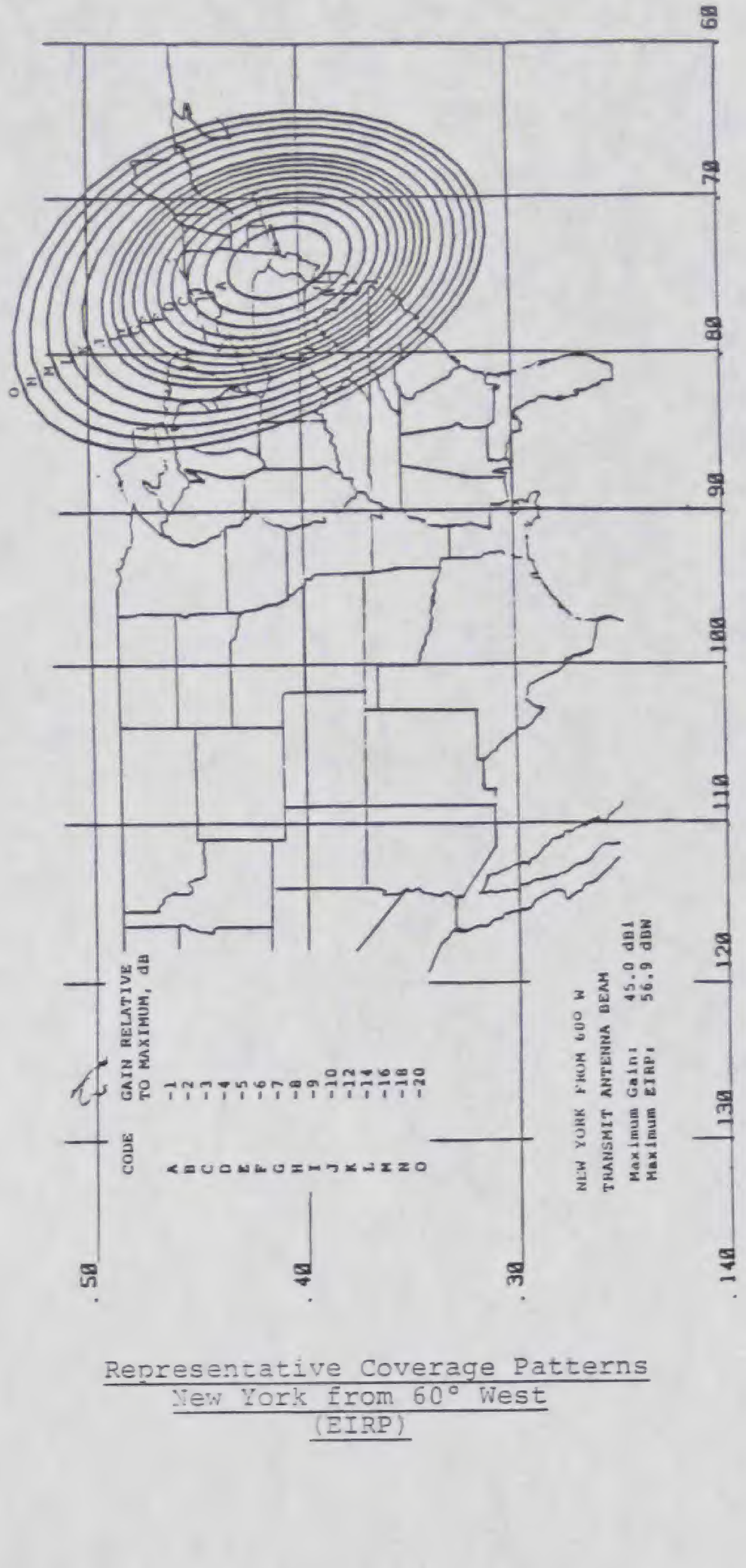
Communications receive G/T	Min. Size Beam 19.4 dB/K Max. Size Beam 16.4 dB/K
Communications receive SFP (at 0 dB gain step)	$-95.4/-102.4$ dBW/m^2 (See Section 3.5.3)
Commandable gain steps	4 ; 0, -3, -6, -9 dB (Min.)
12/14 communications frequencies -	
Transmit	11.700 to 12.200 GHz
Receive	14.000 to 14.500 GHz
TT&C EIRP	To be determined (TBD)
	TBD
TT&C receive	TBD
flux density	TBD
TT&C frequencies -	
Telemetry	TBD
Command	TBD
Communications polarization -	
Transmit	12 channel linear horizontal, 12 channel linear vertical
Receive	12 channel linear vertical, 12 channel linear horizontal
TT&C polarization -	
Telemetry	TBD
Command	TBD



FREQUENCY AND POLARIZATION PLAN

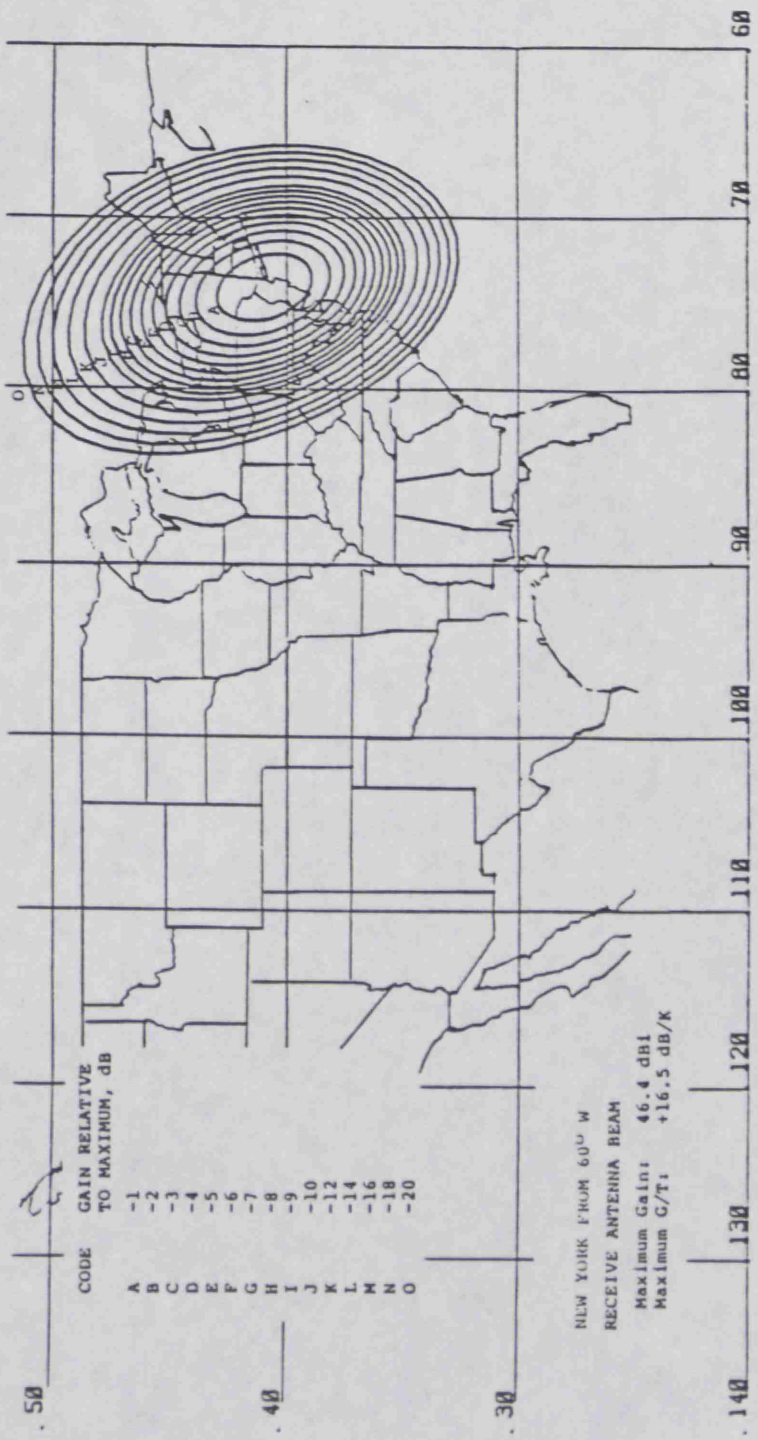
FIGURE 3-1

FIGURE 3-2

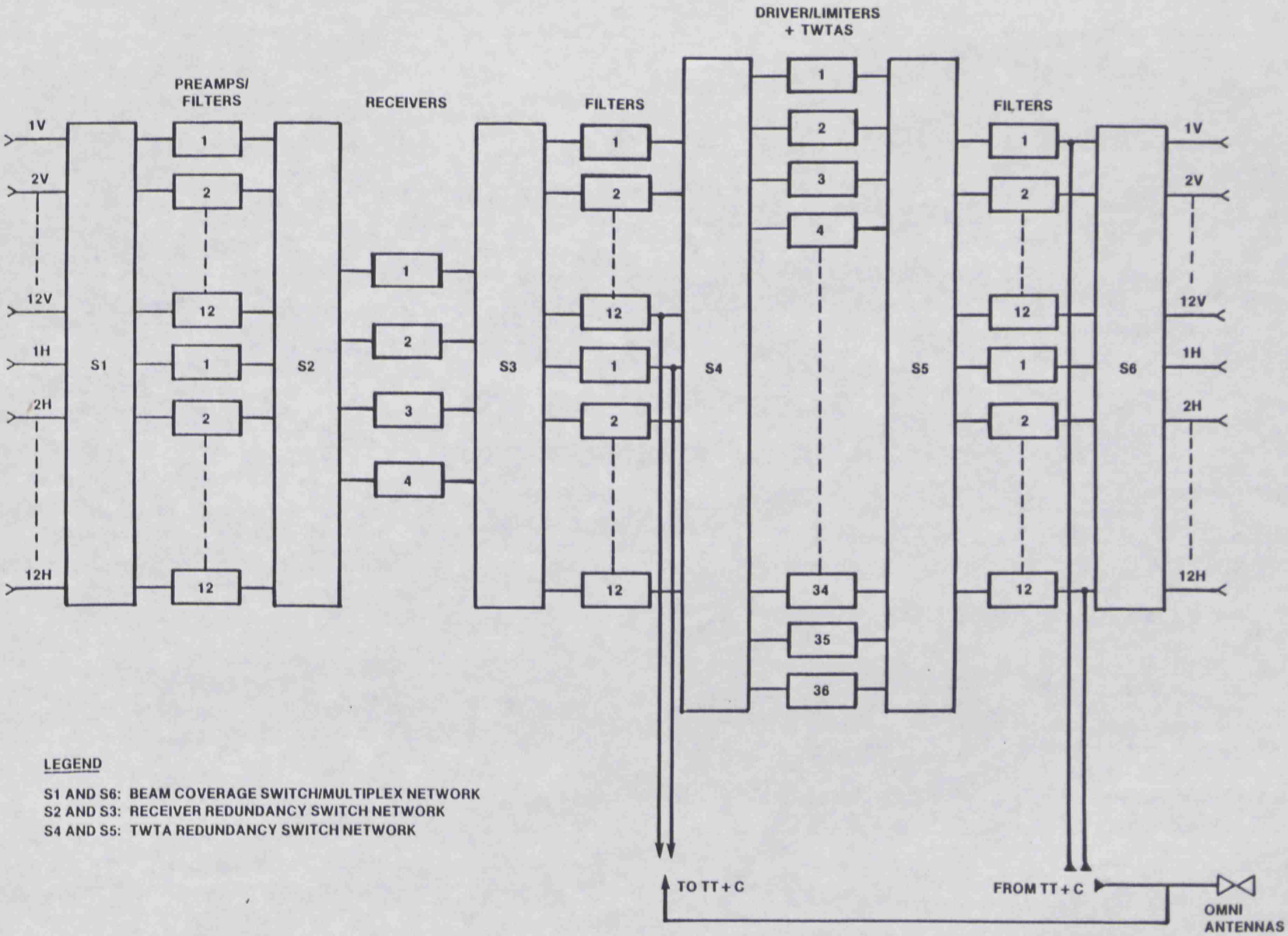


Representative Coverage Patterns
New York from 60° West
(EIRP)

FIGURE 3-3



Representative Coverage Patterns
New York from 60° West
(G/T)



LEGEND

S1 AND S6: BEAM COVERAGE SWITCH/MULTIPLEX NETWORK
S2 AND S3: RECEIVER REDUNDANCY SWITCH NETWORK
S4 AND S5: TWTA REDUNDANCY SWITCH NETWORK

SPOTNET SATELLITE COMMUNICATIONS SUBSYSTEM

FIGURE 3-4

of which this application is a part, and is incorporated herein by reference.

7. The costs of this satellite and NEX's four other proposed satellites, four launch vehicles, and launch service for four launches -- all of which comprise the space segment -- are provided in Part I, Section 5.0, of the NEX satellite system proposal referenced above.

8. Correspondence with respect to this application may be addressed to the following:

Clay T. Whitehead
President
Network Exchange, Inc.
Suite 1000
10850 Wilshire Boulevard
Los Angeles, California 90024

with a copy to

Henry Goldberg, Esq.
Verner, Liipfert, Bernhard
and McPherson, Chartered
Suite 1100
1660 L Street, N.W.
Washington, D.C. 20036
(202) 452-7440

9. The Applicant waives any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests construction and launch authority in accordance with this application. All statements made in the attached exhibits are a material part hereof, and are incorporated herein as if set out in full in this application.

10. Parts I and II of NEX's application set forth the public interest considerations and the financial, legal and

technical qualifications of the Applicant, as well as other information pertinent to this application, and are incorporated herein by reference.

11. The undersigned certifies individually and for NEX that the statements made in this application are true, complete, and correct to the best of his knowledge and belief, and are made in good faith.

Wherefore, NEX requests that the Commission grant this application.

Respectfully submitted,

NATIONAL EXCHANGE, INC.

By ______________________
Clay T. Whitehead
President

DATED: April 26, 1983

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I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, and that I am familiar with Part 25 of the Commission's Rules. In preparing this application I relied upon the expertise of Walter L. Morgan, Consultant, Communications Center of Clarksburg, for certain information. Mr. Morgan worked under my supervision. I certify that this application is complete and accurate to the best of my knowledge.

By Dale N. Hatfield

Dale N. Hatfield
Technical Consultant
NATIONAL EXCHANGE, INC.

DATED: April 26, 1983

1.3

<u>Application for Authority to Construct and Launch a Domestic Communications Satellite to be Fixed at Orbital Position 105° West Longitude</u>

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of the Application of NATIONAL EXCHANGE, INC. For Authority to Construct, Launch and Operate a Domestic Communications Satellite to be Fixed in Geosynchronous Orbit at 105° West Longitude	)))))))))))	File No. ____________

APPLICATION

National Exchange, Inc. ("NEX"), pursuant to Sections 308, 309 and 319 of the Communications Act of 1934, as amended, hereby applies for authority to construct, launch and operate a domestic communications satellite that will function in the 12- and 14-GHz frequency bands. NEX requests that the Commission reserve a geosynchronous orbital position in the vicinity of 105° West Longitude for this satellite, as well as for a second satellite that will be co-located with this satellite and which is the subject of a separate application being submitted simultaneously with this application. In support of this application, NEX respectfully states:

1. The satellite for which construction, launch and operating authority is requested herein is an integral part of the Spotnet domestic communications satellite system that is being proposed by NEX. The satellite will perform communications

and tracking, telemetry and command (TT&C) functions in the 12-GHz (downlink) and 14-GHz (uplink) frequency bands. The satellite is one of four in-orbit satellites that NEX proposes to construct, launch and position at two orbital locations to comprise its initial satellite system.

2. The satellite's technical characteristics are summarized in Table 3-1. Figure 3-1 shows the satellite frequency plan.

3. The antenna design of the satellite provides for spot beams covering an area from 250 to 400 miles across, with the exact dimensions of each beam chosen to reach as many customers as possible. Representative service contours are shown in Figures 3-2 and 3-3 for the orbital position of 105° West Longitude.

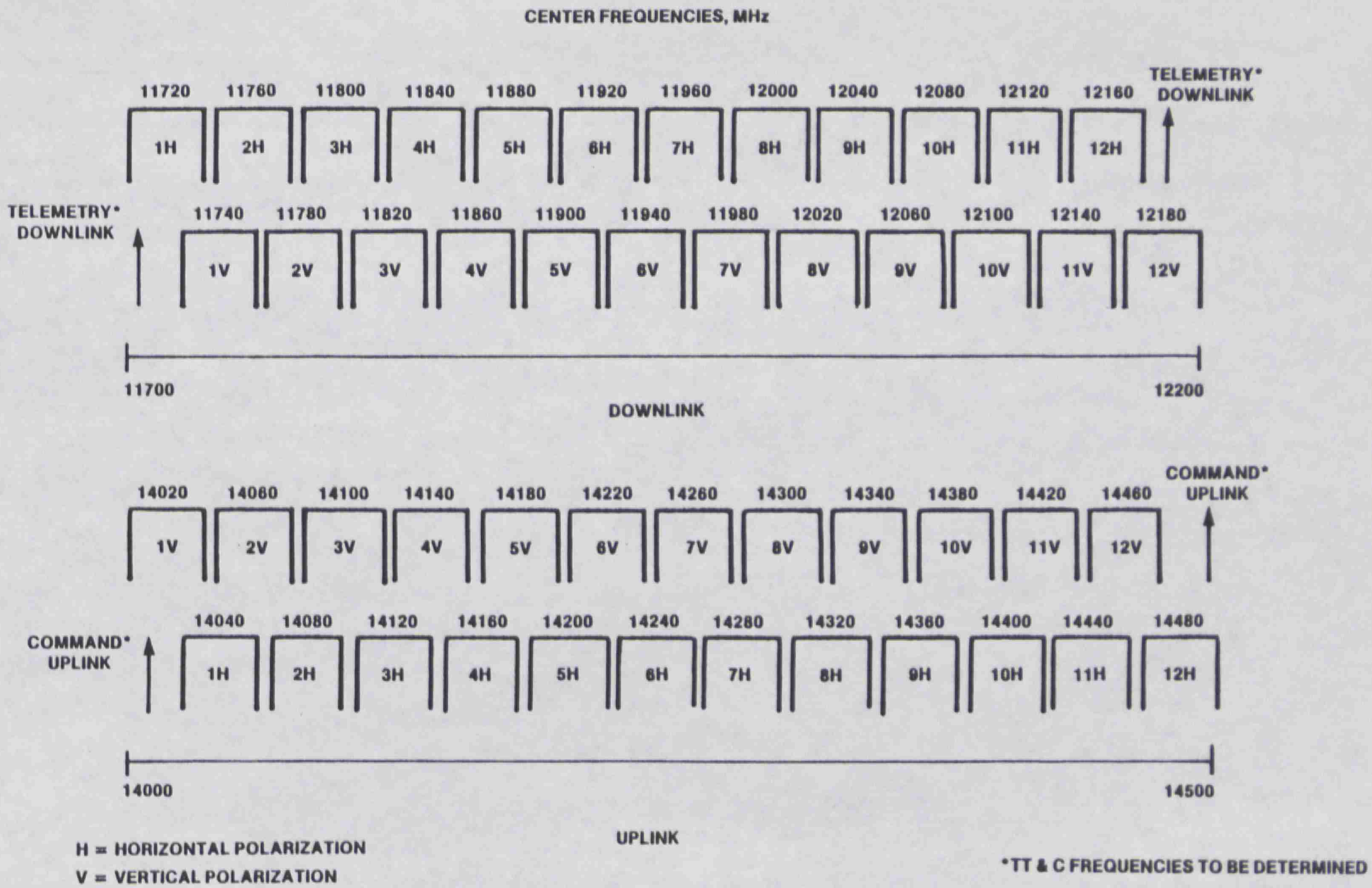
4. The satellite will be equipped with 24 operational transponder channels. The communications subsystem block diagram is shown in Figure 3-4. The satellite will be designed for a mission and orbital life of 10 years.

5. The satellite's TT&C signals will occupy parts of the 11.7-12.2-GHz and 14.0-14.5-GHz bands, using frequencies and polarizations that are not occupied by the normal communications signals. The exact command frequencies, polarizations, and transmission characteristics will be specified in a separate letter to the Commission at a later time.

6. An analysis of potential harmful inter-satellite interference due to the satellite's operation is included in Part II, Section 2.7, of the application for overall system authority of which this application is a part, and is incorporated herein by reference.

TABLE 3.1 OPERATIONAL SATELLITE CHARACTERISTICS

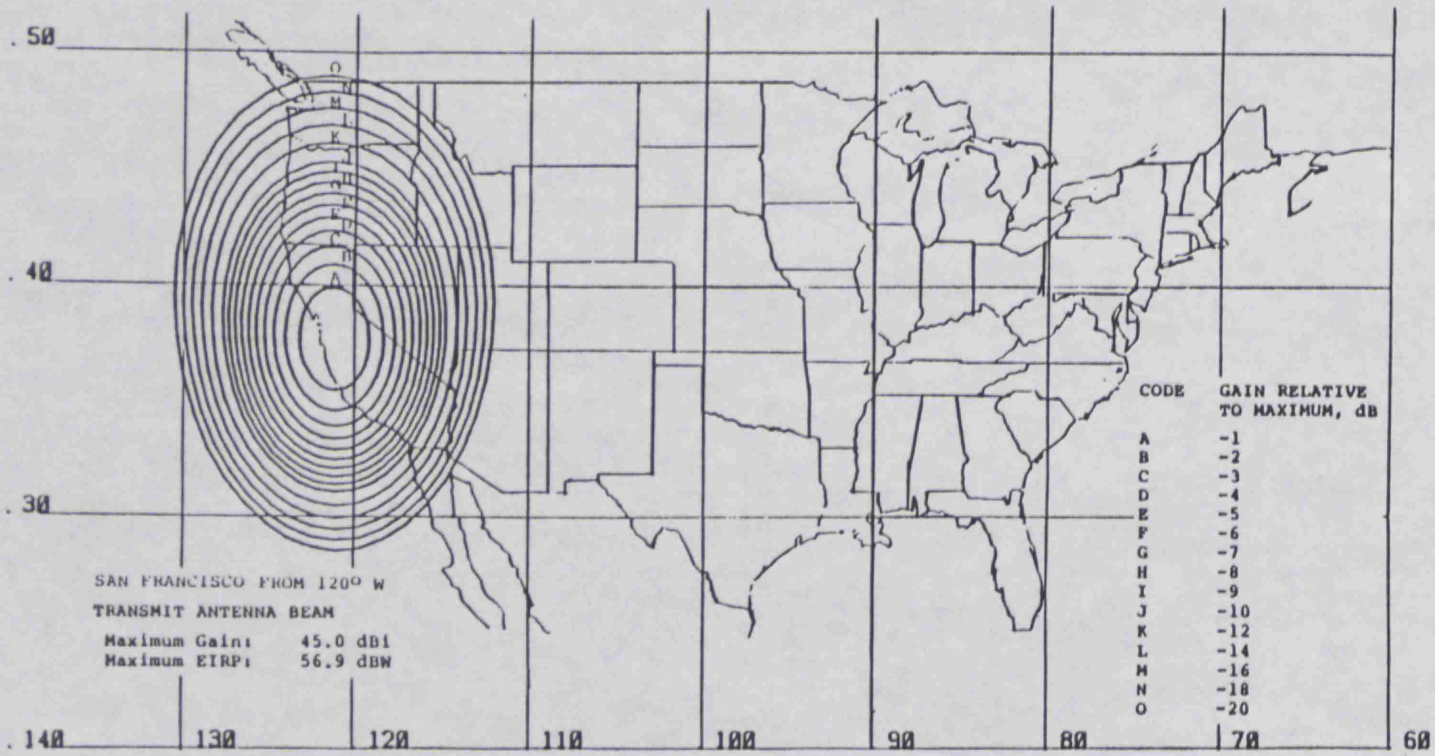
Parameter	Type of Value
Launch vehicle	STS (Shuttle) or Ariane
Launch date	Early 1986
Satellite mission life/ design life	10 years
North-south stationkeeping accuracy	0.05°
East-west stationkeeping accuracy	0.05°
Eclipse capability	50% (12 of 24 channels)
Stabilization	Spin or 3-axis stabilized
RF output power per TWTA	20 watts
Communications channelization channels	24 operational 36 MHz
Communications EIRP per transponder	Min. Size Beam 59.9 dBW Max. Size Beam 56.9 dBW
Communications receive G/T	Min. Size Beam 19.4 dB/K Max. Size Beam 16.4 dB/K
Communications receive SFP (at 0 dB gain step)	$-95.4/-102.4$ dBW/m^2 (See Section 3.5.3)
Commandable gain steps	4 ; 0, -3, -6, -9 dB (Min.)
12/14 communications frequencies -	
Transmit	11.700 to 12.200 GHz
Receive	14.000 to 14.500 GHz
TT&C EIRP	To be determined (TBD) TBD
TT&C receive	TBD
flux density	TBD
TT&C frequencies -	
Telemetry	TBD
Command	TBD
Communications polarization -	
Transmit	12 channel linear horizontal, 12 channel linear vertical
Receive	12 channel linear vertical, 12 channel linear horizontal
TT&C polarization -	
Telemetry	TBD
Command	TBD



FREQUENCY AND POLARIZATION PLAN

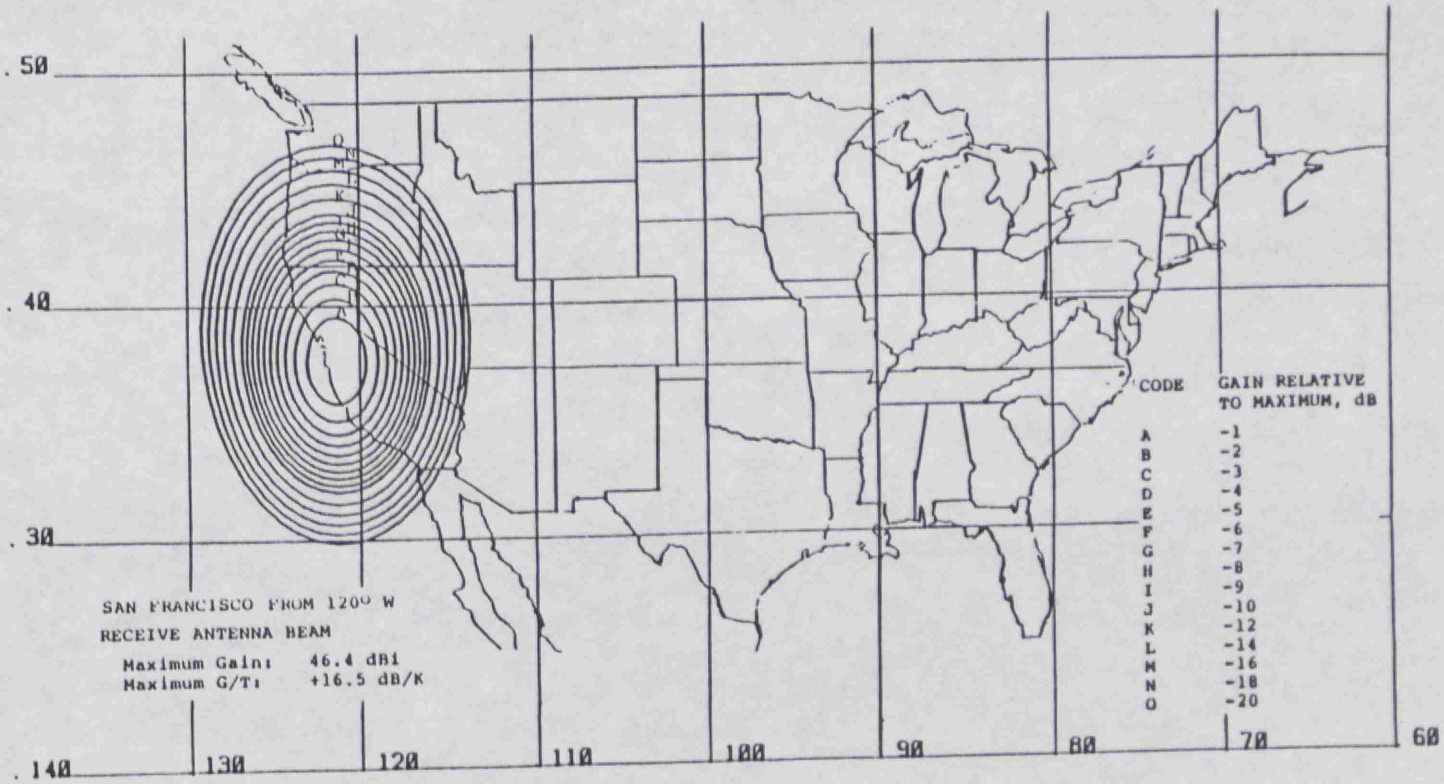
FIGURE 3-1

FIGURE 3-5

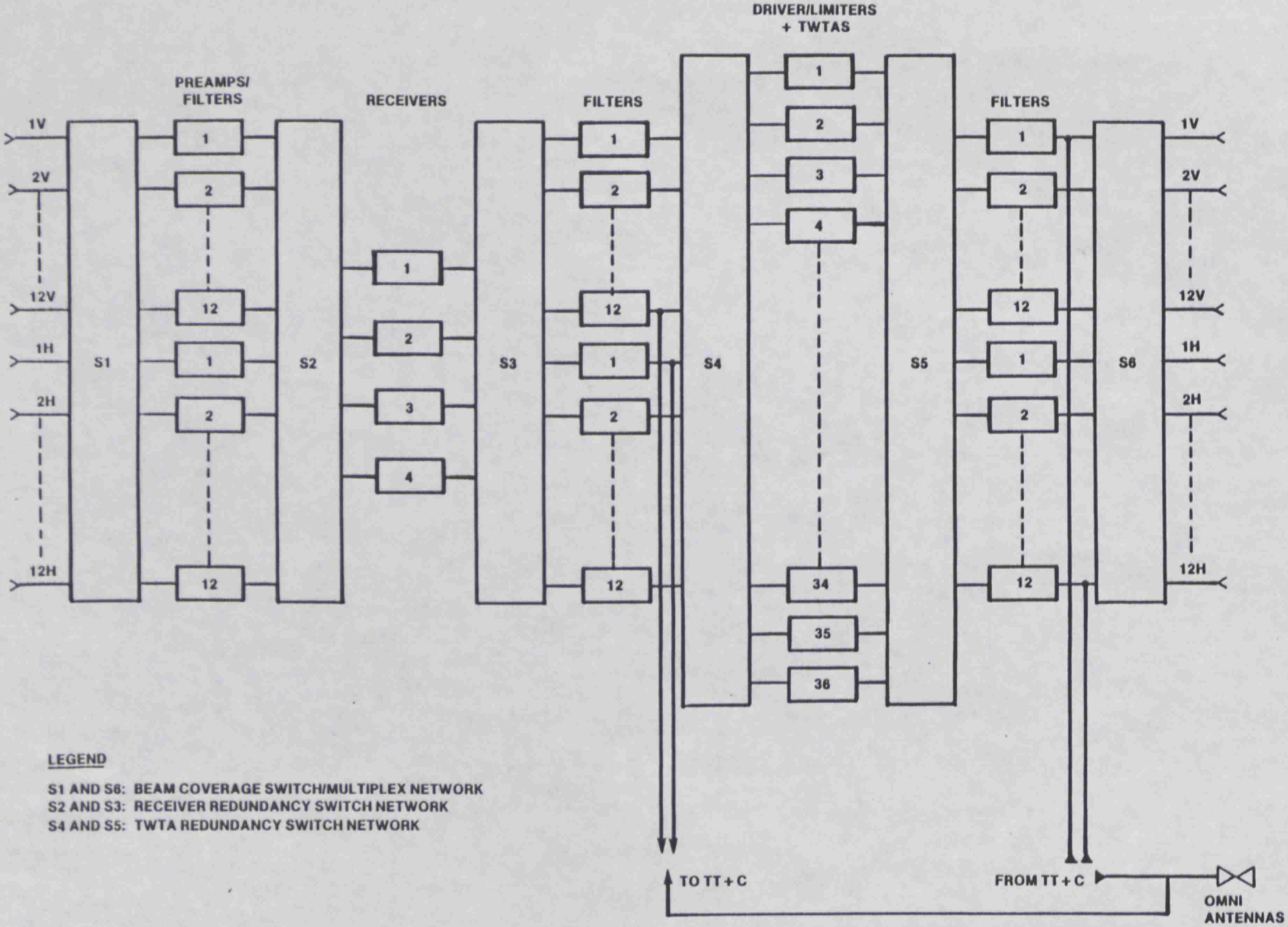


Representative Coverage Pattern
San Francisco from 120° West
(EIRP)

FIGURE 3-6



Representative Coverage Pattern
San Francisco from 120° West
(G/T)



SPOTNET SATELLITE COMMUNICATIONS SUBSYSTEM

FIGURE 3-4

7. The costs of this satellite and NEX's four other proposed satellites, four launch vehicles, and launch service for four launches -- all of which comprise the space segment -- are provided in Part I, Section 5.0, of the NEX satellite system proposal referenced above.

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11. The undersigned certifies individually and for NEX that the statements made in this application are true, complete, and correct to the best of his knowledge and belief, and are made in good faith.

Wherefore, NEX requests that the Commission grant this application.

Respectfully submitted,

NATIONAL EXCHANGE, INC.

By ______________________
Clay T. Whitehead
President

DATED: April 26, 1983

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FOR PREPARING ENGINEERING INFORMATION
SUBMITTED IN THIS APPLICATION

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By Dale N. Hatfield
Dale N. Hatfield
Technical Consultant
NATIONAL EXCHANGE, INC.

DATED: April 26, 1983

1.4

<u>Application for Authority to Construct and Launch a Domestic Communications Satellite to be Fixed at Orbital Position 105° West Longitude</u>

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of the Application of NATIONAL EXCHANGE, INC. For Authority to Construct, Launch and Operate a Domestic Communications Satellite to be Fixed in Geosynchronous Orbit at 105° West Longitude	)))))))))))	File No. ________________

APPLICATION

National Exchange, Inc. ("NEX"), pursuant to Sections 308, 309 and 319 of the Communications Act of 1934, as amended, hereby applies for authority to construct, launch and operate a domestic communications satellite that will function in the 12- and 14-GHz frequency bands. NEX requests that the Commission reserve a geosynchronous orbital position in the vicinity of 105° West Longitude for this satellite, as well as for a second satellite that will be co-located with this satellite and which is the subject of a separate application being submitted simultaneously with this application. In support of this application, NEX respectfully states:

1. The satellite for which construction, launch and operating authority is requested herein is an integral part of the Spotnet domestic communications satellite system that is being proposed by NEX. The satellite will perform communications

and tracking, telemetry and command (TT&C) functions in the 12-GHz (downlink) and 14-GHz (uplink) frequency bands. The satellite is one of four in-orbit satellites that NEX proposes to construct, launch and position at two orbital locations to comprise its initial satellite system.

2. The satellite's technical characteristics are summarized in Table 3-1. Figure 3-1 shows the satellite frequency plan.

3. The antenna design of the satellite provides for spot beams covering an area from 250 to 400 miles across, with the exact dimensions of each beam chosen to reach as many customers as possible. Representative service contours are shown in Figures 3-2 and 3-3 for the orbital position of 105° West Longitude.

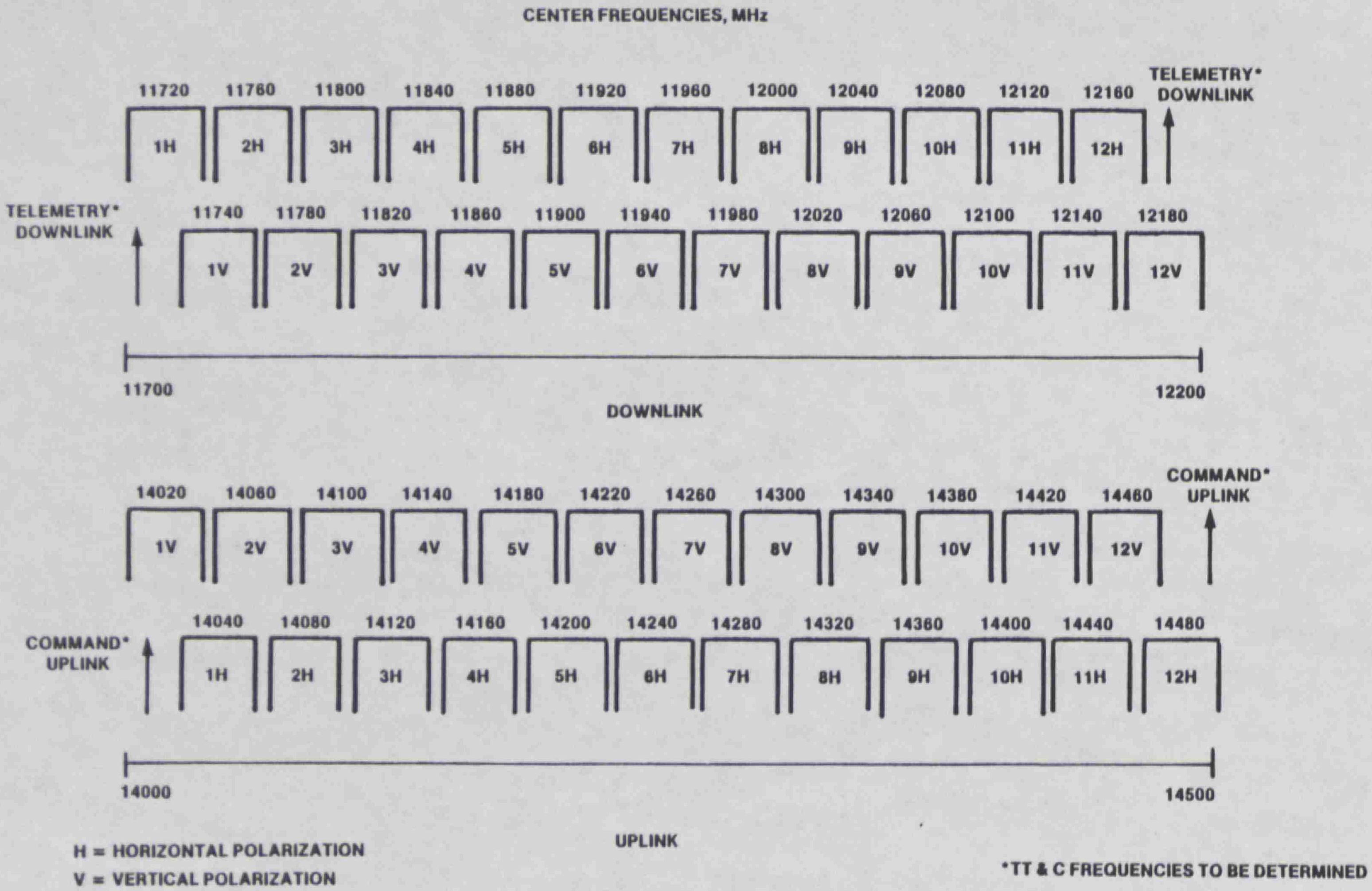
4. The satellite will be equipped with 24 operational transponder channels. The communications subsystem block diagram is shown in Figure 3-4. The satellite will be designed for a mission and orbital life of 10 years.

5. The satellite's TT&C signals will occupy parts of the 11.7-12.2-GHz and 14.0-14.5-GHz bands, using frequencies and polarizations that are not occupied by the normal communications signals. The exact command frequencies, polarizations, and transmission characteristics will be specified in a separate letter to the Commission at a later time.

6. An analysis of potential harmful inter-satellite interference due to the satellite's operation is included in Part II, Section 2.7, of the application for overall system authority of which this application is a part, and is incorporated herein by reference.

TABLE 3.1 OPERATIONAL SATELLITE CHARACTERISTICS

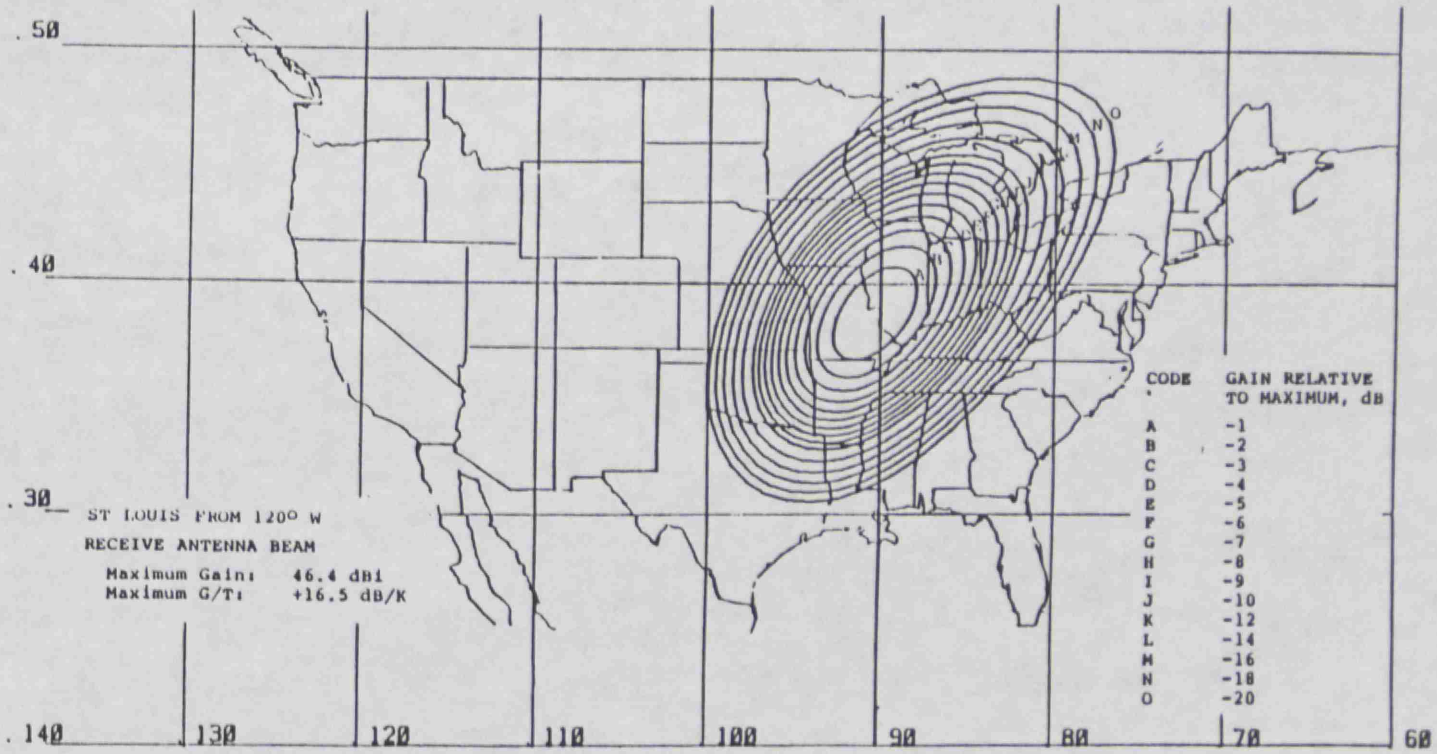
Parameter	Type of Value
Launch vehicle	STS (Shuttle) or Ariane
Launch date	Early 1986
Satellite mission life/ design life	10 years
North-south stationkeeping accuracy	0.05°
East-west stationkeeping accuracy	0.05°
Eclipse capability	50% (12 of 24 channels)
Stabilization	Spin or 3-axis stabilized
RF output power per TWTA	20 watts
Communications channelization channels	24 operational 36 MHz
Communications EIRP per transponder	Min. Size Beam 59.9 dBW Max. Size Beam 56.9 dBW
Communications receive G/T	Min. Size Beam 19.4 dB/K Max. Size Beam 16.4 dB/K
Communications receive SFP (at 0 dB gain step)	-95.4/-102.4 dBW/m^2 (See Section 3.5.3)
Commandable gain steps	4 ; 0, -3, -6, -9 dB (Min.)
12/14 communications frequencies -	
Transmit	11.700 to 12.200 GHz
Receive	14.000 to 14.500 GHz
TT&C EIRP	To be determined (TBD) TBD
TT&C receive	TBD
flux density	TBD
TT&C frequencies -	
Telemetry	TBD
Command	TBD
Communications polarization -	
Transmit	12 channel linear horizontal, 12 channel linear vertical
Receive	12 channel linear vertical, 12 channel linear horizontal
TT&C polarization -	
Telemetry	TBD
Command	TBD



FREQUENCY AND POLARIZATION PLAN

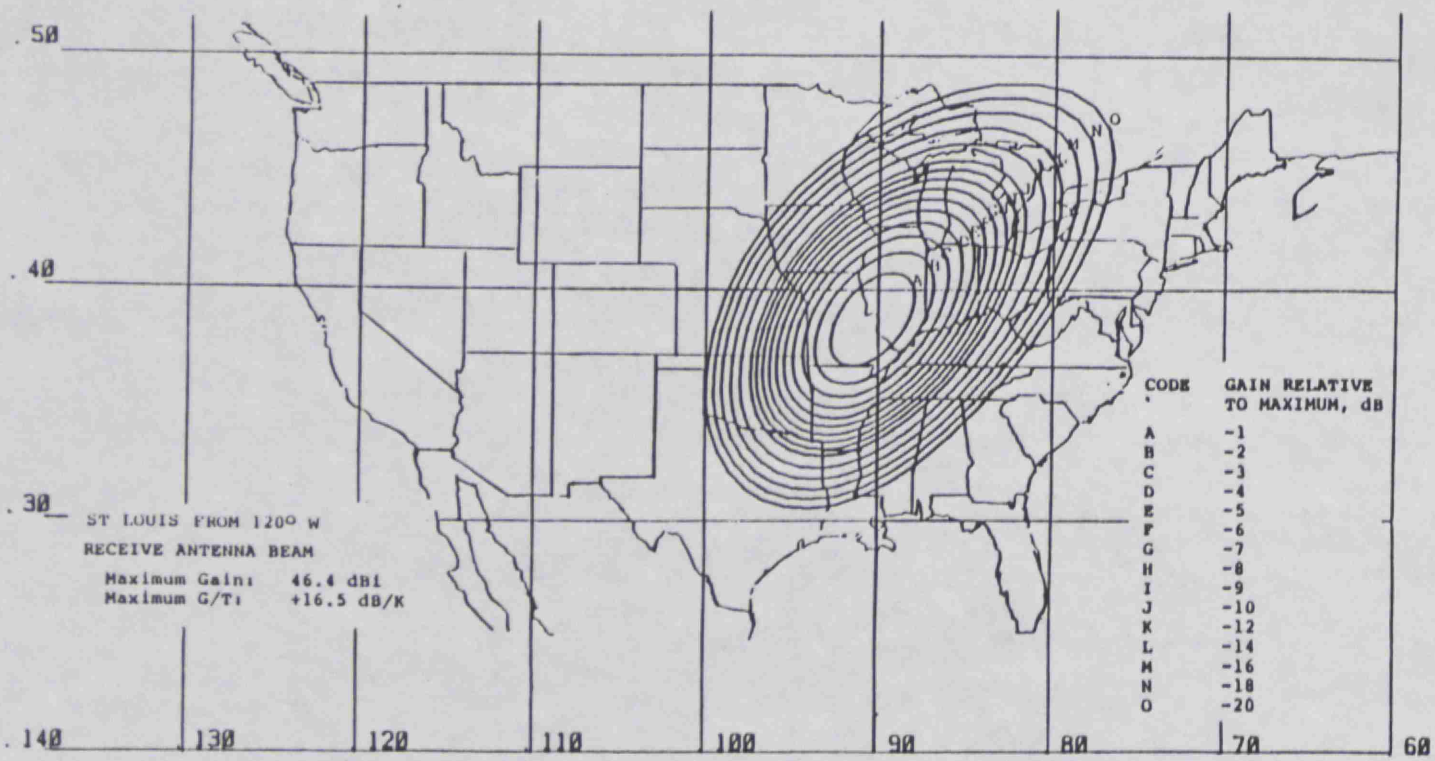
FIGURE 3-1

FIGURE 3-7

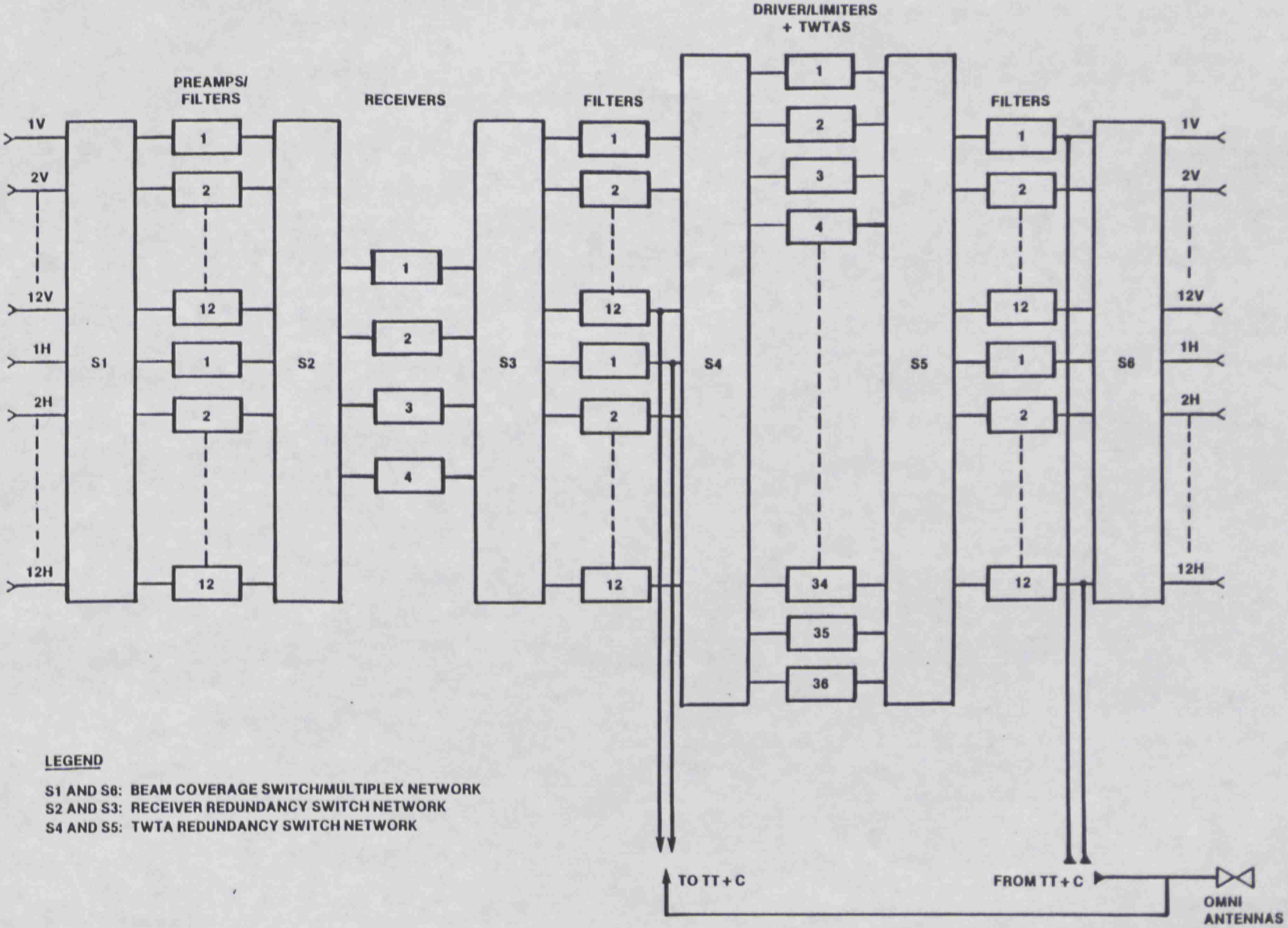


Representative Coverage Pattern
St. Louis from 120° West
(EIRP)

FIGURE 3-8



Representative Coverage Pattern
St. Louis from 120° West
(G/T)



LEGEND

S1 AND S6: BEAM COVERAGE SWITCH/MULTIPLEX NETWORK
S2 AND S3: RECEIVER REDUNDANCY SWITCH NETWORK
S4 AND S5: TWTA REDUNDANCY SWITCH NETWORK

SPOTNET SATELLITE COMMUNICATIONS SUBSYSTEM

FIGURE 3-4

7. The costs of this satellite and NEX's four other proposed satellites, four launch vehicles, and launch service for four launches -- all of which comprise the space segment -- are provided in Part I, Section 5.0, of the NEX satellite system proposal referenced above.

8. Correspondence with respect to this application may be addressed to the following:

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11. The undersigned certifies individually and for NEX that the statements made in this application are true, complete, and correct to the best of his knowledge and belief, and are made in good faith.

Wherefore, NEX requests that the Commission grant this application.

Respectfully submitted,

NATIONAL EXCHANGE, INC.

By ______________________
Clay T. Whitehead
President

DATED: April 26, 1983

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By Dale N. Hatfield

Dale N. Hatfield
Technical Consultant
NATIONAL EXCHANGE, INC.

DATED: April 26, 1983

1.5

Application for Authority to Construct a

Domestic Fixed Communications Satellite for

Ground-Storage Back-up Use

Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of the Application of	)	
NATIONAL EXCHANGE, INC.	)	File No. ____________
For Authority to Construct a Domestic Communications Ground Spare Satellite	)	

APPLICATION

National Exchange, Inc. ("NEX"), pursuant to Sections 308, 309 and 319 of the Communications Act of 1934, as amended, hereby applies for authority to construct a domestic communications satellite that will be capable of operating in the 12- and 14-GHz frequency bands. In support of this application, NEX respectfully states:

1. The satellite for which construction and launch authority is requested herein is an integral part of the domestic communications satellite system that is being proposed by NEX, and will be constructed under the same program as the four operational satellites for which authority is requested simultaneously with this application. The satellite will be held in reserve in ground storage for use in the event of failure or substantial degradation of any of the in-orbit satellites for which construction and launch authority is being requested simultaneously with this application. The satellite will be capable

of performing communications and tracking, telemetry and command (TT&C) functions in the 14-GHz (downlink) and 12-GHz (uplink) frequency bands.

2. The satellite's technical characteristics are summarized in Table 3-1. Figure 3-1 shows the satellite frequency plan.

3. The antenna design of the satellite provides for spot beams covering an area from 250 to 400 miles across, with the exact dimensions of each beam chosen to reach as many customers as possible. Representative service contours are shown in Figures 3-2 and 3-3 for the orbital position of 60° West Longitude.

4. The satellite will be equipped with 24 operational transponder channels. The communications subsystem block diagram is shown in Figure 3-4. The satellite will be designed for a mission and orbital life of 10 years.

5. The TT&C signals will occupy parts of the 11.7-12-GHz and 14.0-14.5-GHz bands, using frequencies and polarizations that are not occupied by the normal communications signals. The exact command frequencies, polarizations, and transmission characteristics will be specified in a separate letter to the Commission at a later time.

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7. The costs of this satellite and of NEX's four other

TABLE 3.1 OPERATIONAL SATELLITE CHARACTERISTICS

Parameter	Type of Value
Launch vehicle	STS (Shuttle) or Ariane
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Eclipse capability	50% (12 of 24 channels)
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Communications receive SFP (at 0 dB gain step)	$-95.4/-102.4$ dBW/m^2 (See Section 3.5.3)
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Telemetry	TBD
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Communications polarization -	
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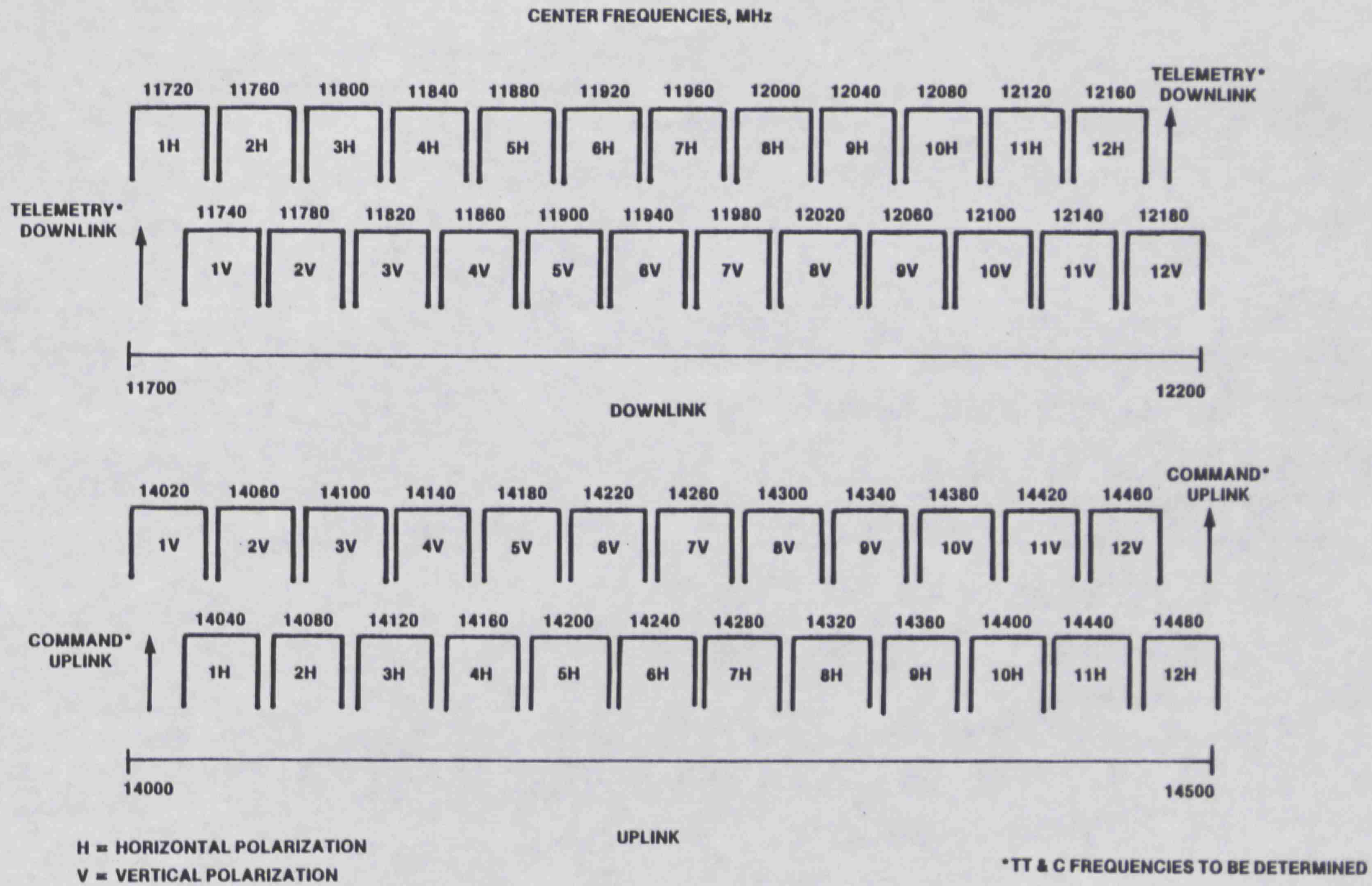
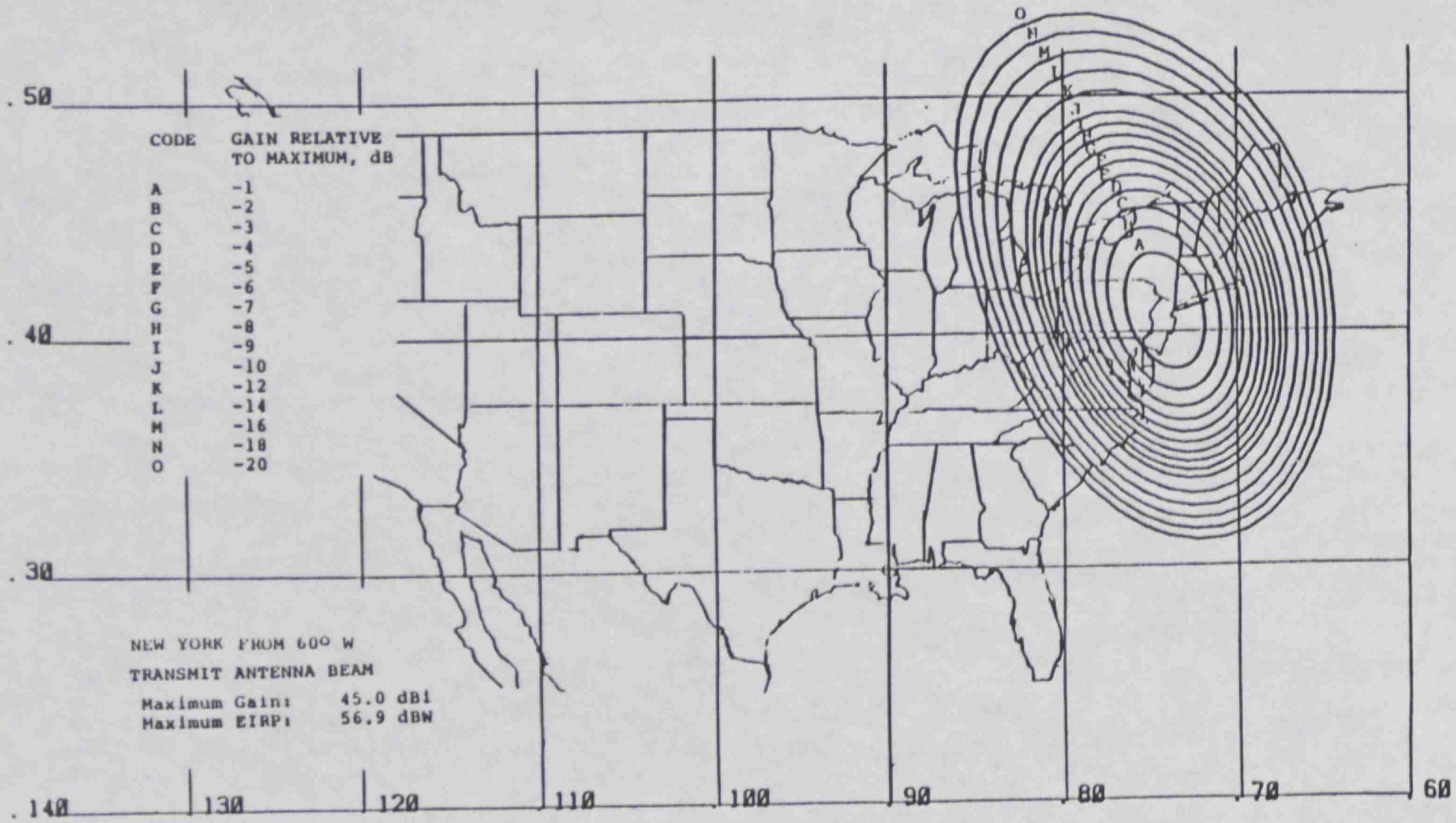
Receive	12 channel linear vertical, 12 channel linear horizontal
TT&C polarization -	
Telemetry	TBD
Command	TBD



FREQUENCY AND POLARIZATION PLAN

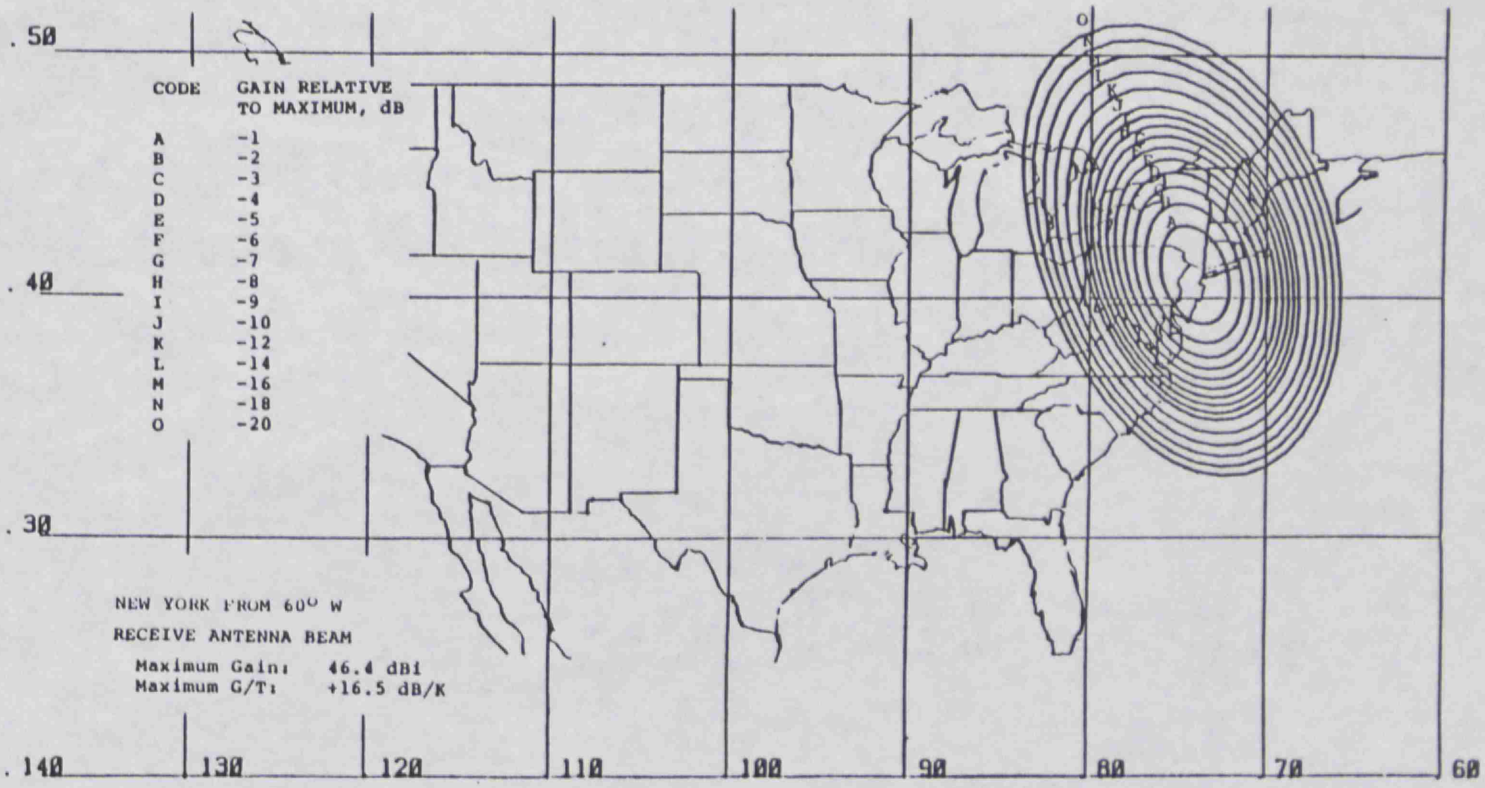
FIGURE 3-1

FIGURE 3-2

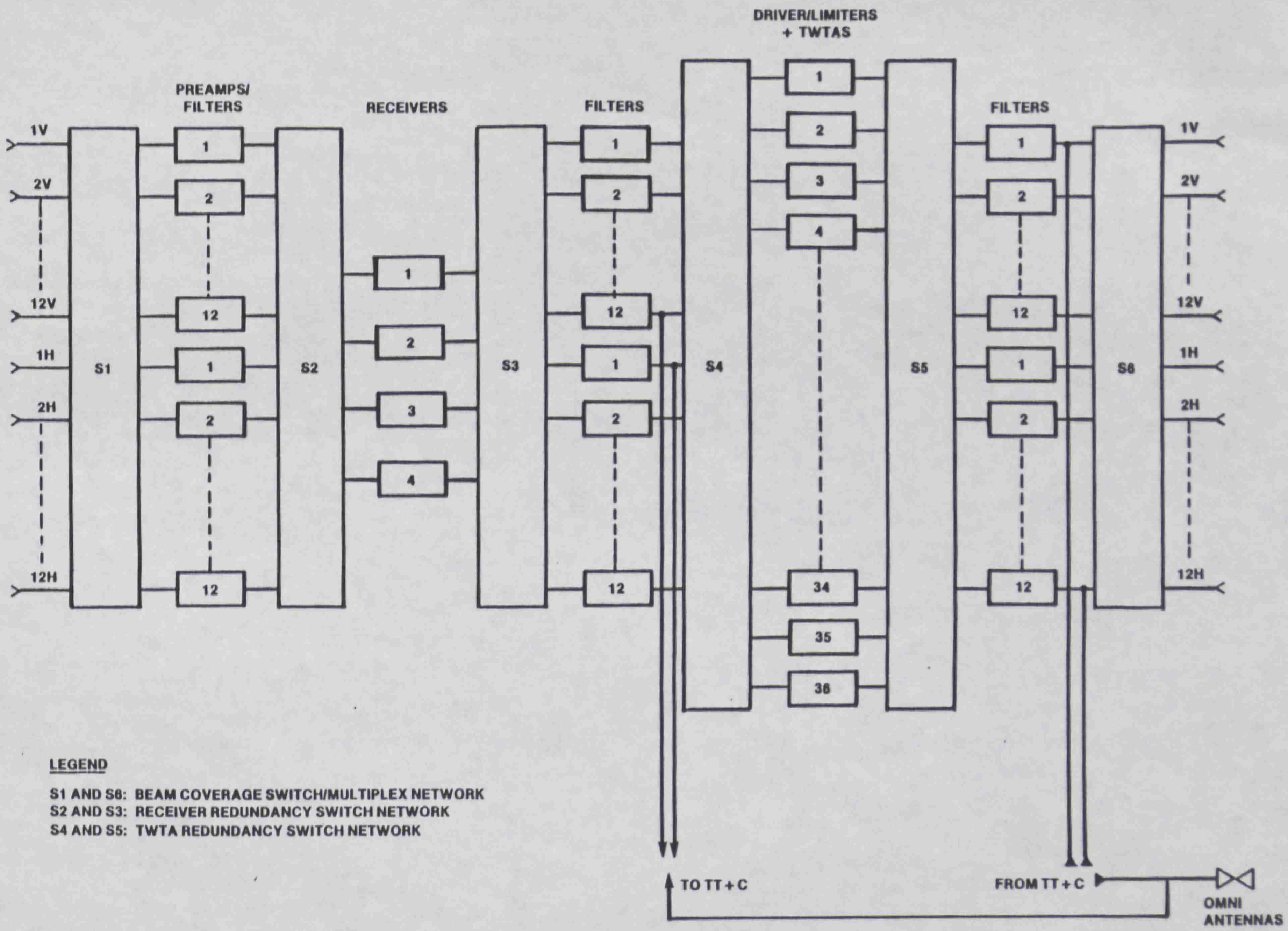


Representative Coverage Pattern
New York from 60° West
(EIRP)

FIGURE 3-3



Representative Coverage Patterns
New York from 60° West
(G/T)



SPOTNET SATELLITE COMMUNICATIONS SUBSYSTEM

FIGURE 3-4

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