FEDERAL COMMUNICATIONS COMMISSION

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Received MAR 15 1995 Satellite and Radiocommunication Division Office of the Chief

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91-SAT-MP/LA-95

(Read instructions carefully BEFORE proceeding.)

PAYOR INFORMATION

(1) FCC ACCOUNT NUMBER: 0 0 6 1 3 5 5 4 5 5

Did you have a number prior to this? Enter it.

(2) TOTAL AMOUNT PAID (dollars and cents): $ 80,360 . 00

(3) PAYOR NAME (If paying by credit card, enter name exactly as it appears on your card): PanAmSat, Inc.

(4) STREET ADDRESS LINE NO. 1: One Pickwick Plaza

(5) STREET ADDRESS LINE NO. 2:

(6) CITY: Greenwich

(7) STATE: CT

(8) ZIP CODE: 06830

(9) DAYTIME TELEPHONE NUMBER (Include area code): 202-622-6664

(10) COUNTRY CODE (if not U.S.A.):

RECEIVED MAR 15 11 42 AM '95 INT'L FACILITIES POLICY DIVISION

ITEM #1 INFORMATION

(11A) NAME OF APPLICANT, LICENSEE, REGULATEE, OR DEBTOR: PanAmSat Licensee Corporation

FCC USE ONLY

(12A) FCC CALL SIGN/OTHER ID: CSS-94-006 / PAS-2R

(13A) ZIP CODE: 06830

(14A) PAYMENT TYPE CODE: B N Y

(15A) QUANTITY: 1

(16A) FEE DUE FOR PAYMENT TYPE CODE IN BLOCK 14: $ 80,360.00

(17A) FCC CODE 1:

(18A) FCC CODE 2:

(19A) ADDRESS LINE NO. 1: One Pickwick Plaza

(20A) ADDRESS LINE NO. 2:

(21A) CITY/STATE OR COUNTRY CODE: Greenwich, CT 06830

ITEM #2 INFORMATION

(11B) NAME OF APPLICANT, LICENSEE, REGULATEE, OR DEBTOR:

FCC USE ONLY

(12B) FCC CALL SIGN/OTHER ID:

(13B) ZIP CODE:

(14B) PAYMENT TYPE CODE:

(15B) QUANTITY:

(16B) FEE DUE FOR PAYMENT TYPE CODE IN BLOCK 14: $

(17B) FCC CODE 1:

(18B) FCC CODE 2:

(19B) ADDRESS LINE NO. 1:

(20B) ADDRESS LINE NO. 2:

(21B) CITY/STATE OR COUNTRY CODE:

CREDIT CARD PAYMENT INFORMATION

(22) MASTERCARD/VISA ACCOUNT NUMBER:

☐ Mastercard

☐ Visa

EXPIRATION DATE: Month Year

(23) I hereby authorize the FCC to charge my VISA or Mastercard for the service(s)/authorization(s) herein describe.

AUTHORIZED SIGNATURE DATE

See public burden estimate on reverse

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

In the Matter of Amendment to Application of	)))	
PANAMSAT LICENSEE CORPORATION	)	File No. CSS-94-006
For Authority to Construct, Launch and Operate a Replacement Satellite	)))	

To: The Managing Director

REQUEST FOR WAIVER OF FILING FEES

PanAmSat Licensee Corporation ("PanAmSat"), pursuant to Section 8(d)(2) of the Communications Act of 1934, as amended, 47 U.S.C. § 158(d)(2), and Section 1.1115 of the Commission's Rules, hereby requests that the Commission waive the filing fee for the attached application for expedited authority to construct, launch, and operate a replacement satellite. Under the Commission's rules, the Commission may waive applicable filing fees "where good cause is shown and where waiver . . . of the fees would promote the public interest."[1]

1. Background

As initially authorized, the PanAmSat satellite that is the subject of the attached application (*hereinafter* "PAS-2R") consisted of a hybrid ground spare to be used in the event that either the PAS-2, PAS-4, or PAS-7 satellite was lost due to launch or in-orbit failure. In December 1994, PAS-2 was lost in a launch failure. Accordingly, PanAmSat proposes in its attached application to modify PAS-2R , and to launch and operate PAS-2R, at 43° W.L., as a replacement for PAS-2.

2. Discussion

PAS-2R will be modified to comply, in all material respects, with the specifications and operational characteristics of PAS-2. PAS-2R will carry the

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[1] 47 C.F.R. § 1115(a).

same payload, operate on the same power, employ the same frequency plan, occupy the same orbital location, and provide the same coverage and services, as PAS-2 would have had it not been destroyed. In short, the authorizations now being requested by PanAmSat for PAS-2R are identical in all material respects with those which the Commission initially granted PanAmSat for PAS-2.

As a result of the identification between PAS-2 and PAS-2R, the Commission will be required to engage in minimal regulatory review of the attached application. Since the Commission has already passed on the various technical and operational aspects of PAS-2, and since the attached application raises no new policy issues, the "fees contained in the fee schedule bear scant relationship to the resources require to process the replacement satellite's authorizations."[2] Accordingly, PanAmSat requests refund and waiver of its filing fee submitted in connection with its application for construction, launch, and operational authority for PAS-2R.

Respectfully submitted,

PANAMSAT LICENSEE
CORPORATION

By: /s/ Joseph A. Godles
Joseph A. Godles

GOLDBERG, GODLES, WIENER
& WRIGHT
1229 Nineteenth Street, N.W.
Washington, D.C. 20036
(202) 429-4900

Its Attorneys

March 9, 1995

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2 See Fee Decisions of the Managing Director, 9 FCC Rcd 2223, 2230-31 (1994) (granting partial fee waiver for application to construct, launch, and operate replacement satellite).

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

In the Matter of the Application of	)	
	)	
PANAMSAT LICENSEE CORPORATION	)	File No. CSS-94-006
	)	
For Authority to Construct,	)	
Launch and Operate a Replacement Satellite	)	

AMENDMENT AND REQUEST FOR FINAL AUTHORITY

Joseph A. Godles
W. Kenneth Ferree
GOLDBERG, GODLES, WIENER
& WRIGHT
1229 Nineteenth Street, N.W.
Washington, D.C. 20036
(202) 429-4900

Attorney for
PanAmSat Licensee Corp.

March 9, 1995

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

In the Matter of the Application of	)	
	)	
PANAMSAT LICENSEE CORPORATION	)	File No. CSS-94-006
	)	
For Authority to Construct,	)	
Launch and Operate a Replacement Satellite	)	

AMENDMENT AND REQUEST FOR FINAL AUTHORITY

PanAmSat Licensee Corp. ("PanAmSat"), pursuant to Sections 308, 309, and 319 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 308, 309, 319, hereby requests final authority to construct, launch and operate a replacement hybrid satellite as part of its separate international communications satellite system. As initially filed, the above-captioned application requested authority to construct a hybrid ground spare to be used in the event that either its PAS-2, PAS-4, or PAS-7 satellite was lost due to launch or in-orbit failure. In December 1994, PAS-2 was lost in a launch failure. Accordingly, PanAmSat is amending the application for its "ground spare" satellite (*hereinafter* "PAS-2R") to request authority to construct, launch and operate PAS-2R, at 43° W.L., as a replacement for PAS-2.

This amendment demonstrates that PanAmSat is financially, legally, and technically qualified to receive final authority to construct, launch, and operate PAS-2R. The technical portions of this amendment conform the specifications for PAS-2R to the specifications the FCC approved when it authorized PanAmSat to construct, launch, and operate PAS-2. The amendment also sets forth PanAmSat's full financial showing. As discussed below, the insurance proceeds from PAS-2 provide all the funds needed to construct and launch PAS-2R and operate it for one year. PanAmSat's legal qualifications are a matter of a public record. See FCC Form 430, filed November 2, 1993. Finally, the Commission already determined, when it granted final authority for PAS-2, that all requirements arising from Article XIV(d) of the Intelsat Agreement have been satisfied. See Memorandum Opinion, Order and Authorization, DA 94-1178 (Oct. 21, 1994).

PanAmSat respectfully requests expedited processing. PanAmSat's filing is necessitated by the exigent circumstances arising from the launch failure of PAS-2. Granting final authority for PAS-2R expeditiously will enable PanAmSat to replace PAS-2 promptly, and will provide assurance to the customers who had subscribed for service on PAS-2 that PanAmSat will be able to proceed in a timely manner with its replacement satellite plans.

In support of this amendment, PanAmSat submits the following information.

I. APPLICANT

PanAmSat Licensee Corporation
One Pickwick Plaza
Greenwich, CT 06836
(203) 622-6664

II. CORRESPONDENCE

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

Frederick Landman
President

with a copy to:

Joseph A. Godles, Esq.
Goldberg, Godles, Wiener & Wright
1229 Nineteenth Street, N.W.
Washington, D.C. 20036
(202) 429-4900

III. SATELLITE TECHNICAL DESCRIPTION INCLUDING RADIO FREQUENCY AND POLARIZATION PLAN

See attached technical description.

IV. DATES BY WHICH SIGNIFICANT MILESTONES ARE LIKELY TO BE ACHIEVED

A detailed schedule specifying dates by which significant milestones in establishment of the PAS-2R satellite system are planned to be achieved is included in Exhibit 1, hereto.

V. ESTIMATED PROGRAM COSTS/FULL FINANCIAL SHOWING

PanAmSat has analyzed the costs associated with the satellite, TT&C, communications gateway, and management of the satellite communications system that is the subject of this application. Exhibit 2 hereto sets forth PanAmSat's estimated cost of constructing and launching PAS-2R and operating it for one year. Exhibit 3 hereto demonstrates that PanAmSat has adequate funds, in the form of insurance proceeds from the loss of PAS-2 that have been placed in an escrow account, to finance these costs.

VI. LEGAL QUALIFICATIONS OF APPLICANT

PanAmSat's annual Common Carrier and Satellite Radio Licensee Qualification Report (FCC Form 430) was filed on November 2, 1993, and is incorporated herein by reference.

VII. WAIVER OF CLAIMS

PanAmSat waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests construction 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.

The undersigned certifies individually and for PanAmSat 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.

The undersigned also certifies that neither PanAmSat nor any party to this application is subject to a denial of federal benefits pursuant to Section 5301 of the Anti-drug Abuse Act of 1988, 21 U.S.C. § 853.

Respectfully submitted,

By: ______________________
Frederick Landman

Date: March 10, 1995

EXHIBIT 1

PAS-2R MILESTONES

EVENT	COMPLETION DATE
Spacecraft RFP issued	Completed
Spacecraft contractor selected	Completed
Spacecraft contract executed	Completed
Preliminary spacecraft construction go-ahead	Completed
Launch services contractor selected	February 28, 1995
Spacecraft construction completed	November 1995
Spacecraft launched	December 1995
Spacecraft in service	February 1996

EXHIBIT 2

PAS-2R CAPITAL REQUIREMENTS

REQUIREMENT	ESTIMATED COST
Spacecraft construction	$75,000,000
Launch Vehicle cost	84,140,000
Launch insurance premium	36,500,000
TT&C construction cost	965,000
TT&C operations cost (1st year)	1,500,000
First year operating expenses	6,000,000
Total	$204,105,000

EXHIBIT 3

FULL FINANCIAL SHOWING

The Chase Manhattan Bank of Connecticut
999 Broad Street
Bridgeport, Connecticut 06604

CHASE

February 27, 1995

Mr. Patrick Costello, C.F.O.
PanAmSat, L.P.
One Pickwick Plaza
Greenwich, CT 06830

Ref: PanAmSat New Satellite Insurance Proceeds Sub-Account

Dear Mr. Costello,

Please be advised that on January 31, 1995 the above mentioned Escrow Account reflected the balance of **$212,708,441.72.**

We as Escrow Agent hereby certify that the above mentioned balance as reflected on our Trust Statement is true and correct.

If you have any questions please feel free to contact us at (203) 382-6323.

Sincerely,

Aranka R. Paul
Assistant Treasurer and
Corporate Trust Officer

RUBIN, BEDNAREK & ASSOCIATES, INC.
COMMUNICATIONS ENGINEERING AND ECONOMICS
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TELEPHONE (202) 296-9380
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ENGINEERING CERTIFICATION

I, Philip A. Rubin, a principal in the engineering consulting firm of Rubin, Bednarek and Associates, do hereby certify that I am the technically qualified person responsible for the preparation of the engineering information contained in this application, and that I am familiar with Parts 21 and 25 of the FCC Rules and Regulations. I am a registered Professional Engineer in Washingtion, D.C. and my seal appears on this certification. I certify that the technical material contained herein is complete and accurate to the best of my knowledge.

DISTRICT OF COLUMBIA
PHILIP A. RUBIN
No. 10037
REGISTERED
PROFESSIONAL ENGINEER

By: Philip A. Rubin

Philip A. Rubin

Date: February 15, 1995

Pan American Satellite-2R Technical Description

1.0 Introduction

Pan American Satellite-2R (PAS-2R) will be the fourth satellite in the Alpha Lyracom Space Communication (PanAmSat) family of Pan American Satellites, the first private international satellite system. PAS-2R is based on the latest technology available from America's satellite manufacturing industry. The satellite design will be based on either the Hughes Aircraft Company's HS-601 Series. The satellite is a three-axis stabilized spacecraft combining high powered amplifiers with large stationary antennas capable of high EIRP's on earth in both C-Band and Ku-Band. PAS-2R is designed to operate from the 43°WL orbital slot over the Atlantic Ocean allowing communications between the United States, Eastern and Western Europe and Latin America, and within Africa.

1.1 The 43°WL Orbital Slot

At present, PAS-2R is the only satellite registered with the IFRB to operate from the 43°WL location. The closest satellites with IFRB registrations to this slot are the Columbia Communications Corporation's C-Band package on the NASA TDRSS at 41°WL, the Orion satellite applied for at 47°WL, and the Intelsat system registrations at 40.5°WL. PanAmSat and the Intelsat have already completed a detailed technical coordination between their respective systems and only a very minor amendment will be required based on a minor change in transponder switching which PanAmSat has made on the PAS-2R replacement satellite.

PAS-2R is 4° from the Orion satellite at 47°WL and 2° from Columbia's TDRSS at 41°WL. These locations do not present any coordination problems as will be shown in the section on that subject.

1.2 PAS-2R Is An Integral Link of the Pan American Satellite Network

PAS-2R will be a vital link in the Pan American Satellite worldwide network of satellites and terrestrial facilities. PAS-2R is the necessary and timely backup to PAS-1, which will by the 1996 time-frame have been in orbit for eight years. PAS-2R is an opportunity to provide new services. Through the use of its Ku-Band uplink from South America, PAS-2R is the first satellite to provide such capability from the Latin American continent. Late breaking news stories from remote locations within South America can be covered for the first time with this capability. Cross-strapped C-Band to Ku-Band capability between South America and Europe and the US will make possible program exchanges and direct data links not previously feasible. Because PAS-2R position will reach into all of Eastern Europe, PanAmSat's open access policy of working from user-to-user will allow American businesses to go to the heart of these new markets. It may

even be possible to establish links between Latin America and the Middle East. In addition, two transponders which can be switched from Latin America to African coverage have been included making possible service in that continent.

1.2 Services to be Offered

PAS-2R transponders will be state-of-the-art repeaters which will offer low cost video interconnection and distribution, data services of all types, voice services and a variety of specialized services which have grown out of the marketing experience of PAS-1. As the first separate satellite system in existence, PanAmSat has accumulated a wide body of communications marketing expertise and has in the process identified markets not previously explored by Intelsat and other operators. These specialized and unique services will be offered by PanAmSat from the PAS-2R satellite in the 43°WL orbital position.

2.0 Satellite Description

Pan American Satellite-2R, hereafter PAS-2R, is an advanced hybrid communication satellite with C and Ku-Band transponders, to be located at 43°WL. The satellite design is based on the Hughes-601 spacecraft. The satellite lifetime is estimated to be fifteen years. The satellite will be equipped with sufficient battery power to enable operation at full capacity during periods of solar eclipse. End-of-life (EOL) solar power will be sufficient to operate all active transponders after at least fifteen years in orbit.

2.1 Telemetry and Command Subsystem

The PAS-2R Telemetry and Command (TT&C) subsystem will provide high-quality two-way interaction with the spacecraft throughout all mission phases and lifetime of the satellite. In the transfer orbit portion of launch, when the communication payload antennas are stowed, the TT&C links will be operated through the dual-mode omni-antenna. After the satellite reaches its permanent station at 43°WL, the primary TT&C links will be established through the dedicated communications antenna. Should an anomaly occur which results in a pointing error for the main antennas, there is an automatic transfer of control to the omni-antenna which is able to maintain communications with the earth at any angle. In its high power mode, the omni-antenna is capable of reaching any US location visible from 43°WL.

Uplink command signals are received by redundant command receivers which are cross-strapped to the command decoder units. The command receivers demodulate the uplinked carrier and route the command tones to the decoder units. Ranging tones are routed to the telemetry transmitters.

Commands will be transmitted in an encrypted (secure) mode. The command receivers process the digital data in parallel. After a command is verified or authenticated (clear or secure mode) the address is checked to ensure the command is intended for PAS-2R and to determine which decoder will execute the desired command. Execution is completed only after an execute-enable signal is received from the TT&C station.

2.2 Attitude and Orbit Control Subsystem

The Attitude and Orbit Control Subsystem (AOCS) maintains the satellite's attitude during transfer orbit; points the satellite's antennas at the earth locations designated during the design; and executes stationkeeping maneuvers during the life of the satellite. The AOCS uses an earth sensor as the primary on-station sensor; a three-axis gyro for yaw sensing; a two-axis momentum wheel as the primary on-station actuator; and the SCP as the control system processor. Each of these units is redundant (including the momentum wheel), while the earth sensor is internally redundant. North-South maneuvers are required no more than every three to three and one-half weeks while the solar tracking eliminates momentum wheel dumping more often than that.

2.3 Propulsion System

The satellite is actively controlled by a bi-propellant propulsion system which supplies the impulse required for insertion into geostationary orbit as well as normal orbital maneuvers. A tankage system supplies fuel to the apogee engine and the thrusters. This tankage system operates in a pressurized mode in transfer orbit and in a blowdown mode on-orbit. All thrusters are constructed with double seat protection against leakage. Most thrusters are configured so that functions are doubly redundant and all are at least singly redundant.

2.4 Electric Power Subsystem

Payload power is provided by two solar array wings oriented North-South and pointed at the sun by the SCP. Secondary power during eclipse is provided by Ni-H_2 battery cells sized for 80 percent depth of discharge for end-of-life (EOL) loads. This spacecraft operates a single bus to save weight and facilitate thermal control. The bus operates at 50 volts. The SCP automatically initiates charging each day depending on voltage or pressure readings from the battery cells. Both the batteries and the solar array have been designed to match the payload on PAS-2R and constitute an efficient system minimizing weight, cost and complexity, while providing ample redundancy.

2.5 Thermal Control

The satellite's thermal control system is designed to provide all necessary margins for thermal control using a system of heat pipes, passive radiators, and heaters (computer controlled and thermostatic). The high heat dissipating payload units are mounted on the North and South facing radiators. Uniform thermal conditions are maintained by heat pipes which are integral to these radiators, and which pass directly behind the high power amplifiers. Redundant heat pipes allow any header pipe to fail without compromising communications performance. There are also dynamically controlled heater panels which are used to maintain the high power amplifiers within their required temperature range.

Lower powered units are mounted on the subnadir shelf, which provides a benign stable thermal environment. Propulsion tanks and bus equipment are housed in the aft compartment which is cool.

Exterior surfaces of the radiators are covered with optical solar reflectors (OSR's). Thermal barriers and multilayer insulation control internal spacecraft temperatures. Batteries and propulsion lines are heated by solid state thermostatically controlled heaters.

2.6 Structure

The spacecraft structure is a cubical enclosure with a series of equipment panels. Within the box, a cruciform structure provides lateral tank support and can transfer loads from the tanks. Equipment shelves are aluminum-faced honeycomb while panels, struts and various supports are composite graphite-epoxy. The lightweight structure allows precise pointing of spacecraft antennas, while simultaneously providing support for all of the loads which the launch vehicles will subject upon the satellite.

3.0 Communication Payload Description

Pan American Satellite-2R is an advanced hybrid communication satellite with C and Ku-Band transponders which will be located at 43°WL. From its location at 43°WL, the PAS-2R will provide communications capacity between and within the United States, Europe, Latin America and Africa. Using its C-Band transponders, PAS-2R will provide regional and domestic service for Latin America; regional and domestic service for Africa;as well as interconnection between Latin America, Africa and the United States. Using its Ku-Band transponders, the satellite will provide communications capacity between the United States and Europe and between Latin America and the US and Europe. The satellite also has the capability to provide a direct-to-home (DTH) television service to certain highly populated areas of Latin America. Using its C- and Ku-Band transponders which have the option of being cross-strapped, PAS-2R will also permit telecommunications traffic flow between Latin America and Europe and Africa. In addition, a special Ku-Band uplink beam centered over South America has been designed so that small-terminal Ku-Band uplinking (including SNG type services), will be possible for the first time from that continent with downlinking in either in the United States, Europe or South America.

Figure 1 is an overall view of the possible coverages of a satellite located at 43°WL, showing elevation angles from different locations. In this figure, elevation angles of 0°, 5° and 10° are outlined. It can be seen from Figure 1 that PAS-2R has the potential to reach from the mid-west of the United States to Eastern Europe, as well as from Canada to the Antarctic and within Africa. The footprints provided in Appendix A represent the coverage patterns which have been designed into this satellite.

3.1 Latin American Capacity and Coverage

The PAS-2R satellite employs sixteen C-Band transponders, each 54/64MHz in bandwidth. These transponders are used for serving the United States and Latin America. In total, 1000MHz of bandwidth are used in this configuration. Each transponder operating in this frequency band will be a solid state power amplifier (SSPA) rated at 34 watts. The Latin American service will is directed through two independent downlink antenna beams which are very similar but not identical. These are:

The Latin Horizontal Beam - covering all of Latin America including Central America and the Caribbean, as well as portions of the eastern and southeastern United States;
The Latin Vertical Beam - covering all of Latin America including Central America and the Caribbean, as well as portions of the eastern and southeastern United States. Coverages provided by these two beams can be found in Figures 2 and 3.

C-Band uplinking from Latin America is accomplished by the two beams described below and shown in Figures 4 and 5.

the Latin Horizontal Uplink Beam - Covers all of South America, Central America, the Caribbean, and Southeastern US.

the Latin Vertical Uplink Beam - Covers all of South and Central America, the Caribbean, the Mid-Atlantic and Southeastern US.

Ku-Band service in Latin America is provided by one uplink beam and three downlink spot beams. These beams which are principally intended to provide a DTH service are shown in Figures 6-9 and described as follows:

the Brazil Spot Beam - covers the southeastern coastal cities of Brazil;
the Chile/Argentina or SSA Spot Beam - covers Buenos Aires and Santiago and areas in-between and nearby;
the Colombia/Venezuela or NSA Spot Beam - covers Bogota and Caracas and areas in-between and nearby.
the South American Uplink Beam - covers all of South America.

3.2 US/European Coverage

The PAS-2R satellite US and European coverages will employ sixteen Ku-Band transponders, each 54MHz in bandwidth. Half of the transponders will be available from the US-to-Europe, while the other half is assigned to Europe-to-US traffic. The eight transponders which downlink in Europe can also be used there regionally or domestically within Europe. This capability is afforded by the common uplink beam is similar to the common uplink beam on the PAS-1. The common uplink allows each transponder in the group assigned to that beam to be accessed from either Europe or the United States and there to be used either regionally within Europe or internationally.

There are two principal downlink antenna footprints in Ku-Band for the Atlantic service which are shown in Figures 10 and 11. These are:

The Europe Beam - Covering East and West Europe

The Conus Beam - Covering the US and Caribbean

The Ku-Band uplink footprint, the Atlantic Receive Beam, is shown in Figure 12.

Each of the sixteen transponders operating in Ku-Band is driven by a 63-watt traveling wave tube amplifier. These amplifiers are predicted to operate at efficiencies greater than 50%.

3.3 African Coverage

Three C-Band transponders assigned to the Latin Beam can be switched into the African Beam which is shown in Figure 13 for the downlink pattern and Figure 14 for the uplink pattern which also includes the US. Although PAS-2R is not located far enough eastward on the orbital arc to provide full coverage of the African continent, the relatively high-powered coverage that is provided can be of use to many nations.

3.4 Communication System Operation at C-Band

A vertical receive antenna and a horizontal receive antenna, both of which are shaped and gridded are sandwiched on the same structure. These antennas feed five 6GHz receivers, of which three are active and two are spares. Received signals are downconverted by the receivers and fed to the input multiplexer filters. This separates out each channel (frequency- and polarization-wise) for amplification. The outputs of all C-Band amplifiers are fed through low-pass filters and into common output multiplexers for each beam, a vertical Latin Beam, a horizontal Latin Beam and a horizontal African Beam. Step attenuators allow the saturation flux density for each channel to be adjusted to fifteen distinct values. These values are a function of the traffic assigned to that transponder and the conditions assigned to its use.

3.5 Communication System Operation at Ku-Band

The communications system at Ku-Band consists of shaped vertical and horizontal gridded antennas which receive ground originated transmissions and feed these signals into a bank of five receivers. The frequency translations provided by these receivers are geared to the European downlink band employed, the US downlink band, and the Latin American downlink band. The downconverted output from these receivers is connected to input multiplexers, then to step attenuators, driver amps and finally the traveling wave tube amplifier for that channel. The outputs of the final amplifiers are combined in one of the output multiplexers for downlinking in either Europe, the Continental United States or the three areas in Latin America covered by the three spot beams. All of the traveling wave tube amplifiers (including the two spares) are nominally sixty-three watts output power.

3.6 Cross-Strapping of C and Ku-Band Transponders

Half of the transponders on the satellite are capable of being cross-strapped. This can occur when part of the signal energy for both Ku-Band and C-Band is coupled off to provide the cross-connected channels. In the C-Band repeaters, redundant C/Ku upconverters are followed by Ku-Band channelizing filters. In the Ku-Band repeater, redundant Ku/C down-converters are followed by C-Band channel filters. Converted signals are switched into the opposite repeater, following the input multiplexers. From that point onward, the information signals are treated exactly the same as non-cross-strapped channels.

3.6 Communication System Redundancy

At C-Band, the solid-state power amplifier chains are arranged in two groups with 10-8 ring redundancy which is implemented using R switches. In Ku-Band, traveling wave tubes are also arranged in two 10-8 ring redundancy groups, one for each radiator panel. Using this approach to sparing, any amplifier can use any available spare.

3.7 EIRP and G/T Performance

The C-Band and Ku-Band payload performance is described in Table 1 which is shown below:

Table 1

Beam	Directivity	EIRP/G/T
C-Band Transmit V/Pol Latin Beam	25.6dBi	39.1dBW
C-Band Transmit H/Pol Latin Beam	24.0dBi	37.3dBW
C-Band Receive V/Pol Latin Beam	29.4dBi	2.5dB/^{o}K
C-Band Receive H/Pol Latin Beam	29.2dBi	2.9dB/^{o}K
C-Band Transmit African Beam	25.6dBi	38.9dBW
C-Band Receive African Beam	24.8dBi	-2.3dB/^{o}K
Ku-Band Transmit Conus Beam	35.1dBi	50.6dBW
Ku-Band Transmit Europe Beam	35.8dBi	51.5dBW
Ku-Band Receive Atlantic Beam	33.1dBi	2.9dB/^{o}K
Ku-Band Transmit NSA Beam	36.9dBi	52.3dBW
Ku-Band Transmit SSA Beam	36.7dBi	51.8dBW
Ku-Band Transmit Brazil Spot Beam	35.5dBi	51.4dBW
Ku-Band Receive Latin Beam	29.6dBi	2.3dB/^{o}K

The gain values shown in Table 1 are for beam center and may be used with the footprints shown in Figures 2-14 to determine exact EIRP or G/T for the locations desired. Saturation Flux Density (SFD) with the gain step attenuator at the "0" setting is equal to -90 - receive gain contour value at the location of interest. The gain step attenuator is variable in 1dB increments for a range of up to 15dB.

3.8 Cross-Polarization Isolation

At any point in the coverage regions of the various beams shown in Figures 2-14, and at any receive or transmit frequency, the cross-polarization isolation between any channel and any other cross-polarized channel will be at least 27dB.

3.9 Other Communication System Parameters

The other parameters for both the C-Band and Ku-Band communications systems including:

1. Short-term frequency stability
2. Transponder channel gain flatness
3. Transponder channel gain slope
4. Transponder channel input out-of-band response
5. Transponder channel output out-of-band response
6. Wideband out-of-band response
7. Input group delay
8. Total group delay
9. Group delay stability
10. Transponder phase shift vs. level
11. Amplitude linearity
12. Intelligible crosstalk
13. Small signal gain stability
14. Spurious outputs

shall all be specified between PanAmSat and the spacecraft contractor and comply with good engineering practices and any applicable rules of the FCC Part 25 Rules and Regulations.

3.10 Cessation of Emissions

It shall be possible to turn on and off by ground command, each transponder channel independently of all other channels. PanAmSat shall constantly monitor its channels to make certain that no undue interference results from their operation. In addition, all analog video uplinks operating through PAS-2R shall be equipped with an ATIS system, monitored by the PanAmSat's Atlanta and Homestead Teleport.

4.0 Frequency and Polarization Plan

PAS-2R is a hybrid satellite with transponders operating in both C-Band and Ku-Band. Unlike the PAS-1 satellite presently in orbit, PAS-2R is cross-polarized (i.e., uplink and downlink transmissions are polarized orthogonally) in C-Band. At Ku-Band, PAS-2R is linearly cross-polarized as is PAS-1.

4.1 C-Band Operation

At C-Band, the satellite will have sixteen operating transponders which provide full frequency reuse in that band. The C-Band transponders will follow the center frequency assignments shown in Table 2 and Figure 14. Each transponder in this plan is 54 or 64MHz in bandwidth, with eight transponders available for each polarization. Satellite reception occurs from 5.925GHz to 6.425GHz, while satellite transmission is at 3.7GHz to 4.2GHz. Signals are received in both polarizations as the band is reused for the full 500MHz.

Table 2 - C-Band Transponders

Transponder	Freq Up/Dn	Pol	Transponder	Freq Up/Dn	Pol
1	5955/3730	H/V	9	5955/3730	V/H
2	6015/3790	H/V	10	6015/3790	V/H
3	6075/3850	H/V	11	6075/3850	V/H
4	6140/3915	H/V	12	6140/3915	V/H

5	6205/3980	H/V	13	6205/3980	V/H
6	6265/4040	H/V	14	6265/4040	V/H
7	6325/4100	H/V	15	6325/4100	V/H
8	6390/4165	H/V	16	6390/4165	V/H

4.2 Ku-Band Operation

Sixteen transponders, each 54 or 64MHz in bandwidth, will be employed on the satellite at Ku-Band. These transponders will operate at various Ku-Band frequencies depending where they are switched, i.e., US, Latin America or Europe. Within each region they will use the standard FSS bands assigned to that region.

In Europe, the satellite downlink band used will be 12.5-12.75GHz. This band thus provides an interference-free band terrestrially for small earth stations (VSats) to operate in. In the United States and Latin America, the satellite will operate in the traditional 11.7-12.2GHz bands presently used in Region 2 for interference-free FSS operations. Because of all the possible switching in this band, the frequency plan for the Ku-Band transponders is shown in Figure 15 rather than in a Table.

4.4 C-Band and Ku-Band Beacons

PAS-2R will utilize beacons at both C-Band and Ku-Band for the purpose of allowing large and small stations to track the motion of the satellite when required. Although it is unlikely that many C-Band stations will require a beacon, this carrier is provided in the form of the telemetry channel. Earth stations requiring a Ku-Band beacon in the absence of programming or for use with UPC functions will find that beacon at 11.7GHz.

5.0 Technical Analysis of Various Services to be Offered

A full range of communications services are anticipated for PAS-2R. This includes:

Video services :

1. Full bandwidth analog video;
2. Reduced bandwidth analog video;
3. Wideband high definition video and audio;
4. TDM compressed digital video
5. SCPC compressed digital video
6. MCPC compressed digital video
7. SNG between Latin America, Africa and the US and Europe

Audio services:

8. SCPC-FM 15kHz audio;
9. SCPC-FM 7.5kHz audio;
10. subcarrier audio;
11. digital audio;

Digital services in the mode of IBS and IDR:

12. 56/64kBps;

13. 128kBps;

14. 256kBps;

15. 512kBps;

16. 768kBps;

17. T1 (1.544MBps);

18. CEPT (2.048MBps);

19. 45MBps.

VSat services

20. Using Hub stations and TDM/TDMA modulation;

Spread spectrum services:

21. Equatorial and other similar services;

as well as other newer types of communications offerings as will be available in the 1996 time frame.

Sample link analyses contained in Appendix B, examine how many of these services would utilize satellite bandwidth and power when operating with different types of earth stations in the various beams which will be available.

No effort has been made to examine every possible case which could occur and the analyses which are contained in Appendix B are meant to offer a general picture of how the satellite will be operated when in-orbit. Links are shown for individual beams and services in order to be illustrative of each type of service.

5.1 Assumptions Used in the Calculations

In general link analyses are computed for stations within the satellite's -2dB uplink and downlink contours. This includes most locations of interest, and certainly all of the major cities on the continents covered. Indeed, a full range of services out to the -4dB contour as well as locations outside this contour can be provided when required by customers. Thus these calculations are not meant to preclude the usability of locations outside the -2dB contour where larger earth terminals might be required to effect the efficient use of PAS-2R space segment.

As in the case of PAS-1, PanAmSat's other Atlantic Ocean Region satellite, and PAS-3, PanAmSat's Pacific Ocean satellite, all earth stations utilizing the PAS-2R satellite will be required to observe the FCC's improved sidelobe envelope of [29-25 logø] for uplinking and when possible, for reception. Based on our experience with PAS-1 and PAS-3, this should not be a problem.

5.2 Service Analysis

The link budgets which are contained in Appendix B., provide a complete picture of how the PAS-2R communication's capability will be used. Each link budget is contained in a Table followed by a data input Table, which describes all of the input values used in the actual analysis.

5.2.1 Video Services

Link budgets explore video services in Latin America. In these analyses, full transponder TV, half transponder TV, and compressed video TV are examined using various size earth terminals in various beams. For the most part, broadcast quality television would be available in the Latin Beam with antennas as small as 4.6-meters (G/T = 23dB/^{o}K). Even smaller antennas will provide broadcast quality television within the C-Band spot beams. Home quality reception is possible in the half transponder mode with a 3-meter antenna (G/T = 19dB/^{o}K). Appendix B also demonstrates full analog video from the United States to Europe on the Europe Beam. The presence of a unique Ku-Band uplink beam will allow SNG transmissions with small terminals from remote areas of Latin America to Latin American capitals, Europe or the United States as shown in Appendix B where an uplink from Rio on 2.4-meter terminal is shown to a 4.6-meter station in Madrid.

The video link budgets also examine how high quality compressed video signals could be delivered to earth stations covered by the Latin Beam providing video quality on the TV set equivalent to VHS home recorder quality at 3Mbps and for near-broadcast quality at 8MBps. It is believed that with the CCITT standardization (H261) and MPEG-1 and MPEG-2, that compressed video will play a large and important role in the delivery of pay television internationally. Finally, the ability to deliver high definition television by satellite is critical to the future development of HDTV worldwide. PAS transponders will be capable of providing an HDTV signal anywhere in Latin America, Europe or east of the Rocky Mountains in the United States.

5.2.2 Audio Services

Varuious types of SCPC audio services can be provided. In one case it would be as part of the TV signal base-bandwidth which is the traditional method. In another case, as many as 8-10 separate audio or data carriers can be accommodated in the spectrum 5.8 to 8.90MHz beyond the video baseband spectrum. These carriers (often called subcarriers) have been providing low cost audio and data services to US users for many years. Various other SCPC audio services are available including the traditional 15kHz and 7.5kHz services which are prevalent today. In addition, digital audio services are in great demand at present and an example of this type of service is also shown in Appendix B. The PAS-1 satellite presently carries these types of audio services and as such, these analyses represent actual equipment performance in present use.

5.2.3 Digital Services

A wide variety of digital services can be accommodated by the PAS-2R transponders. These range from the heavily used 64kBps circuits, all the way to the European CEPT carrier (2.048MBps). These carriers can be delivered anywhere a PAS footprint exists including Europe, Latin America and the United States. A direct link exists between Latin America and Europe through the use of the satellite's cross-strapped transponders which allow the interconnection of Latin Beam transponders with Europe Beam transponders permitting data services to be delivered between those continents. As Appendix B demonstrates, a typical Latin Beam transponder can accommodate five-hundred and forty 64kBps carriers when operating into a 3.7-meter antenna. T1 (1.544MBps) carriers can also be efficiently carried in a transponder when operating between 3.0-meter terminals. Although not shown in the

Appendix B, a 45MBps carrier could operate from the US into Europe using a 4.5-meter receiving station.

5.2.4 FDM/FM Telephony Services

Traditional FDM/FM telephony in 60 channel and 360 channel loadings can be handled by any of the satellite's transponders. These are not shown in Appendix B since telephony is largely handled in a digital fashion at present.

5.2.5 VSat Services

VSat services have been examined including the traditional Hub to remote approach used by many operators. In this approach a centrally located hub station (usually a larger antenna and the system control software), communicates with a large number of remotes by sending out a TDM (Time Division Multiplex) carrier at, e.g., 512kBps. Each remote responds, when necessary, to the hub in a TDMA format, typically at either 64kBps or 128kBps. As traffic growth warrants, additional "outbound" (TDM) carriers and additional "inbound" (TDMA) carriers can be added.

Although such systems have traditionally operated principally at Ku-Band in the US and Europe, because of the high power of the

PAS-2R beams, such operation will be possible in Latin America at C-Band as is presently occurring on PAS-1. Appendix B shows the outbound and inbound circuits for a hypothetical VSat service in PAS-2R's Latin Beam.

Other VSat services could occur in hubless systems where mesh operation is possible, i.e., communication directly between remotes where no communication needs to be relayed through a hub. In these systems, small antennas again are used at remote sites, while a slightly larger station is used at a central location. Intelligence in each remote, and communication with the central station, allows the selection of carrier frequencies between stations on a burst basis so that addressed packets of information are constantly going through the satellite and being received only at the station of choice. In this design, the hub need not be an expensive station. An additional modem is required for each additional station added to the network.

6.0 Power Flux Density Levels

The power flux density limits for space stations are specified in Section 25.208 of the Commissions Rules and Regulations . This section of the PAS-2R application will demonstrate compliance with the Commission's rules regarding power flux density limits in the bands of use where the rules apply.

6.1 C-Band Flux Density Limits

The Rules state, that in the band 3700-4200 MHz, the power flux density at the Earth's surface produced by emissions from a space station shall not exceed the following values:

a) $-152 dBW/m^2$ in any 4kHz band for angles of arrival between 0 and 5 degrees above the horizon;

b) $-152 + (\delta - 5) / 2$ dBW/m^2 for any 4kHz band for angles of arrival δ between 5 and 25 degrees above the horizon;

c) $-142 dBW/m^2$ in any 4kHz band for angles of arrival between 25 and 90 degrees above the horizon.

6.2 Calculating Flux Density Limits at C-Band

Using the PAS-2R satellite's C-Band antenna contours as shown in Figures 2-13 and the values computed for beam center maximum EIRPs in

Table 1, it is possible to verify that the PAS-2R design meets the Commission's 25.208 regulations for C-Band emissions.

Power flux density at the earth's surface is calculated by computing the path loss (in dB) from the satellite to the earth's surface and adding to that the gain of a $1m^2$ antenna (in dB). This value is then subtracted from the maximum EIRP of the satellite to determine the boresite maximum flux density. Since the most powerful signal emitted by the satellite occurs when an unmodulated TV/FM carrier is transmitted to earth, we noted that in this condition, an artificial energy dispersal signal of 2 MHz is applied. Thus:

Maximum EIRP in Latin Beam (dBW)	39.1
Path Loss to Latin Beam Boresite (dB)	-196.0
Gain of $1m^2$ Antenna (dB)	33.4
Energy dispersal of 2MHz (dB)	-63.0
Conversion to 4kHz bandwidth (dB)	36.0
Maximum Power Flux Density (dBW/m2 per 4kHz)	-150.5

As can be seen, this results in a power flux density of $-150.5dBW/m^2$ at the boresite point. The boresite of the Latin Beam falls in Brazil as shown in Figures 2 and 3. The elevation angles to the satellite at the boresight point is clearly above 30^o. At this elevation angle, the maximum allowable flux density is $-142dBW/m^2$, which is greater than the projected $-150.5dBW/m^2$ by more than 8.5dB. The other principal C-Band beam is the Africa beam which has a lower EIRP and is also above a 30° elevation angle.

6.3 Ku-Band Flux Density Limits

In Region 1 in the band 12.5-12.75GHz, the power flux density at the Earth's surface produced by emissions from a space station shall not exceed the following according to RR 28-8 of the ITU Rules:

a) -148dBW/m^2 in any 4kHz band for angles of arrival between 0 and 5 degrees above the horizon;

b) -148+ (δ - 5) / 2 dBW/m^2 for any 4kHz band for angles of arrival δ between 5 and 25 degrees above the horizon;

c) -138dBW/m^2 in any 4kHz band for angles of arrival between 25 and 90 degrees above the horizon.

6.4 Calculating Flux Density Limits at Ku-Band in Europe

Using the satellite's Ku-Band antenna contours as shown in Figure 10, and the values computed for beam center maximum EIRPs in Table 1, it is possible to determine whether the PAS-2R design meets the ITU regulations for Ku-Band emissions.

Power flux density at the earth's surface for the Europe Beam is calculated by computing the path loss (in dB) from the satellite to the earth's surface and adding to that the gain of a 1m^2 antenna (in dB). This value is then subtracted from the maximum EIRP of the satellite to determine the boresite maximum flux density. Since the most powerful signal emitted by the satellite occurs when an unmodulated TV/FM carrier is transmitted to earth, we noted that in this condition, an artificial energy dispersal signal of 4 MHz is applied which reduces the power flux density value by 66dB. In addition, PanAmSat's plan for usage of analog video in Europe calls for split transponder operation. Based on this operational decision, each TV carrier would be 4.6dB down from saturation. Therefore:

Maximum EIRP in Europe Spot Beam (dBW)	51.5
Transponder backoff for dual carrier	- 4.6
Path Loss to European Beam (dB)	-205.9
Gain of $1m^2$ Antenna (dB)	42.8
Energy dispersal of 4MHz (dB)	-66.0
Conversion to 4kHz bandwidth (dB)	36.0
Maximum Power Flux Density (dBW/m^2 per 4kHz)	-146.2

The boresite of the Europe Beam falls on the Northeastern border of Spain as can be seen from Figure 10. All of Spain, including the boresite location is above a 30^o elevation angle. At the thirty degree angle, maximum allowable flux density is $-138dBW/m^2$, which is 8.2dB greater than the $-146.2dBW/m^2$ calculated above. Based on this analysis, the Europe Beam flux density for analog video complies with ITU rules (RR28-8).

6.5 Calculating Flux Density Limits at Ku-Band in United States

Part 25.208 of the FCC rules does not place flux density limitations on the Ku-Band downlink frequencies which cover the United States at 11.7-12.2GHz, and therefore those frequencies/power levels are not exceeded in this application.

6.6 Calculating Flux Density Limits at Ku-Band in Latin America

The Latin American DTH service presently planned does not contemplate using analog TV. The service is based on compressed digital video (MCPC) of approximately 40MBps in each 54/64MHz transponder. Therefore no flux density limitations would be exceeded since the effective spreading bandwidth of the DTH carrier is 10dB higher than the spreading bandwidth of the TV/FM carrier.

7.0 Adjacent Satellite Interference

The analysis of adjacent satellite interference is a critical element in the design of any satellite communication system due to the crowded nature of the geostationary orbit. As such, preliminary analyses has been conducted to determine whether the PAS-2R satellite will cause excessive interference to adjacent satellites and whether those satellites will cause excessive interference to PAS-2R. The analysis has been conducted in accordance the principles and procedures discussed in OST Report FCC/OST R-83-2, as well as Intelsat's procedures and guidelines as outlined in the IICM (Intelsat Intersystem Coordination Manual).

7.1 Satellites Under Consideration for Interference Analysis

At 43°WL, as noted previously, PAS-2R will be adjacent to the Intelsat network at 40.5°WL at both Ku- and C-Band and Columbia Communication's TDRSS capacity at 41°WL at C-Band, and the Orion 1 reservation at 47°WL at Ku-Band.

7.2 Interference Geometry and Theory

The interference geometry is shown in Appendix A in Figure 17 which has been extracted from the FCC's OST report. As shown in the figure, the "wanted" carrier is subject to both uplink and downlink interference. The $(C/I)_u$ and the $(C/I)_d$ are given by the following equations:

$(C/I)_u = P_t + G_1 - \Delta L_u - p_t - g_1(\phi) + \Delta G_2 + Y_u$

and

$(C/I)_d = E + G_4 - \Delta L_d - e - g_4(\phi) + Y_d$

where

$(C/I)_u$	=	uplink wanted-to-interfering carrier ratio
$(C/I)_d$	=	downlink wanted-to-interfering carrier ratio
P_t	=	power of wanted carrier at input of transmit station
pt	=	power of interfering carrier at input of earth station
G_1	=	gain of wanted transmit antenna to wanted satellite
G_4	=	gain of wanted receive antenna to wanted satellite
ΔL_u	=	uplink path loss differential (wanted-to-interfering)
ΔL_d	=	downlink path loss differential (wanted-to-interfering)
$g_1(\phi)$	=	gain of interfering station antenna to wanted satellite
(ϕ)	=	topocentric angular separation between satellites
ΔG_2	=	differential between receive antenna gain at wanted satellite towards the two earth stations
Y_u	=	uplink minimum polarization discrimination
Y_d	=	downlink minimum polarization discrimination
E	=	satellite EIRP of wanted carrier
e	=	satellite EIRP of interfering carrier
$g_4(\phi)$	=	receive antenna gain of wanted earth station in direction of interfering satellite.

Please note that the notation used in the equations listed above is identical to that used in CCIR Report 455-2. Capital letters relate to the wanted system while lower case apply to the interfering system as is the convention.

It is important to note that the C/I ratios referred to in the equations in this section do not take account for bandwidth differences (or spectral shape differences) between the two carriers. These differences must be accounted for by the factor Q which is the ratio of interfering power between the two signals as defined below:

$$Q \quad = \quad 10 \log \int_{-B1/2}^{B1/2} S_2 (f - F)\, df \text{ , in dB}$$

where S_2 is the normalized power spectral density of the interfering signal in dB.

7.3 Interference Objectives

This analysis uses the CCIR recommendations for allowable level of adjacent satellite interference. The CCIR has established "single entry" and "aggregate" limits for this interference. Single entry is defined as the maximum allowable interference caused by the combined effects of a single uplink and downlink satellite system into another. The term aggregate refers to the maximum allowable interference from all other satellite systems. Typically an inter-system coordination only focuses on the single entry case and attempts to insure that these limits would not be exceeded by either party.

7.3.1. Digital Carriers

For digital carriers, CCIR Recommendation 523-1 states that interference from any single adjacent satellite system should not exceed 4% of the total system noise giving rise to a bit-error-rate of 1×10^{-6}. Thus for digital carriers,

$$(C/I)_{total} = (C/N)_{ref} + 14dB$$

where,

$(C/I)_{total}$ = total carrier-interference ratio

$(C/N)_{ref}$ = carrier-to-noise that would lead to BER of 1×10^{-6}.

7.3.2. TV Carriers

For TV carriers, CCIR Recommendation 483-1 states that the maximum level of interference noise power caused by one satellite system into another shall not exceed 4% of the allowable video noise. For TV/FM signals, this leads to,

$$(S/I)_{total} = (S/I)_{ref} + 14dB$$

where,

$(S/I)_{total}$ = baseband signal-interference ratio defined as $(C/I)_{total} + X$ (see footnote 2)

$(S/I)_{ref}$ = required baseband signal-noise, typically 53dB for broadcast quality reception

7.4 Potential Interference Between PAS-2R and Columbia's TDRSS

Tables B-17 and B-18 show the "worst case" uplink and downlink interference between PAS-2R Latin Beam digital carriers and the "typical" SCPC/PSK carrier given in the Columbia application. The uplink interference calculation is based on a minimum uplink gain differential (parameter ΔG_2) of 7.0dB, i.e., the uplink gain of the Columbia receive antenna is -3dB in the direction of the Columbia transmit earth station while the maximum uplink gain in the direction of the worst located PAS-2R Latin Beam earth station is -10dB.

The downlink interference calculation is based on a minimum downlink gain differential of -10dB, i.e., in computing the satellite EIRP of the interfering carrier (parameter e), it was assumed that the Columbia receive station lies on or below the -10dB gain contour of the PAS-2R Latin Beam transmit pattern.

Both the uplink and downlink gain differential assumptions used in the interference calculations are believed to be conservative, based on the antenna patterns shown in the two applications.

As the results of the interference calculations indicate, the expected worst case interference from PAS-2R digital carriers into the "typical" SCPC/PSK carrier listed in the Columbia Application is well within the required limit.

While it is possible that a limited number of Columbia carriers will be subject to interference somewhat in excess of the nominal limits, it is believed that such cases can be resolved during coordination between the two systems, using guidelines and criteria generally employed in the coordination of US domestic systems.

Communication's TDRSS C-Band capacity is contained in Appendix B, Tables B17 and B-18 of this application. As only a single digital carrier is described in any detail in the Columbia application, only that carrier is analyzed in this application. The analysis demonstrates that with respect to Columbia's TDRSS capacity, PAS-2R will not cause excess interference into Columbia's digital carriers.

7.4 Technical Coordination Between PAS-2R and the Intelsat Network

PanAmSat completed its Intelsat coordination for the PAS-2 satellite in February 1994. The differences between PAS-2 and PAS-2R are very minor and will be raised with Intelsat in the next few months. We foresee no difficulties in concluding this coordination prior to the satellite's planned launch in December 1995.

8.0 Launch Services

PAS-2R as has been described in §2 as a large hybrid satellite containing thirty-two transponders. The satellite's weight is expected to be 2890 pounds in a dry state. There are presently three launch vehicles which can accommodate this weight. PanAmSat has been in discussions with all three manufacturers, General Dynamics regarding the Atlas 2A and 2AS; Arianespace regarding the Ariane 4; and Lockheed for the Proton.

The satellite's compatibility with three separate and distinct launchers will mean additional study and discussions with the three companies. The final selection will depend on launcher manifests, desired lifetime, launch price, reliability and other tradeoffs which must be considered.

Launch support arrangements have been concluded with the satellite's manufacturer, Hughes Aircraft Company and are the same as they were for the PAS-2 and -3 launches.

Once the liquid apogee motor has been fired the required number of times and the satellite successfully inserted into the geosynchronous orbit, a drift phase will be initiated to be terminated once the satellite reaches 43°WL. At this location, the In-Orbit Test Phase (IOT) will commence. It is anticipated that this phase will last three to four weeks. During that period the satellite will be checked out by its manufacturer and PanAmSat from the manufacturer's facilities in Castle Rock, Colorado and Brooklyn, New York. Once the spacecraft has completed its tests, it will be turned over to PanAmSat by the manufacturer to begin regular operations.

Appendix A

PAS-2R Beam Patterns

and

Frequency Plans

PAS-2R

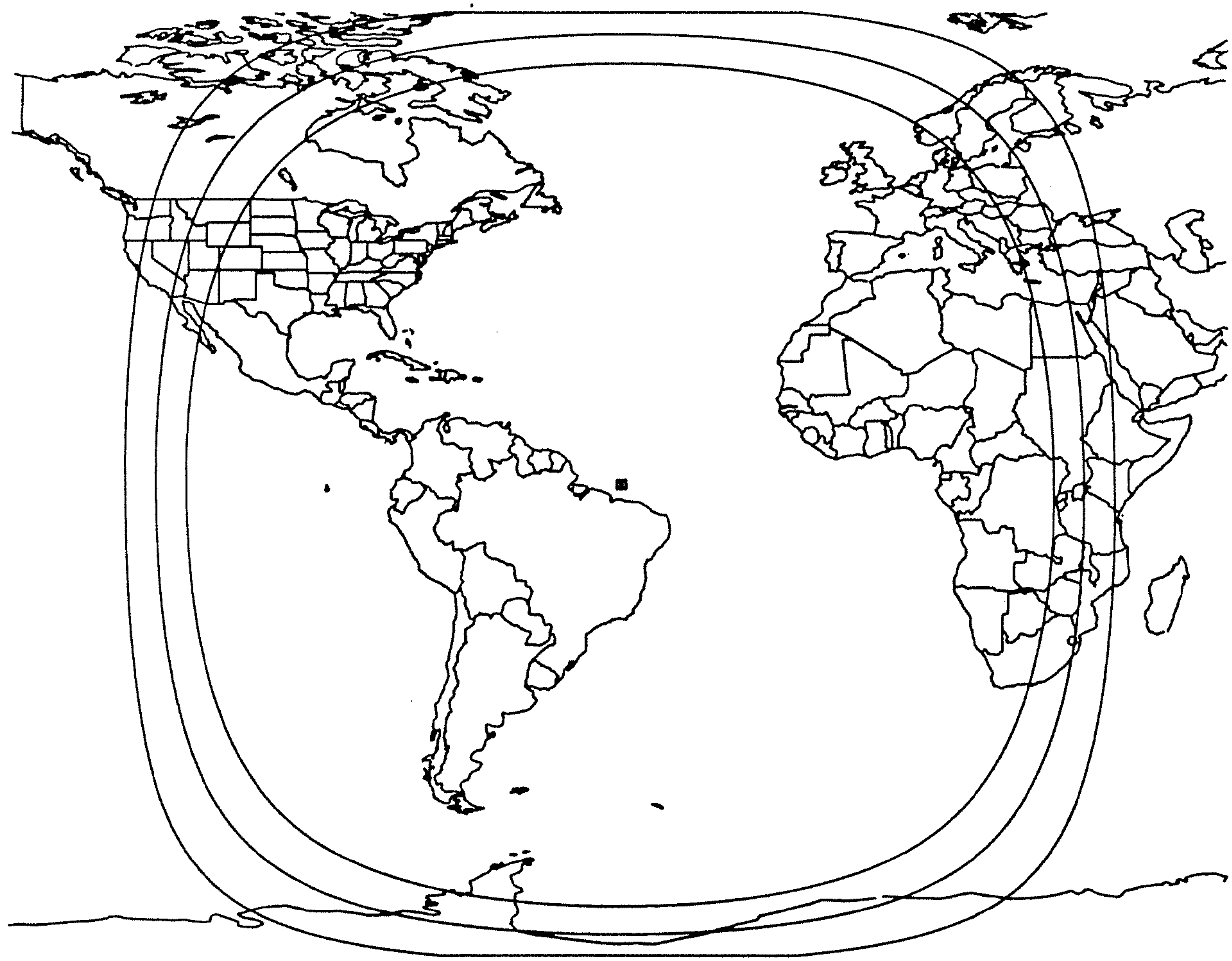

FIGURE 1 - PAS-2R LOOK ANGLES - 0°, 5°, 10°

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Engineering and Operations

PANAMSAT - 2R

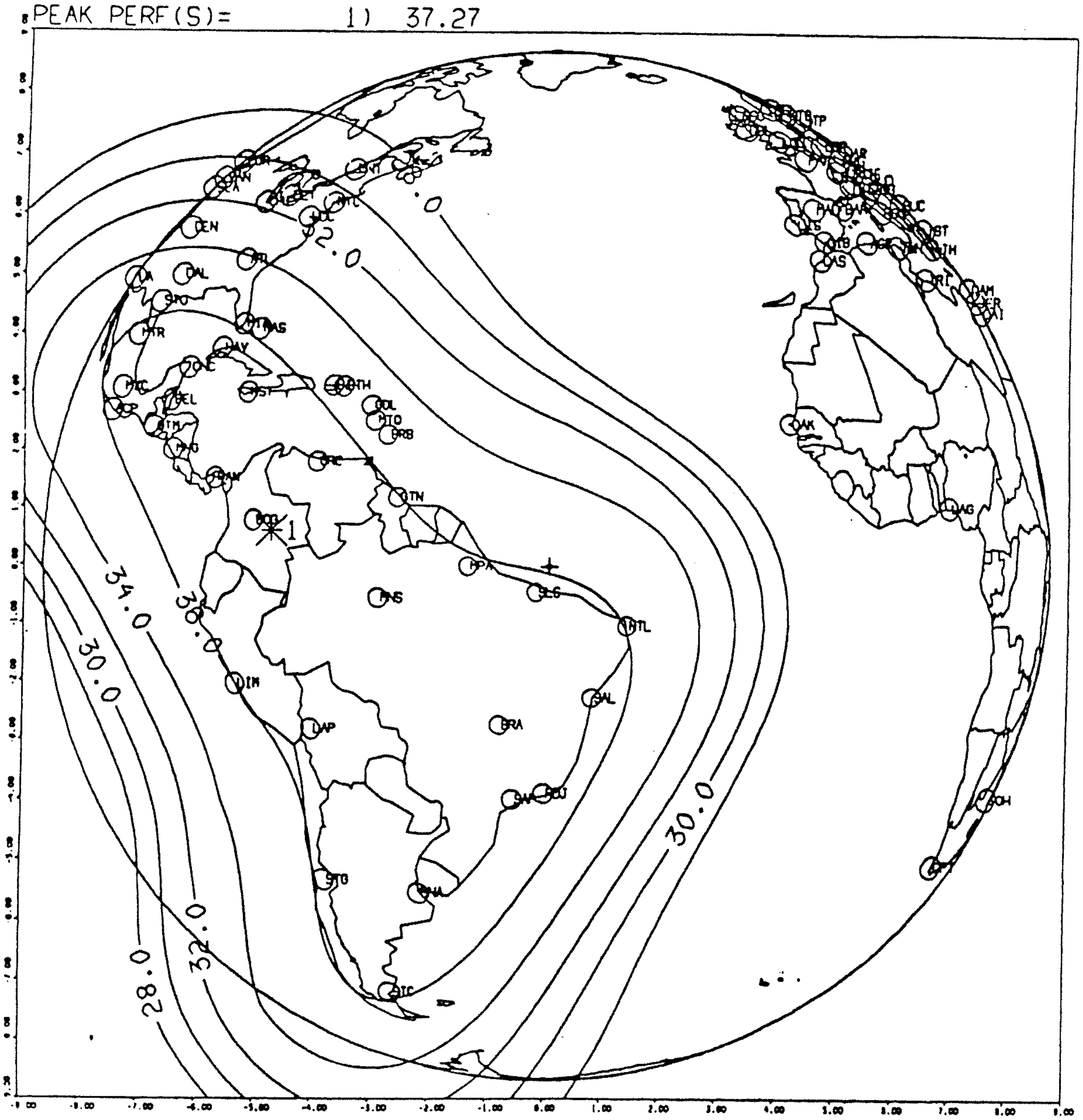

FIGURE 2 - C-BAND LATIN HORIZONTAL TRANSMIT BEAM

PANAMSAT L.P.
Engineering and Operations
Washington, D.C.

PANAMSAT - 2R

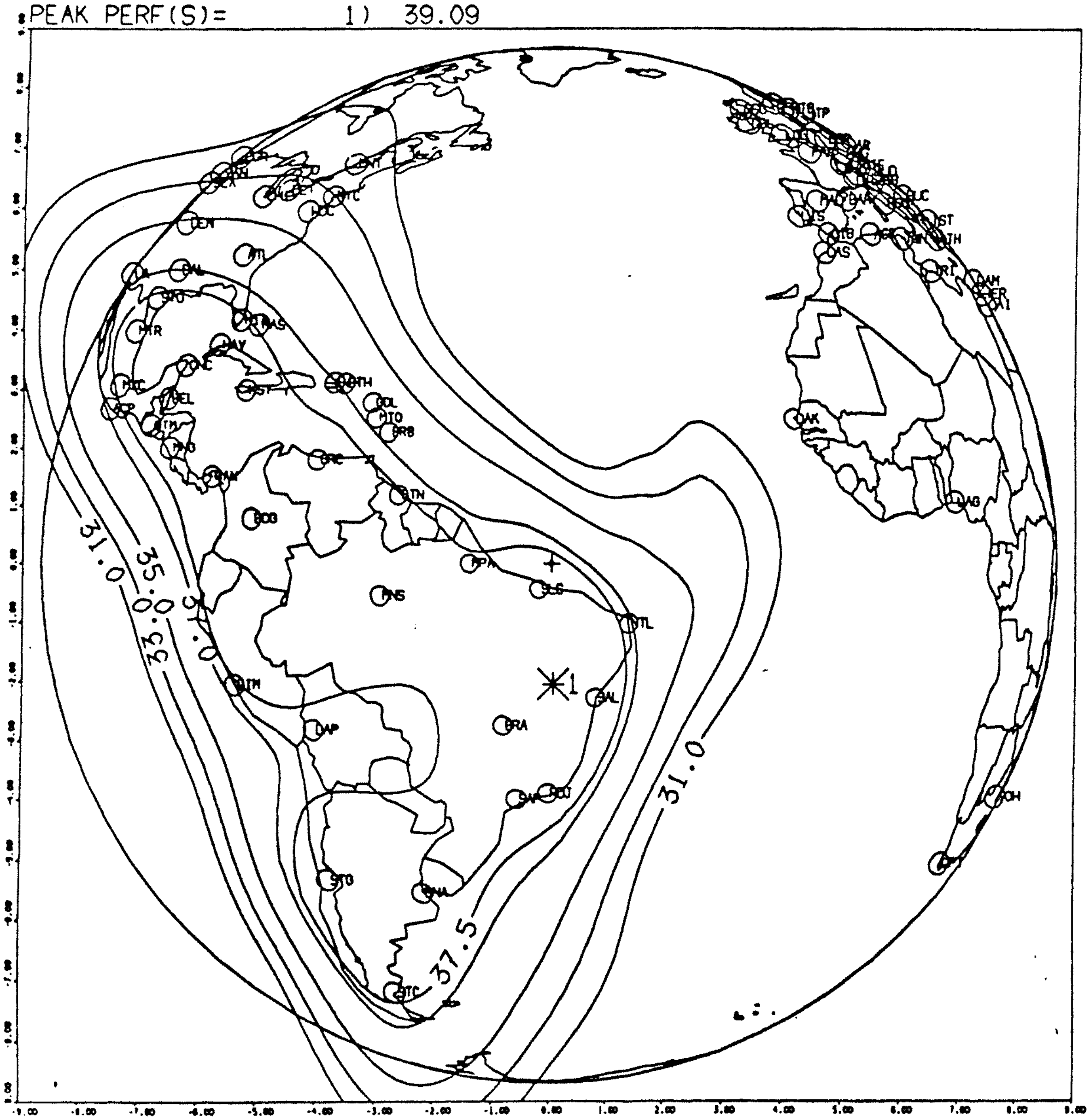

FIGURE 3 C-BAND LATIN VERTICAL TRANSMIT BEAM

PanAmSat L.P.
Engineering and Operations

PANAMSAT - 2R

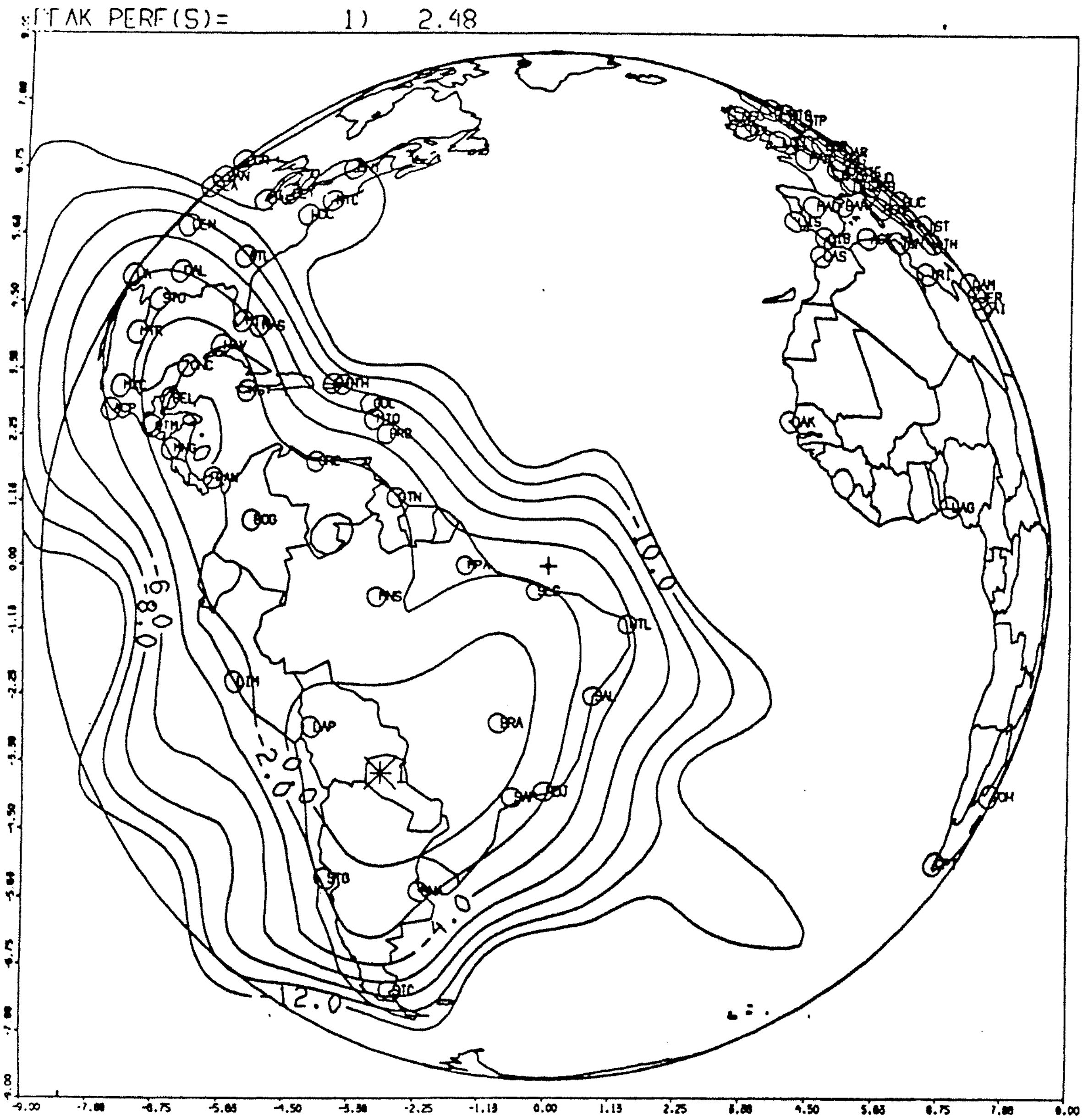

FIGURE 4 - C-BAND LATIN VERTICAL RECEIVE BEAM

PanAmSat L.P.
Engineering and Operations

PANAMSAT - 2R

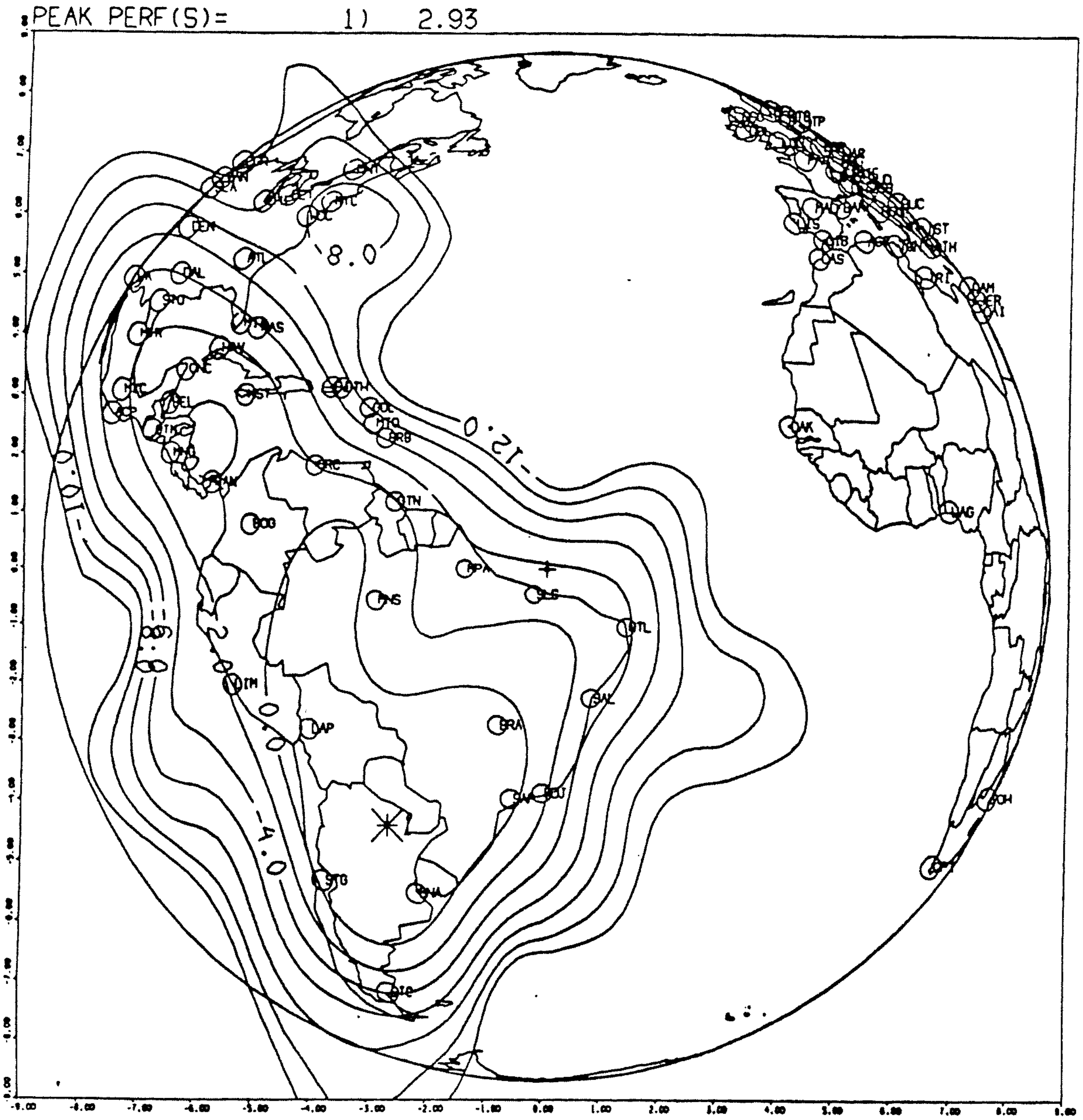

FIGURE 5 - C-BAND LATIN HORIZONTAL RECEIVE BEAM

PANAMSAT L.P.
Engineering and Operations
Washington, D.C.

PANAMSAT - 2R

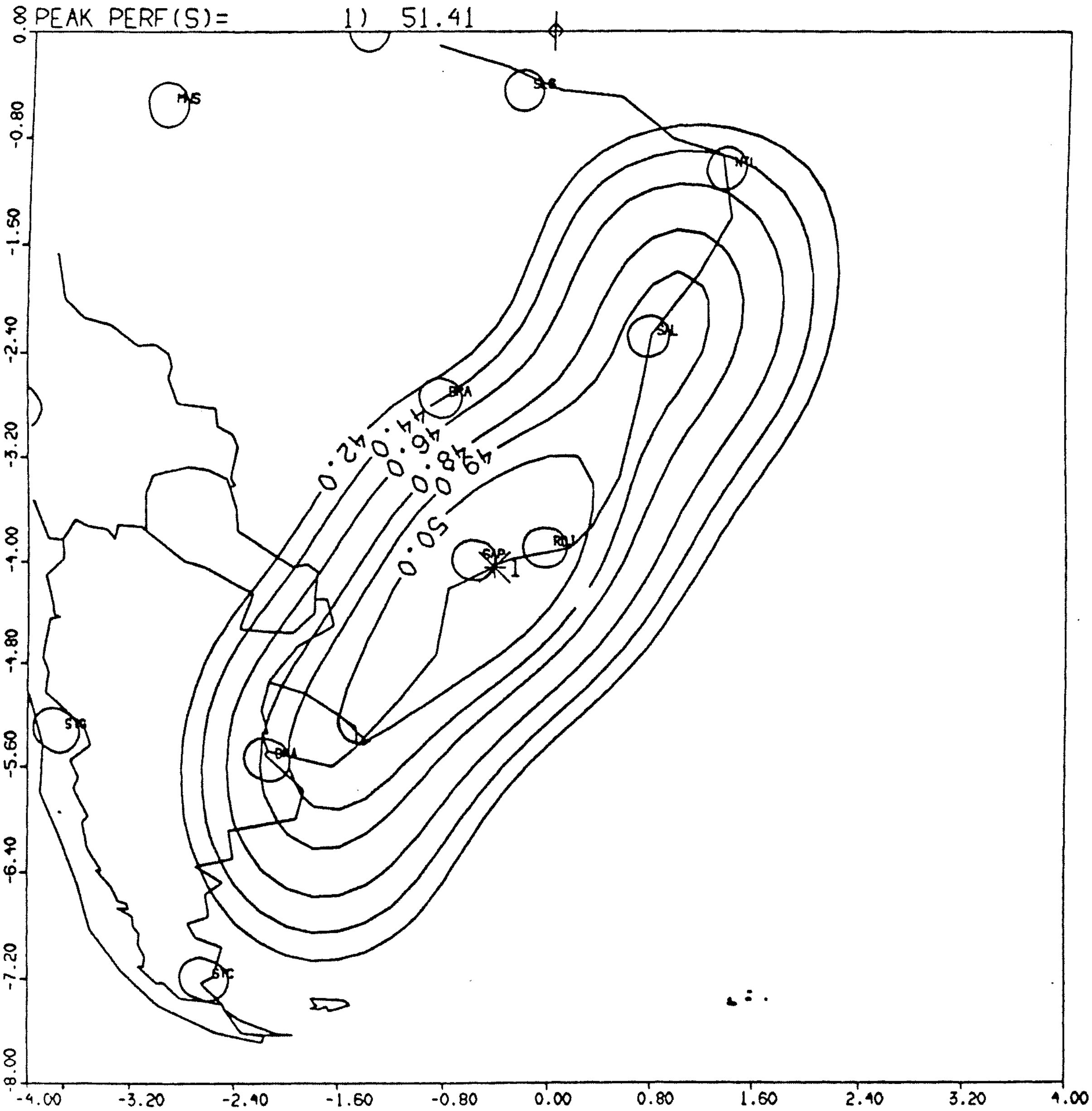

FIGURE 6 - KU-BAND BRAZIL SPOT BEAM

PanAmSat L.P.
Engineering and Operations

PANAMSAT - 2R

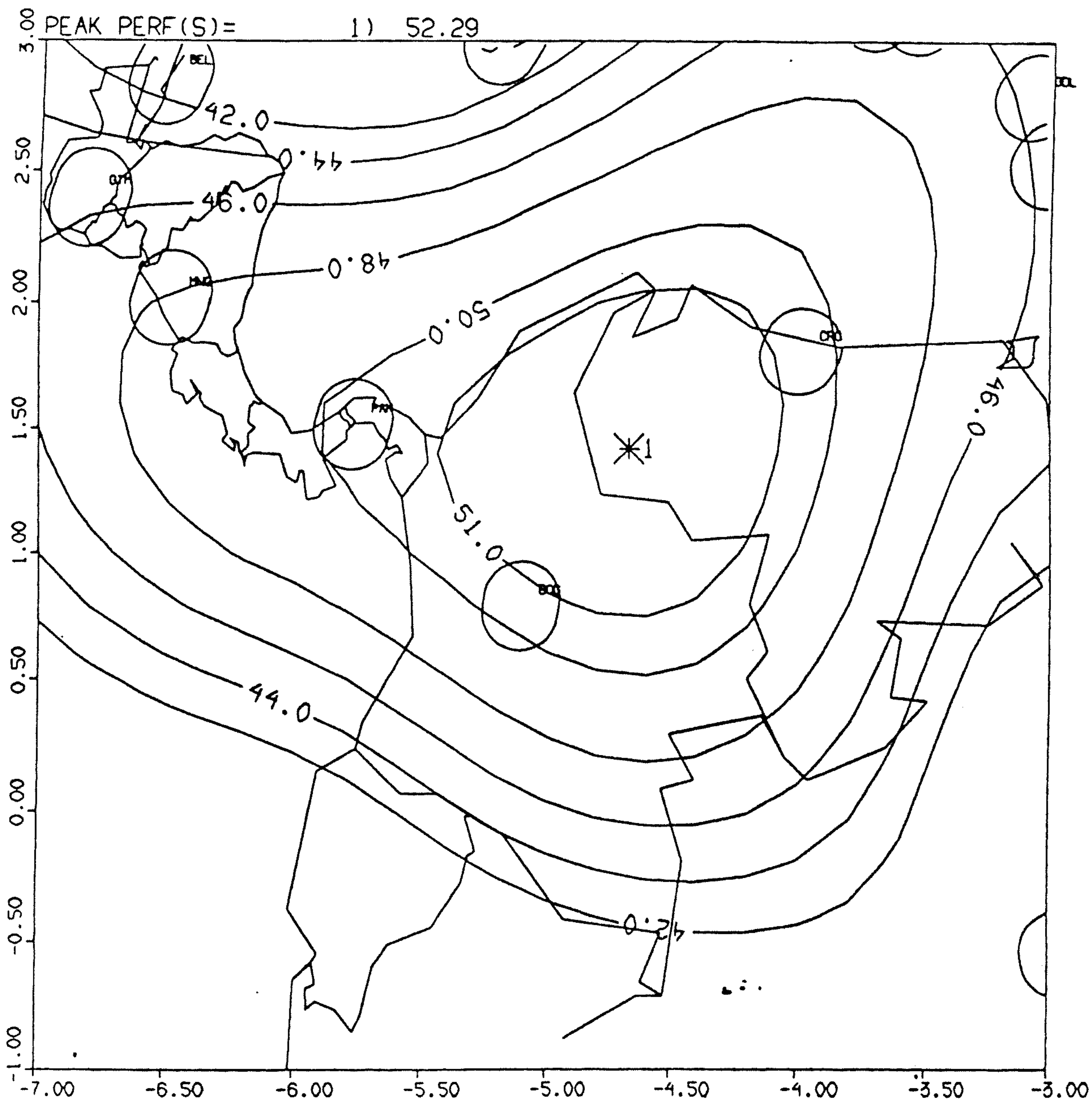

FIGURE 7 - KU-BAND NSA SPOT BEAM

PanAmSat L.P.
Engineering and Operations

PANAMSAT - 2R

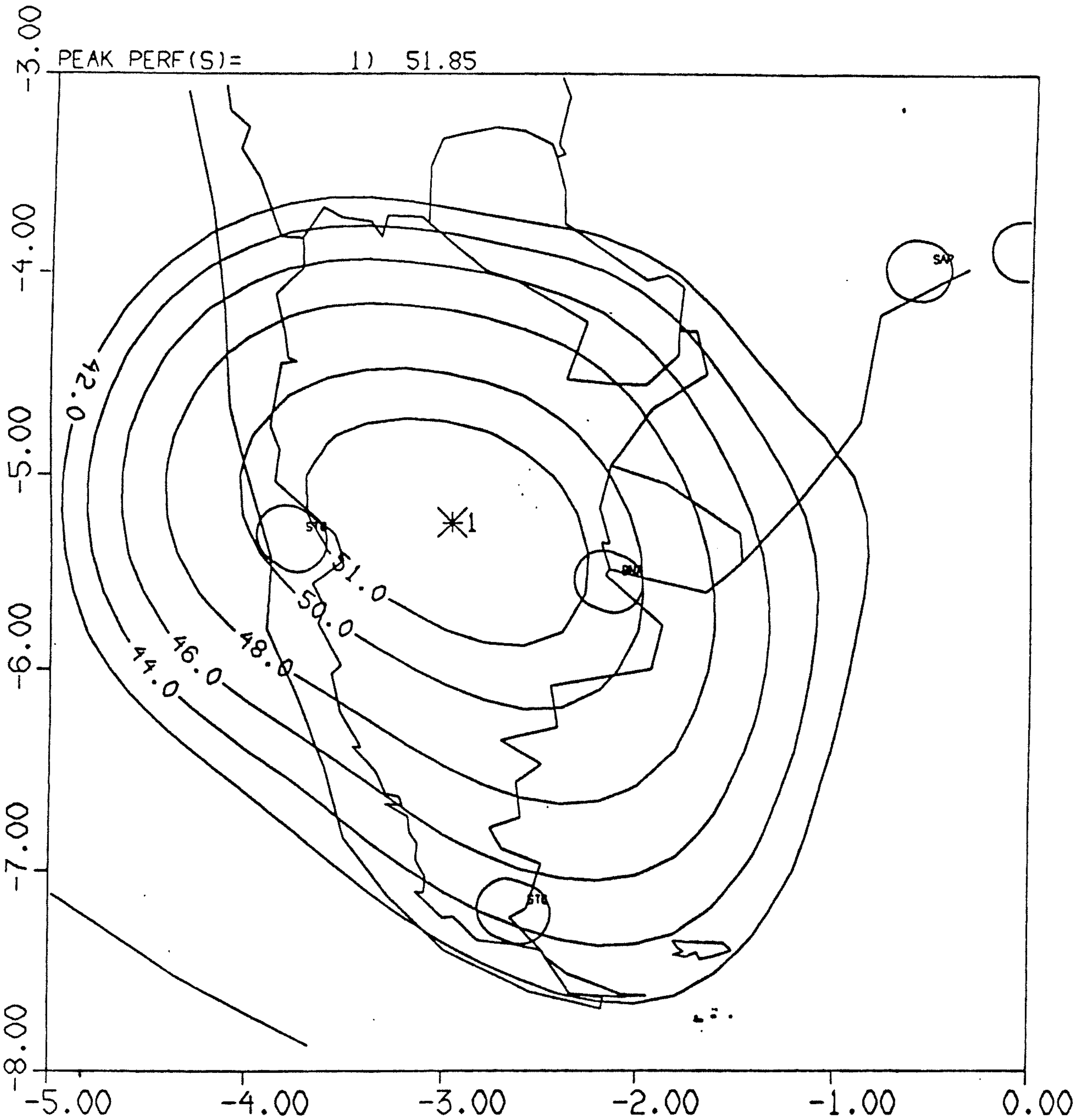

FIGURE 8 - KU-BAND SSA SPOT BEAM

PanAmSat L.P.

Engineering and Operations

PANAMSAT - 2R

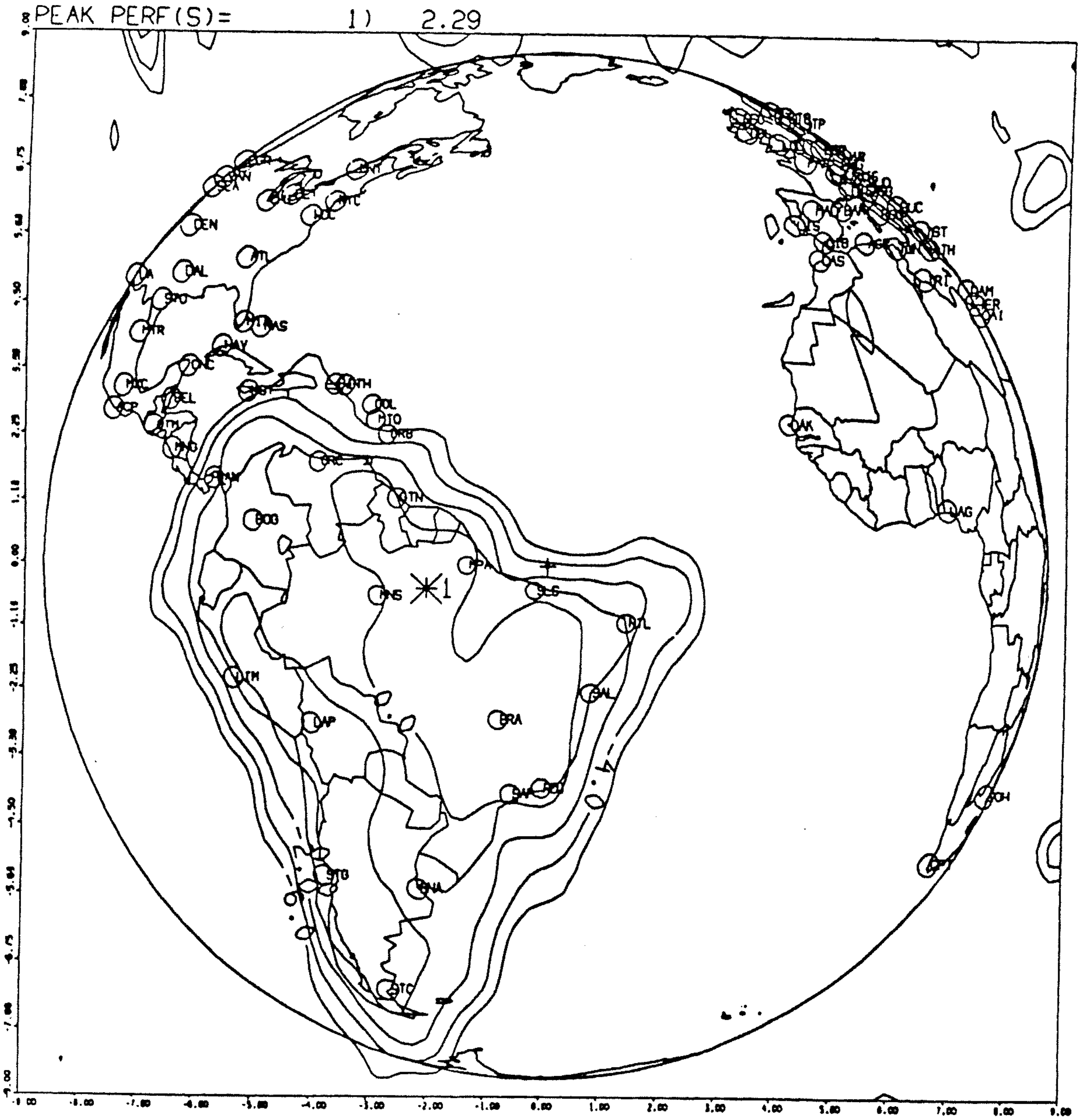

FIGURE 9 - KU-BAND SOUTH AMERICA RECEIVE BEAM

PanAmSat L.P.

Engineering and Operations

PANAMSAT - 2R

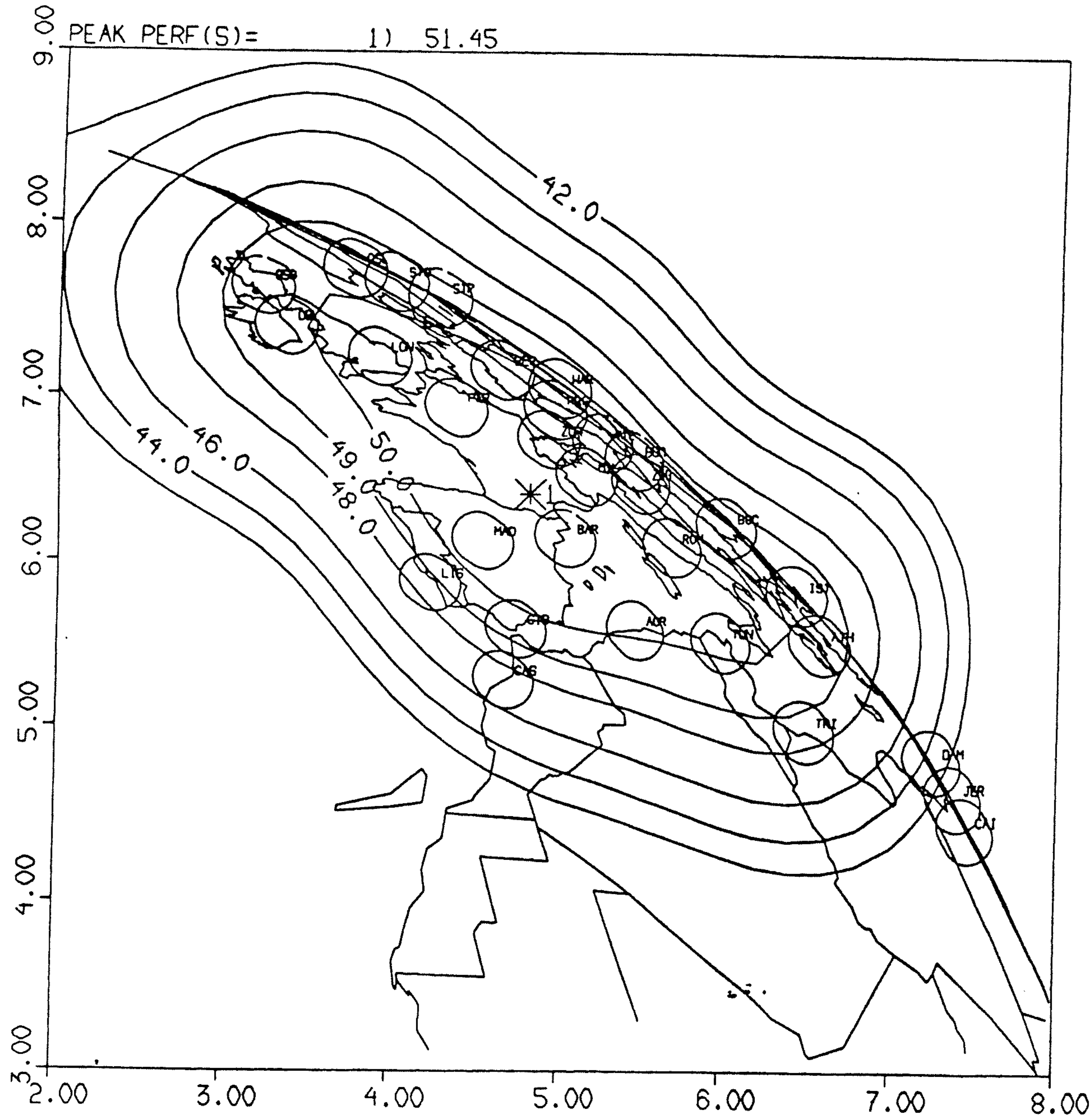

FIGURE 10 - KU-BAND EUROPE BEAM

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Washington, D.C.

PANAMSAT - 2R

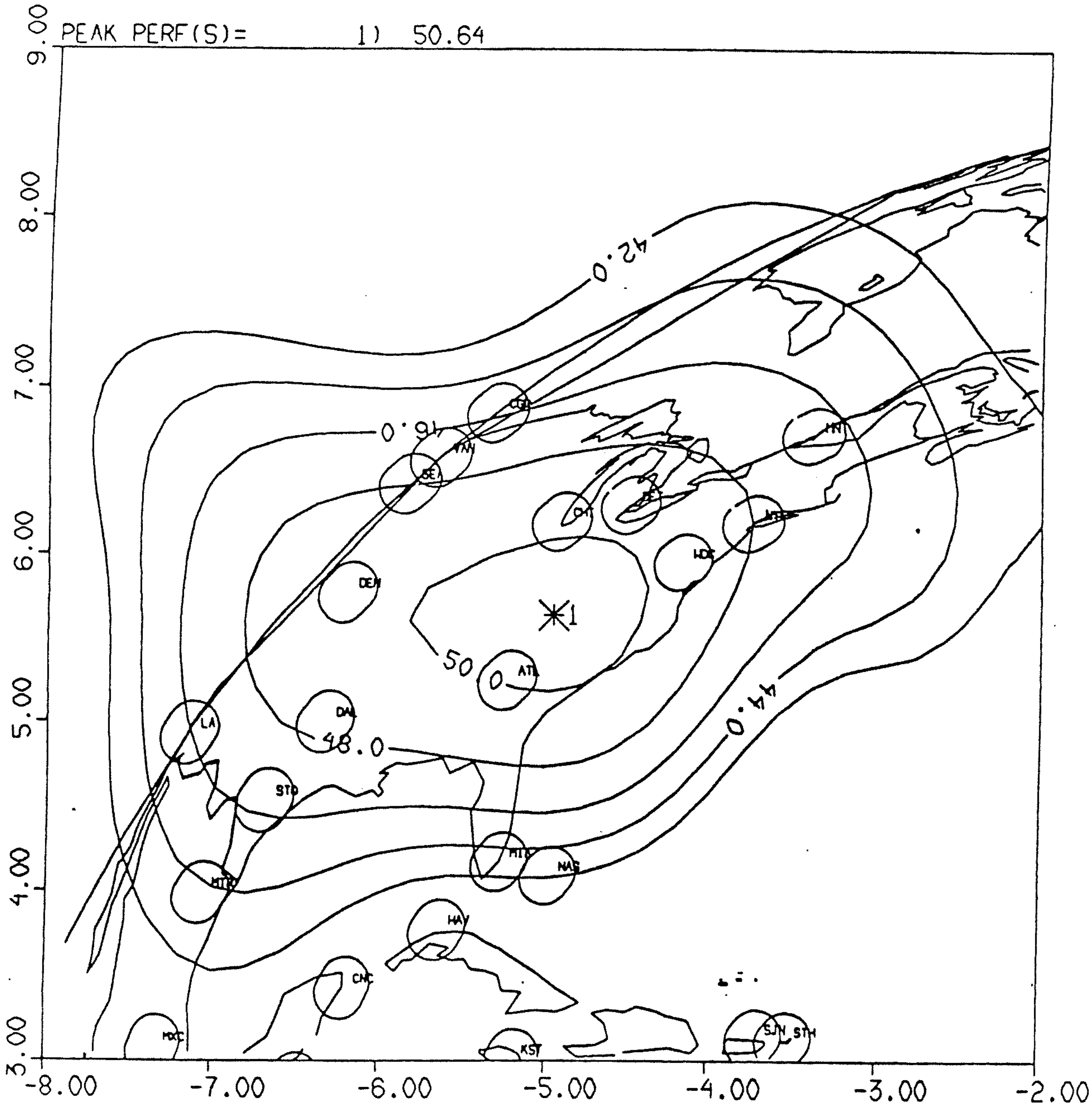


FIGURE 11 - KU-BAND CONUS BEAM

PANAMSAT L.P.
Engineering and Operations
Washington, D.C.

PANAMSAT - 2R

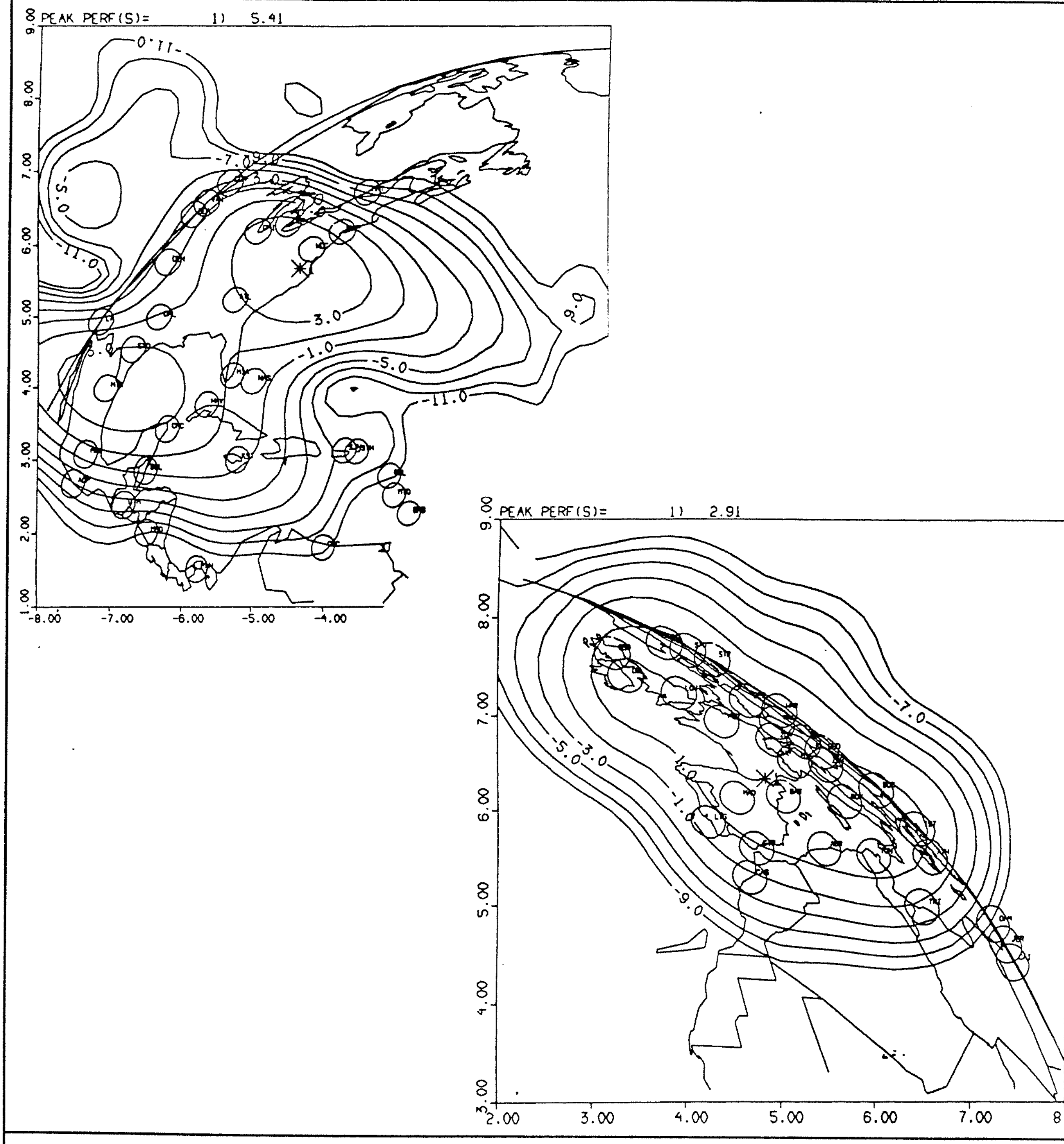


FIGURE 12 - KU-BAND ATLANTIC RECEIVE BEAM

PanAmSat L.P.

Engineering and Operations

PANAMSAT - 2R

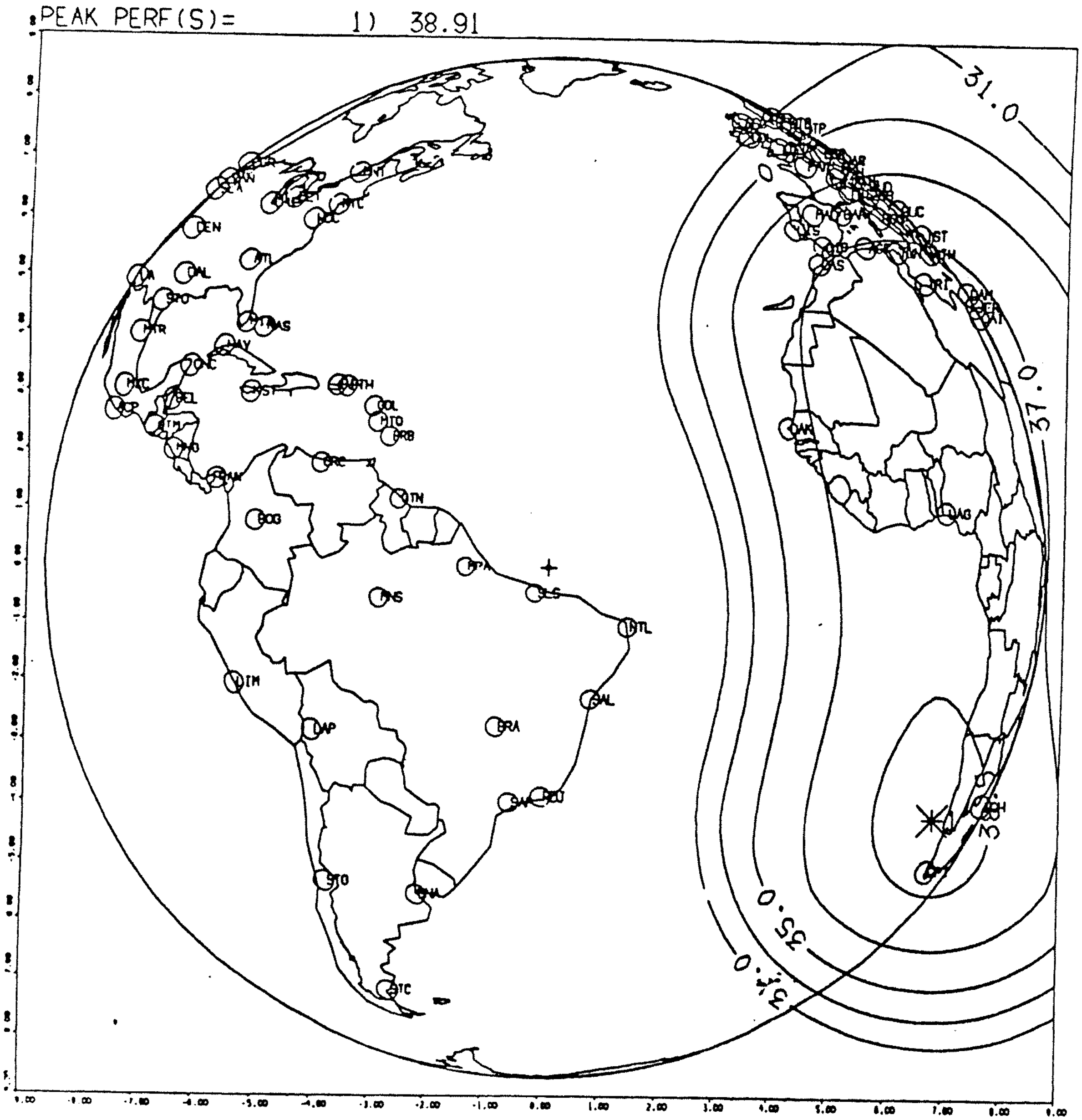


FIGURE 13 - C-BAND AFRICA BEAM

PanAmSat L.P.

Engineering and Operations

PANAMSAT - 2R

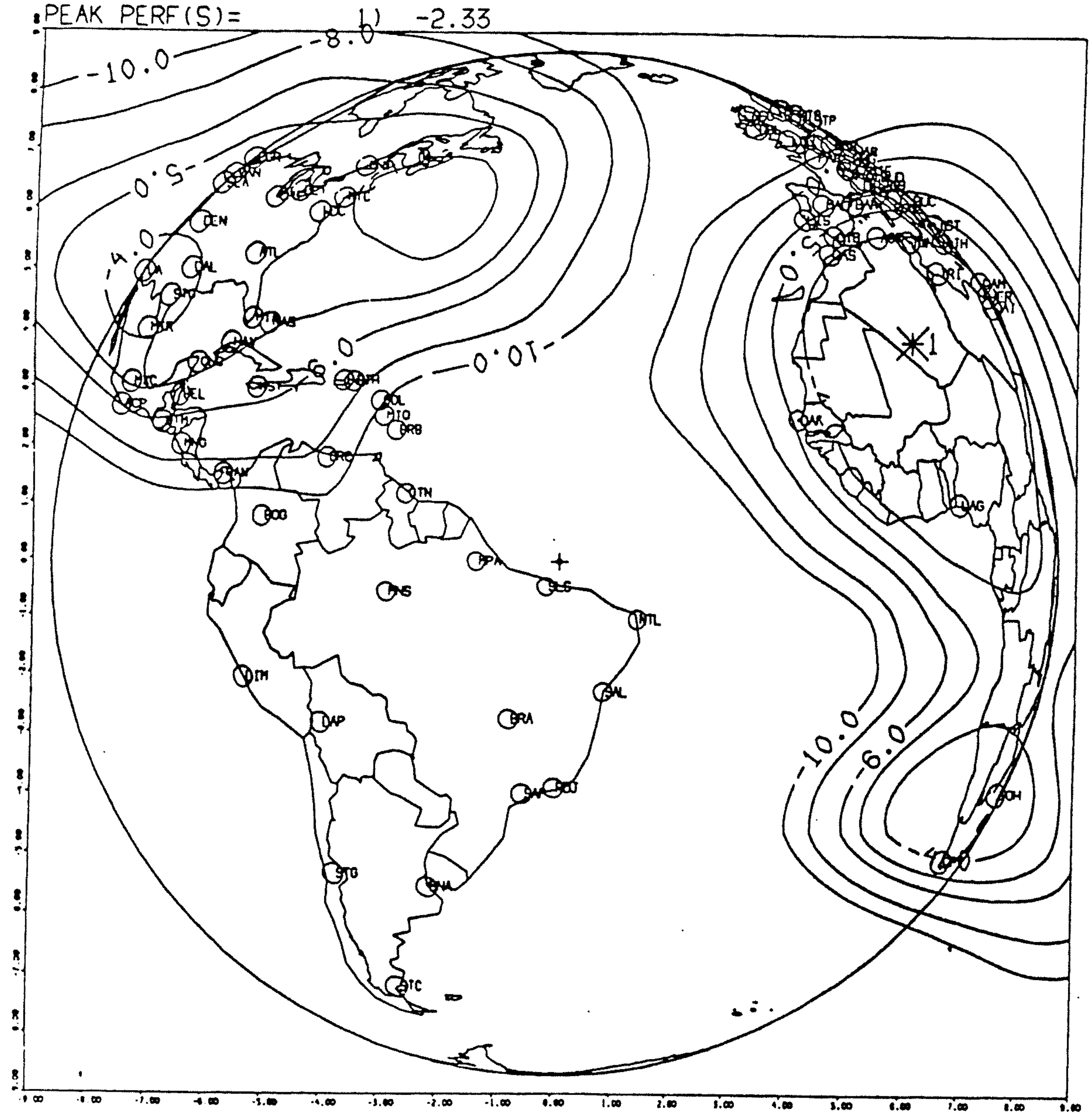


FIGURE 14 - C-BAND AFRICA/US RECEIVE BEAM

PanAmSat L.P.

Engineering and Operations

PAS-2R

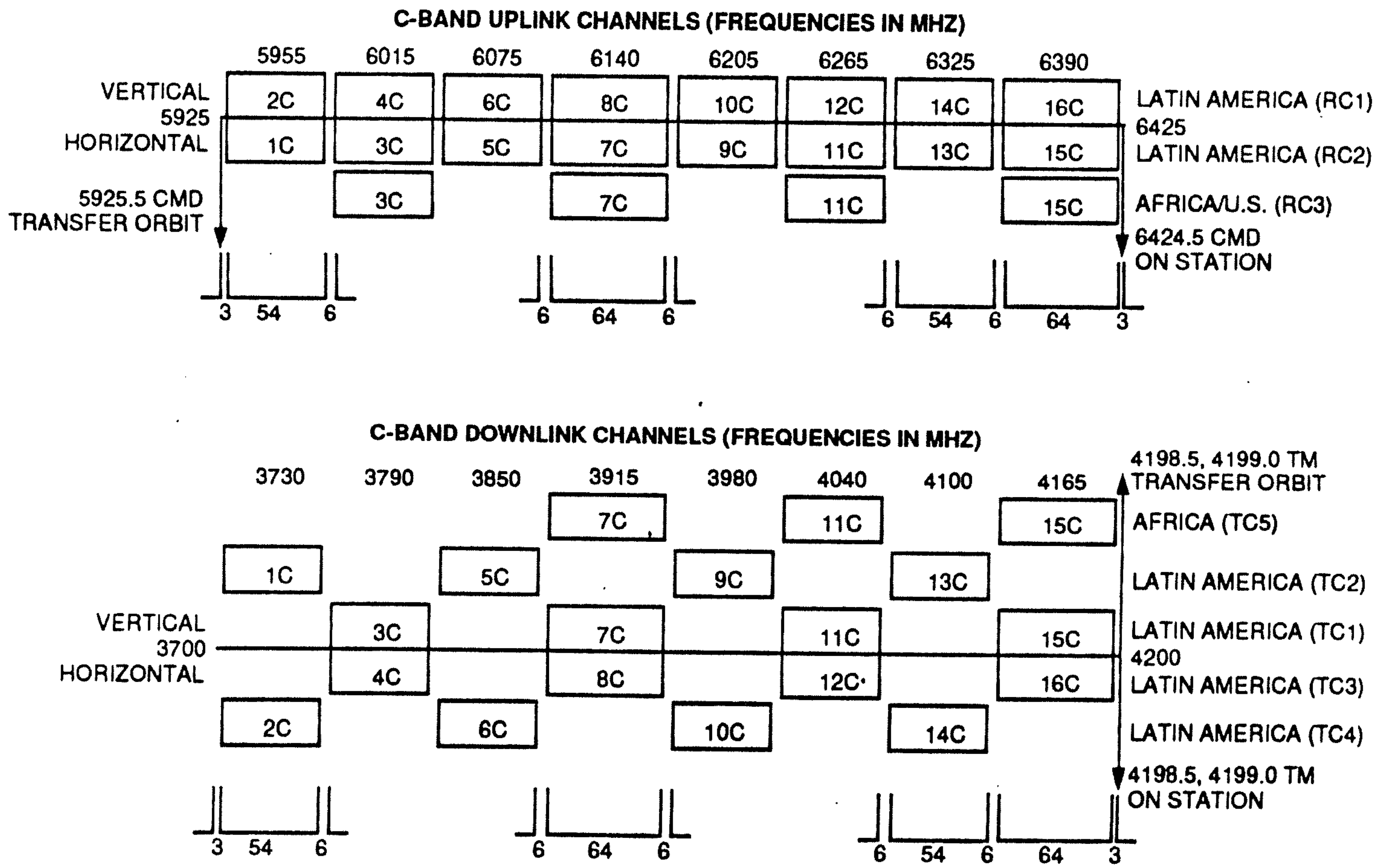


FIGURE 15 - C-BAND FREQUENCY PLAN

PanAmSat L.P.
Engineering and Operations

PAS-2R

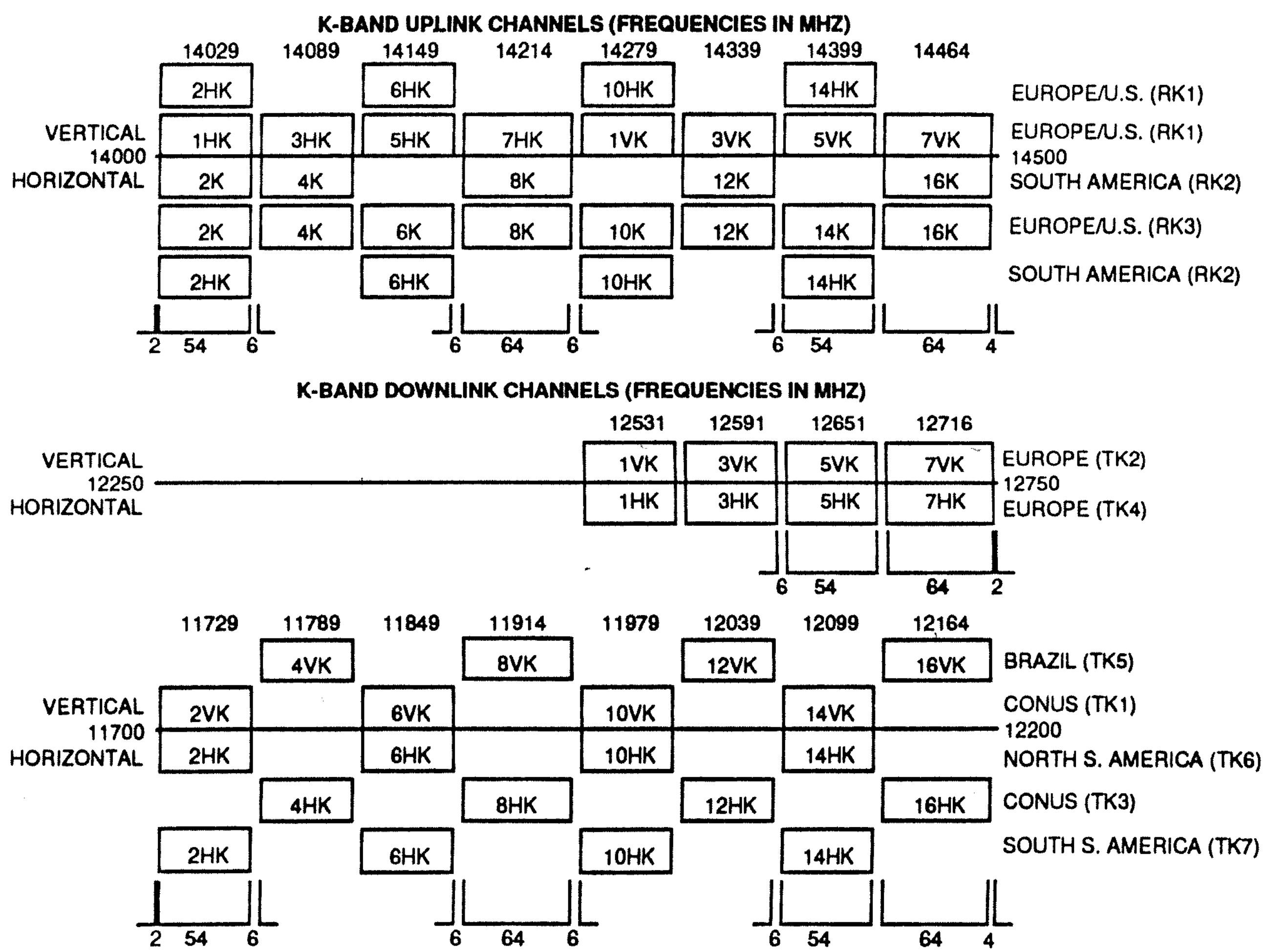
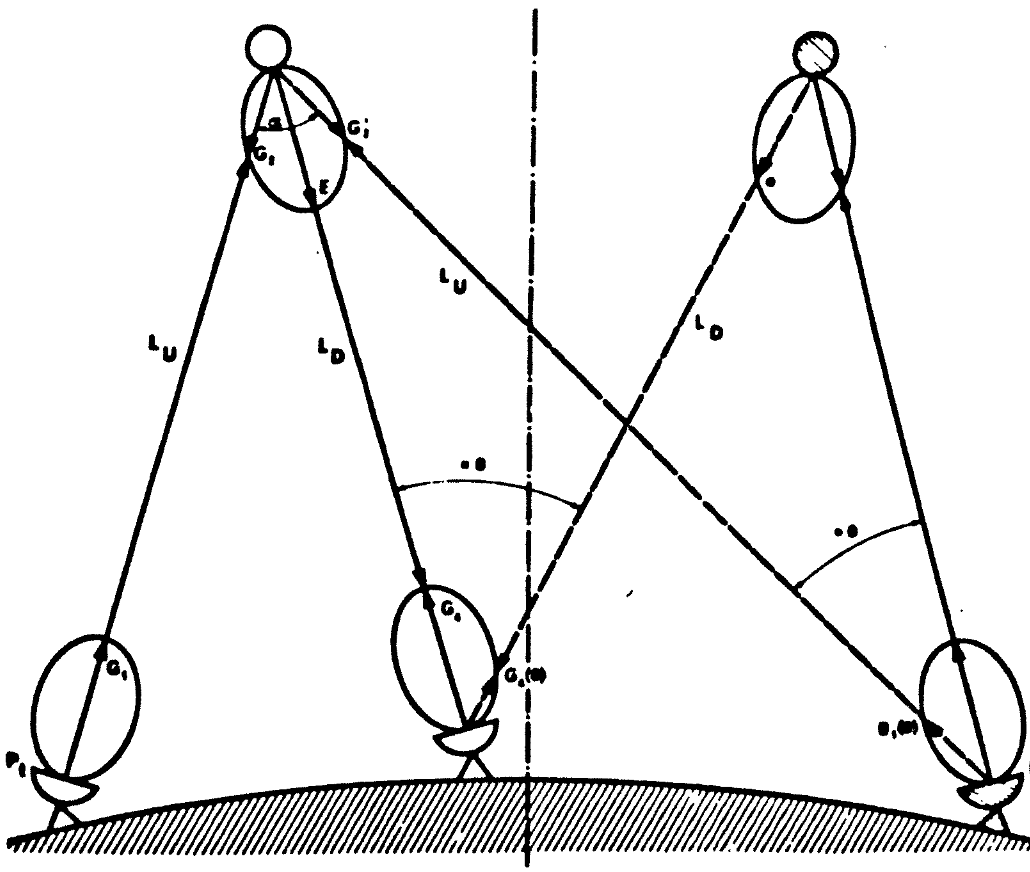


FIGURE 16 - KU-BAND FREQUENCY PLAN

PanAmSat L.P.
Engineering and Operations

PANAMSAT - 2R



Interfered-with network

Interfering network

$G_3 - G'_3 = \Delta G_3(\alpha)$

——— Wanted signal paths

– – – – Interfering signal paths

FIGURE 17 - INTERFERENCE GEOMETRY

PANAMSAT L.P.
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Washington, D.C.

Appendix B

PAS-2R Link Analyses

and

Data Input Information

FULL BANDWIDTH ANALOG TV IN SOUTH AMERICA

Uplink Beam:LATIN,_1V	Dnlink Beam:LATIN,_4H
Tx Es Loc. :BUENOS_AIRES	Rx Es Loc. :BOGOTA
Tx Es Diam :7.0m	Rx Es Diam :3.0m

LINK PERFORMANCE (TV/FM, NTSC, 1 Carrier)

RF_BW=30.0 MHz Video_BW =4.2 MHz
P_DEV=10.75 MHz Weighting=12.8 dB

UP-LINK		
EARTH STATION EIRP	(DBW)	76.7
PATH LOSS (CLEAR SKY)	(DB)	199.4
SATURATION FLUX DENSITY	(DBW/M2)	-85.7
INPUT BACKOFF (TOTAL)	(DB)	0.0
INPUT BACKOFF (PER CARRIER)	(DB)	0.0
SATELLITE G/T	(DB/K)	-3.3
C/N - THERMAL NOISE	(DB)	27.8
C/I - COCHANNEL INTERFERRENCE	(DB)	27.0
C/I - ADJ. SATELLITE INTERFERENCE	(DB)	20.0
C/(N+I) UP-LINK	(DB)	18.7
DOWN-LINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	36.7
OUTPUT BACKOFF (TOTAL)	(DB)	0.0
OUTPUT BACKOFF (PER CARRIER)	(DB)	0.0
SATELLITE EIRP (PER CARRIER)	(DBW)	36.7
PATH LOSS (CLEAR SKY)	(DB)	195.2
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	18.7
C/N THERMAL NOISE	(DB)	13.5
C/I - COCHANNEL INTERFERRENCE	(DB)	27.0
C/I - ADJ. SATELLITE INTERFERENCE	(DB)	20.0
C/(N+I) DOWN-LINK	(DB)	12.5
C/(N+I) TOTAL	(DB)	11.5
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	10.5
VIDEO SIGNAL-TO-NOISE RATIO	(DB)	47.8

E.S. RF POWER (WATTS/CARRIER)= 398.8

DATA INPUP FOR FULL BANDWIDTH ANALOG TV IN SOUTH AMERICA

TRANSMIT EARTH STATION DATA

```
Location           : BUENOS_AIRES
Latitude  (deg N): -34.600
Longitude (deg W): 58.450
Diameter       (m): 7.0
Tx Gain       (dB): 51.0
```

RECEIVE EARTH STATION DATA

```
Location            : BOGOTA
Latitude   (deg N): 4.600
Longitude  (deg W): 74.083
Diameter        (m): 3.0
Rx Gain        (dB): 39.7
Feed Loss      (dB): 0.15
Antenna Temp.(dB): 35
LNA Temp. (deg K): 65
Nom. G/T    (dB/K):
```

```
SATELLITE NAME       : PAS-3
SATELLITE LONGITUDE : 43
TRANSPONDER BW (MHz): 54.0
TRANSPONDER TYPE     : LSSPA_PAS2
```

Up Link

```
Beam: LATIN,_1V
Chan: 2C
Frequency (GHz): 5.955
G/T        (dBK): -3.3
SFD    (dBW/m2): -85.7
```

Down Link

```
Beam: LATIN,_4H
Chan: 2C
Frequency (GHz): 3.730
EIRP       (dBW): 36.7
```

TV CARRIER PARAMETERS

```
RF Bandwidth          (MHz): 30.0
Video Bandwidth       (MHz): 4.2
Peak Deviation        (MHz): 10.75
Weighting+Emphasis     (dB): 12.8
Video Format               : NTSC
```

OPERATING CONDITIONS

```
Transponder Gain Step   (dB): 7
Input Backoff           (dB): 0.0
Number of TV carriers       : 1
Required System Margin (dB): 1.0
Up-Link Co-chan (C/I)   (dB): 27.0
Dn-Link Co-chan (C/I)   (dB): 27.0
Dn-Link Pointing Error (dB): 0.5
Up-Link Adj. Sat (C/I) (dB): 20.0
Dn-Link Adj. Sat (C/I) (dB): 20.0
Up-link Rain Margin     (dB): 0.0
Dn-Link Rain Margin     (dB): 0.0
```

CALCULATED TRANSMIT EARTH STATION PARAMETERS

```
Satellite Azimuth (deg)  :   26.0  Satellite Elevation (deg):   46.5
Gain at Specified Uplink Freq.          (dB):   50.7
Path loss at Specified Uplink Freq.    (dB):  199.4
```

CALCULATED RECEIVE EARTH STATION PARAMETERS

```
Satellite Azimuth (deg)  :   97.6  Satellite Elevation (deg):   53.5
Gain at Specified Downlink Freq.        (dB):   39.2
Path loss at Specified Downlink Freq. (dB):  195.2
G/T  at Specified Downlink Freq.     (dB/K):   18.7
```

HALF BANDWIDTH ANALOG TV IN SOUTH AMERICA

Uplink Beam:LATIN,_1H	Dnlink Beam:LATIN,_1V
Tx Es Loc. :HOMESTEAD,_FL	Rx Es Loc. :LA_PAZ,_BOLIVI
Tx Es Diam :9.0m	Rx Es Diam :3.7m

LINK PERFORMANCE (TV/FM, NTSC, 2 Carriers)

RF_BW=24.0 MHz Video_BW =4.2 MHz
P_DEV=10.75 MHz Weighting=12.8 dB

UP-LINK		
EARTH STATION EIRP	(DBW)	76.2
PATH LOSS (CLEAR SKY)	(DB)	199.6
SATURATION FLUX DENSITY	(DBW/M2)	-83.3
INPUT BACKOFF (TOTAL)	(DB)	0.0
INPUT BACKOFF (PER CARRIER)	(DB)	3.0
SATELLITE G/T	(DB/K)	-5.7
C/N - THERMAL NOISE	(DB)	25.7
C/I - COCHANNEL INTERFERRENCE	(DB)	27.0
C/I - ADJ. SATELLITE INTERFERENCE	(DB)	20.0
C/(N+I) UP-LINK	(DB)	18.3
DOWN-LINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	36.7
OUTPUT BACKOFF (TOTAL)	(DB)	1.6
OUTPUT BACKOFF (PER CARRIER)	(DB)	4.6
SATELLITE EIRP (PER CARRIER)	(DBW)	32.1
PATH LOSS (CLEAR SKY)	(DB)	195.3
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	20.6
C/N THERMAL NOISE	(DB)	11.6
C/I - COCHANNEL INTERFERENCE	(DB)	27.0
C/I - ADJ. SATELLITE INTERFERENCE	(DB)	20.0
C/(N+I) DOWN-LINK	(DB)	10.9
C/(N+I) TOTAL	(DB)	10.2
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	9.2
VIDEO SIGNAL-TO-NOISE RATIO	(DB)	45.5

E.S. RF POWER (WATTS/CARRIER)= 201.2

POSSIBLE LINK BUDGET ERRORS

WARNING - The C/(N+I) may be below threshold.

DATA INPUT FOR HALF BANDWIDTH ANALOG TV IN SOUTH AMERICA

TRANSMIT EARTH STATION DATA

Location	: HOMESTEAD,_FL
Latitude (deg N)	: 25.750
Longitude (deg W)	: 80.250
Diameter (m)	: 9.0
Tx Gain (dB)	: 53.4

RECEIVE EARTH STATION DATA

Location	: LA_PAZ,_BOLIVIA
Latitude (deg N)	: -16.500
Longitude (deg W)	: 68.150
Diameter (m)	: 3.7
Rx Gain (dB)	: 41.2
Feed Loss (dB)	: 0.20
Antenna Temp.(dB)	: 25
LNA Temp. (deg K)	: 65
Nom. G/T (dB/K)	:

SATELLITE NAME	: PAS-3
SATELLITE LONGITUDE	: 43
TRANSPONDER BW (MHz)	: 54.0
TRANSPONDER TYPE	: LSSPA_PAS2

Up Link

Beam: LATIN,_1H
Chan: 3C
Frequency (GHz): 6.015
G/T (dBK): -5.7
SFD (dBW/m2): -83.3

Down Link

Beam: LATIN,_1V
Chan: 3C
Frequency (GHz): 3.790
EIRP (dBW): 36.7

TV CARRIER PARAMETERS

RF Bandwidth	(MHz)	: 24.0
Video Bandwidth	(MHz)	: 4.2
Peak Deviation	(MHz)	: 10.75
Weighting+Emphasis	(dB)	: 12.8
Video Format		: NTSC

OPERATING CONDITIONS

Transponder Gain Step	(dB)	: 7
Input Backoff	(dB)	: 0.0
Number of TV carriers		: 2
Required System Margin	(dB)	: 1.0
Up-Link Co-chan (C/I)	(dB)	: 27.0
Dn-Link Co-chan (C/I)	(dB)	: 27.0
Dn-Link Pointing Error	(dB)	: 0.5
Up-Link Adj. Sat (C/I)	(dB)	: 20.0
Dn-Link Adj. Sat (C/I)	(dB)	: 20.0
Up-link Rain Margin	(dB)	: 0.0
Dn-Link Rain Margin	(dB)	: 0.0

CALCULATED TRANSMIT EARTH STATION PARAMETERS

Satellite Azimuth (deg) : 119.7 Satellite Elevation (deg): 39.1
Gain at Specified Uplink Freq. (dB): 53.2
Path loss at Specified Uplink Freq. (dB): 199.6

CALCULATED RECEIVE EARTH STATION PARAMETERS

Satellite Azimuth (deg) : 58.8 Satellite Elevation (deg): 55.3
Gain at Specified Downlink Freq. (dB): 40.8
Path loss at Specified Downlink Freq. (dB): 195.3
G/T at Specified Downlink Freq. (dB/K): 20.6

COMPRESSED DIGITAL TV SCPC

Satellite : PAS-3	
Uplink Beam:LATIN,_1V	Uplink Chan:6C
Tx Es Loc. :PORTO_ALLEGRE	Tx Es Diam.:7.0m
Dnlink Beam:LATIN,_4H	Dnlink Chan:6C
Rx Es Loc. :BRASILIA	Rx Es Diam.:3.0m

LINK PERFORMANCE (6730 KBPS QPSK R3/4)

UPLINK		
EARTH STATION EIRP	(DBW)	65.2
PATH LOSS (CLEAR SKY)	(DB)	199.5
SATURATION FLUX DENSITY	(DBW/M2)	-85.8
INPUT BACKOFF (TOTAL)	(DB)	3.8
INPUT BACKOFF (PER CARRIER)	(DB)	11.3
SATELLITE G/T	(DB/K)	-3.2
C/N - THERMAL NOISE	(DB)	23.3
C/I - CO-CHANNEL INTERFERENCE	(DB)	27.8
C/I - ADJ SAT INTF (PAS1)	(DB)	21.4
C/I - ADJ SAT INTF (ISVIIA)	(DB)	22.4
C/(N+I) UPLINK	(DB)	17.1
C/I - INTERMODULATION	(DB)	18.7
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	36.7
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	11.0
SATELLITE EIRP (PER CARRIER)	(DBW)	25.7
PATH LOSS (CLEAR SKY)	(DB)	195.3
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	19.0
C/N THERMAL NOISE	(DB)	9.7
C/I - CO-CHANNEL INTERFERENCE	(DB)	27.8
C/I - ADJ SAT INTF (PAS1)	(DB)	19.0
C/I - ADJ SAT INTF (ISVIIA)	(DB)	25.0
C/(N+I) DOWNLINK	(DB)	9.0
C/(N+I) TOTAL	(DB)	8.0
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	7.0

ALLOCATED BW (KHZ/CARRIER)=	8000.00:	OCCUPIED BW (KHZ/CARRIER)=	6000.00
E.S. RF POWER (WATTS/CARRIER)=	26.89:	Uplink Power Density (dBW/Hz)=	-52.84
NUMBER OF CARRIERS PER TRANS.=	5.66:	Dnlink EIRP Density (dBW/Hz)=	-41.30
% TRANS BW (PER CARRIER)=	14.815:	Maximum EIRP Density (dBW/Hz)=	-41.23
% TRANS POWER (PER CARRIER)=	17.658:	Dnlink Flux Den.(dBW/m2/4KHz)=	-167.41

DSAT3Z2 (Version 2.2), 02-16-1995 11:45:39 *** PanAmSat Engineering ***

DATA INPUT FOR COMPRESSED DIGITAL TV SCPC

--- TRANSMIT EARTH STATION DATA -----

Location :	PORTO_ALLEGRE
Latitude (deg N):	-30.067
Longitude (deg W):	51.183
Diameter (m):	7.0
Tx Gain (dB):	51.0
Manufacturer/Model:	STANDARD/

---- RECEIVE EARTH STATION DATA -----

Location :	BRASILIA
Latitude (deg N):	-15.783
Longitude (deg W):	47.917
Diameter (m):	3.0
Rx Gain (dB):	39.7
Feed Loss (dB):	0.15
Ant. Temp.(deg K):	35
LNA Temp.(deg K):	65
Nominal G/T (dB/K):	*
Manufacturer/Model:	STANDARD/

SATELLITE NAME :	PAS-3
SATELLITE LONGITUDE :	43
TRANSPONDER BW (MHZ):	54.0
TRANSPONDER TYPE :	LSSPA_PAS2
CARRIERS/TRANSPONDER:	*

-------------- Uplink ---------------

Beam: LATIN,_1V
Chan: 6C

Uplink Frequency (GHz):	6.075
G/T, Beam Center (dB/K):	0.77
G/T Toward Tx ES (dB/K):	-3.2
SFD Toward Tx ES (dBW/m2):	-85.8

------------- Downlink -------------

Beam: LATIN,_4H
Chan: 6C

Downlink Frequency (GHz):	3.850
EIRP, Beam Center (dBW):	36.77
EIRP Toward Rx ES (dBW):	36.7

----- DIGITAL CARRIER PARAMETERS ----

Information Rate (kBps):	6730
Modulation Type :	QPSK
Code Rate :	R3/4
Overhead\Other Info. :	GI-SCPC
Occupied Bandwidth (kHz):	6000
Allocated Bandwidth (kHz):	8000
C/N (clear sky, dB):	7.0
C/N (rain conditions, dB):	7.0

-------- OPERATING CONDITIONS -------

Trans. Attenuator Setting (dB):	7
Input Backoff (dB):	3.8
Output Backoff (dB):	*
(C/Im) - Nominal (dB):	*
Required System Margin (dB):	1.0
Uplink Co-Chan (C/I) (dB):	27.0
Downlink Co-Chan (C/I) (dB):	27.0
Downlink Pointing Error (dB):	0.5
Min. Uplink Rain Margin (dB):	0.0
Min. Dnlink Rain Margin (dB):	0.0

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------

Satellite Name :	PAS1	ISVIIA
Satellite Longitude :	45.0	40.5
Uplink Power Density or C/I (dBW/Hz):	-46	-43
Uplink Polarization Advantage (dB):	0.0	1.5
Dnlink EIRP Density or C/I (dBW/Hz):	-43.1	-45.1
Dnlink Polarization Advantage (dB):	0.0	1.5

---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------

Satellite Azimuth (deg) : 16.0 Satellite Elevation (deg): 53.8
Gain at Specified Uplink Freq. (dB): 50.9
Path Loss at Specified Uplink Freq. (dB): 199.5

---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------

Satellite Azimuth (deg) : 17.6 Satellite Elevation (deg): 70.6
Gain at Specified Downlink Freq. (dB): 39.5
Path Loss at Specified Downlink Freq. (dB): 195.3
G/T at Specified Downlink Freq. (dB/K): 19.0

DSAT3Z2 (Version 2.1), 02-16-1995 11:45:51 *** PanAmSat Engineering ***

COMPRESSED DIGITAL TV MCPC

Satellite : PAS-3	
Uplink Beam:LATIN,_1V	Uplink Chan:6C
Tx Es Loc. :PORTO_ALLEGRE	Tx Es Diam.:7.0m
Dnlink Beam:LATIN,_4H	Dnlink Chan:6C
Rx Es Loc. :BRASILIA	Rx Es Diam.:3.0m

LINK PERFORMANCE (26920 KBPS QPSK R3/4)

UPLINK		
EARTH STATION EIRP	(DBW)	71.2
PATH LOSS (CLEAR SKY)	(DB)	199.5
SATURATION FLUX DENSITY	(DBW/M2)	-85.8
INPUT BACKOFF (TOTAL)	(DB)	3.8
INPUT BACKOFF (PER CARRIER)	(DB)	5.3
SATELLITE G/T	(DB/K)	-3.2
C/N - THERMAL NOISE	(DB)	23.3
C/I - CO-CHANNEL INTERFERENCE	(DB)	28.5
C/I - ADJ SAT INTF (PAS1)	(DB)	21.4
C/I - ADJ SAT INTF (ISVIIA)	(DB)	22.4
C/(N+I) UPLINK	(DB)	17.2
C/I - INTERMODULATION	(DB)	18.7
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	36.7
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	5.0
SATELLITE EIRP (PER CARRIER)	(DBW)	31.7
PATH LOSS (CLEAR SKY)	(DB)	195.3
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	19.0
C/N THERMAL NOISE	(DB)	9.6
C/I - CO-CHANNEL INTERFERENCE	(DB)	28.5
C/I - ADJ SAT INTF (PAS1)	(DB)	18.9
C/I - ADJ SAT INTF (ISVIIA)	(DB)	25.0
C/(N+I) DOWNLINK	(DB)	9.0
C/(N+I) TOTAL	(DB)	8.0
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	7.0

ALLOCATED BW (KHZ/CARRIER)=	27000.00:	OCCUPIED BW (KHZ/CARRIER)=	24000.00
E.S. RF POWER (WATTS/CARRIER)=	107.21:	Uplink Power Density (dBW/Hz)=	-52.85
NUMBER OF CARRIERS PER TRANS.=	1.42:	Dnlink EIRP Density (dBW/Hz)=	-41.31
% TRANS BW (PER CARRIER)=	50.000:	Maximum EIRP Density (dBW/Hz)=	-41.24
% TRANS POWER (PER CARRIER)=	70.399:	Dnlink Flux Den.(dBW/m2/4KHz)=	-167.42

DSAT3Z2 (Version 2.2), 02-16-1995 11:46:50 *** PanAmSat Engineering ***

DATA INPUT FOR COMPRESSED DIGITAL TV MCPC

```
--- TRANSMIT EARTH STATION DATA -----
Location             : PORTO_ALLEGRE
Latitude   (deg N): -30.067
Longitude  (deg W): 51.183
Diameter        (m): 7.0
Tx Gain        (dB): 51.0
Manufacturer/Model: STANDARD/

---- RECEIVE EARTH STATION DATA -----
Location             : BRASILIA
Latitude   (deg N): -15.783
Longitude  (deg W): 47.917
Diameter        (m): 3.0
Rx Gain        (dB): 39.7
Feed Loss      (dB): 0.15
Ant. Temp.(deg K): 35
LNA  Temp.(deg K): 65
Nominal G/T (dB/K): *
Manufacturer/Model: STANDARD/

SATELLITE NAME        : PAS-3
SATELLITE LONGITUDE : 43
TRANSPONDER BW (MHZ): 54.0
TRANSPONDER TYPE     : LSSPA_PAS2
CARRIERS/TRANSPONDER: *

-------------- Uplink ---------------
Beam: LATIN,_1V
Chan: 6C
Uplink Frequency     (GHz): 6.075
G/T, Beam Center    (dB/K): 0.77
G/T Toward Tx ES    (dB/K): -3.2
SFD Toward Tx ES (dBW/m2): -85.8

------------- Downlink --------------
Beam: LATIN,_4H
Chan: 6C
Downlink Frequency (GHz): 3.850
EIRP, Beam Center  (dBW): 36.77
EIRP Toward Rx ES  (dBW): 36.7

----- DIGITAL CARRIER PARAMETERS ----
Information Rate    (kBps): 26920
Modulation Type           : QPSK
Code Rate                 : R3/4
Overhead\Other Info.      : GI-MCPC
Occupied Bandwidth  (kHz): 24000
Allocated Bandwidth (kHz): 27000
C/N       (clear sky, dB): 7.0
C/N (rain conditions, dB): 7.0

-------- OPERATING CONDITIONS -------
Trans. Attenuator Setting (dB): 7
Input Backoff             (dB): 3.8
Output Backoff            (dB): *
(C/Im) - Nominal          (dB): *
Required System Margin    (dB): 1.0
Uplink   Co-Chan (C/I)    (dB): 27.0
Downlink Co-Chan (C/I)    (dB): 27.0
Downlink Pointing Error   (dB): 0.5
Min. Uplink Rain Margin   (dB): 0.0
Min. Dnlink Rain Margin   (dB): 0.0

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------
Satellite Name                          : PAS1        ISVIIA
Satellite Longitude                     : 45.0        40.5
Uplink Power Density or C/I (dBW/Hz): -46          -43
Uplink Polarization Advantage    (dB): 0.0         1.5
Dnlink EIRP Density or C/I  (dBW/Hz): -43.1        -45.1
Dnlink Polarization Advantage    (dB): 0.0         1.5
---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------
Satellite Azimuth (deg)  :   16.0  Satellite Elevation (deg):  53.8
Gain at Specified Uplink Freq.         (dB):   50.9
Path Loss at Specified Uplink Freq.   (dB):  199.5
---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------
Satellite Azimuth (deg)  :   17.6  Satellite Elevation (deg):  70.6
Gain at Specified Downlink Freq.       (dB):   39.5
Path Loss at Specified Downlink Freq. (dB):  195.3
G/T  at Specified Downlink Freq.     (dB/K):   19.0

DSAT3Z2 (Version 2.1), 02-16-1995  11:47:02 *** PanAmSat Engineering ***
```

DTH SERVICE - MCPC DIGITAL TV

Satellite : PAS-3		
Uplink Beam:SOUTH_AMERICA,_6H	Uplink Chan:5K	
Tx Es Loc. :LA_PAZ,_BOLIVIA	Tx Es Diam.:7.0m	
Dnlink Beam:N.SO.AMER,_5H	Dnlink Chan:5K	
Rx Es Loc. :BOGOTA	Rx Es Diam.:.60m	

LINK PERFORMANCE (43000 KBPS QPSK R7/8)

UPLINK		
EARTH STATION EIRP	(DBW)	78.1
PATH LOSS (CLEAR SKY)	(DB)	206.8
SATURATION FLUX DENSITY	(DBW/M2)	-79.2
INPUT BACKOFF (TOTAL)	(DB)	8.2
INPUT BACKOFF (PER CARRIER)	(DB)	4.9
SATELLITE G/T	(DB/K)	1.2
C/N - THERMAL NOISE	(DB)	25.6
C/I - CO-CHANNEL INTERFERENCE	(DB)	32.0
C/I - ADJ SAT INTF (PAS1)	(DB)	49.3
C/I - ADJ SAT INTF (ISVIIA)	(DB)	28.8
C/(N+I) UPLINK	(DB)	23.3
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	50.5
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	0.3
SATELLITE EIRP (PER CARRIER)	(DBW)	50.2
PATH LOSS (CLEAR SKY)	(DB)	205.3
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	12.4
C/N THERMAL NOISE	(DB)	9.9
C/I - CO-CHANNEL INTERFERENCE	(DB)	32.0
C/I - ADJ SAT INTF (ISVIIA)	(DB)	23.0
C/(N+I) DOWNLINK	(DB)	9.7
C/(N+I) TOTAL	(DB)	9.5
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	8.5

```
ALLOCATED BW     (KHZ/CARRIER)=36000.00: OCCUPIED BW      (KHZ/CARRIER)=36000.00
E.S. RF POWER (WATTS/CARRIER)=     98.30: Uplink Power Density (dBW/Hz)=   -47.64
NUMBER OF CARRIERS PER TRANS.=      0.47: Dnlink EIRP Density  (dBW/Hz)=   -24.53
% TRANS BW        (PER CARRIER)=  66.667: Maximum EIRP Density (dBW/Hz)=   -23.31
% TRANS POWER     (PER CARRIER)= 211.920: Dnlink Flux Den.(dBW/m2/4KHz)= -150.82
DSAT3Z2 (Version 2.2), 02-16-1995   11:49:22 *** PanAmSat Engineering ***
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DATA INHPUT FOR DTH MCPC DIGITAL TV

--- TRANSMIT EARTH STATION DATA -----

Location	: LA_PAZ,_BOLIVIA
Latitude (deg N)	: -16.500
Longitude (deg W)	: 68.150
Diameter (m)	: 7.0
Tx Gain (dB)	: 51.0
Manufacturer/Model	: STANDARD/

---- RECEIVE EARTH STATION DATA -----

Location	: BOGOTA
Latitude (deg N)	: 4.600
Longitude (deg W)	: 74.083
Diameter (m)	: .60
Rx Gain (dB)	: 35.0
Feed Loss (dB)	: 0.25
Ant. Temp.(deg K)	: 45
LNA Temp.(deg K)	: 110
Nominal G/T (dB/K)	: *
Manufacturer/Model	: STANDARD/

SATELLITE NAME	: PAS-3
SATELLITE LONGITUDE	: 43
TRANSPONDER BW (MHZ)	: 54.0
TRANSPONDER TYPE	: LTWTA_PAS2
CARRIERS/TRANSPONDER	: *

-------------- Uplink --------------

Beam: SOUTH_AMERICA,_6H	
Chan: 5K	
Uplink Frequency (GHz)	: 14.149
G/T, Beam Center (dB/K)	: 2.45
G/T Toward Tx ES (dB/K)	: 1.2
SFD Toward Tx ES (dBW/m2)	: -79.2

------------- Downlink -------------

Beam: N.SO.AMER,_5H	
Chan: 5K	
Downlink Frequency (GHz)	: 11.849
EIRP, Beam Center (dBW)	: 51.72
EIRP Toward Rx ES (dBW)	: 50.5

----- DIGITAL CARRIER PARAMETERS ----

Information Rate (kBps)	: 43000
Modulation Type	: QPSK
Code Rate	: R7/8
Overhead\Other Info.	: SA-MCPC
Occupied Bandwidth (kHz)	: 36000
Allocated Bandwidth (kHz)	: 36000
C/N (clear sky, dB)	: 8.5
C/N (rain conditions, dB)	: 8.5

-------- OPERATING CONDITIONS -------

Trans. Attenuator Setting	(dB)	: 11
Input Backoff	(dB)	: 8.2
Output Backoff	(dB)	: *
(C/Im) - Nominal	(dB)	: *
Required System Margin	(dB)	: 1.0
Uplink Co-Chan (C/I)	(dB)	: 27.0
Downlink Co-Chan (C/I)	(dB)	: 27.0
Downlink Pointing Error	(dB)	: 0.5
Min. Uplink Rain Margin	(dB)	: 0.0
Min. Dnlink Rain Margin	(dB)	: 0.0

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------

Satellite Name	: PAS1	ISVIIA
Satellite Longitude	: 45.0	40.5
Uplink Power Density or C/I (dBW/Hz)	: -46	-43
Uplink Polarization Advantage (dB)	: 20.0	0.0
Dnlink EIRP Density or C/I (dBW/Hz)	: -43.1	-32.4
Dnlink Polarization Advantage (dB)	: 90.0	0.0

---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------

Satellite Azimuth (deg) : 58.8 Satellite Elevation (deg): 55.3

Gain at Specified Uplink Freq. (dB): 58.2

Path Loss at Specified Uplink Freq. (dB): 206.8

---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------

Satellite Azimuth (deg) : 97.6 Satellite Elevation (deg): 53.5

Gain at Specified Downlink Freq. (dB): 34.9

Path Loss at Specified Downlink Freq. (dB): 205.3

G/T at Specified Downlink Freq. (dB/K): 12.4

DSAT3Z2 (Version 2.1), 02-16-1995 11:49:44 *** PanAmSat Engineering ***

64KBPS DATA CARRIERS IN SOUTH AMERICA

Satellite : PAS-3
Uplink Beam:LATIN,_1H   Uplink Chan:11C
Tx Es Loc. :ASUNCION,_PAR   Tx Es Diam.:4.6m
Dnlink Beam:LATIN,_1V   Dnlink Chan:11C
Rx Es Loc. :BUENOS_AIRES   Rx Es Diam.:3.7m

LINK PERFORMANCE (64 KBPS QPSK R1/2)

UPLINK		
EARTH STATION EIRP	(DBW)	40.3
PATH LOSS (CLEAR SKY)	(DB)	199.7
SATURATION FLUX DENSITY	(DBW/M2)	-89.5
INPUT BACKOFF (TOTAL)	(DB)	3.8
INPUT BACKOFF (PER CARRIER)	(DB)	32.5
SATELLITE G/T	(DB/K)	0.5
C/N - THERMAL NOISE	(DB)	20.6
C/I - CO-CHANNEL INTERFERENCE	(DB)	25.7
C/I - ADJ SAT INTF (PAS1)	(DB)	19.0
C/I - ADJ SAT INTF (ISVIIA)	(DB)	20.0
C/(N+I) UPLINK	(DB)	14.7
C/I - INTERMODULATION	(DB)	16.2
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	37.5
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	32.2
SATELLITE EIRP (PER CARRIER)	(DBW)	5.3
PATH LOSS (CLEAR SKY)	(DB)	196.0
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	21.1
C/N THERMAL NOISE	(DB)	9.4
C/I - CO-CHANNEL INTERFERENCE	(DB)	25.7
C/I - ADJ SAT INTF (PAS1)	(DB)	19.2
C/I - ADJ SAT INTF (ISVIIA)	(DB)	25.2
C/(N+I) DOWNLINK	(DB)	8.8
C/(N+I) TOTAL	(DB)	7.2
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	6.2

ALLOCATED BW (KHZ/CARRIER)= 100.00: OCCUPIED BW (KHZ/CARRIER)= 82.00
E.S. RF POWER (WATTS/CARRIER)= 0.21: Uplink Power Density (dBW/Hz)= -54.96
NUMBER OF CARRIERS PER TRANS.= 540.00: Dnlink EIRP Density (dBW/Hz)= -43.00
% TRANS BW (PER CARRIER)= 0.185: Maximum EIRP Density (dBW/Hz)= -42.67
% TRANS POWER (PER CARRIER)= 0.136: Dnlink Flux Den.(dBW/m2/4KHz)= -169.39
DSAT3Z2 (Version 2.2), 02-16-1995 11:51:01 *** PanAmSat Engineering ***

DATA INPUT FOR 64KBPS DATA CARRIERS IN SOUTH AMERICA

--- TRANSMIT EARTH STATION DATA -----

Location : ASUNCION,_PAR
Latitude (deg N): -25.267
Longitude (deg W): 57.667
Diameter (m): 4.6
Tx Gain (dB): 46.9
Manufacturer/Model: STANDARD/

---- RECEIVE EARTH STATION DATA -----

Location : BUENOS_AIRES
Latitude (deg N): -34.600
Longitude (deg W): 58.450
Diameter (m): 3.7
Rx Gain (dB): 41.2
Feed Loss (dB): 0.20
Ant. Temp.(deg K): 25
LNA Temp.(deg K): 65
Nominal G/T (dB/K): *
Manufacturer/Model: STANDARD/

SATELLITE NAME : PAS-3
SATELLITE LONGITUDE : 43
TRANSPONDER BW (MHZ): 54.0
TRANSPONDER TYPE : LSSPA_PAS2
CARRIERS/TRANSPONDER: *

-------------- Uplink --------------

Beam: LATIN,_1H
Chan: 11C
Uplink Frequency (GHz): 6.265
G/T, Beam Center (dB/K): 0.65
G/T Toward Tx ES (dB/K): 0.5
SFD Toward Tx ES (dBW/m2): -89.5

------------- Downlink -------------

Beam: LATIN,_1V
Chan: 11C
Downlink Frequency (GHz): 4.040
EIRP, Beam Center (dBW): 37.83
EIRP Toward Rx ES (dBW): 37.5

----- DIGITAL CARRIER PARAMETERS ----

Information Rate (kBps): 64
Modulation Type : QPSK
Code Rate : R1/2
Overhead\Other Info. : PAS
Occupied Bandwidth (kHz): 82.0
Allocated Bandwidth (kHz): 100.0
C/N (clear sky, dB): 6.2
C/N (rain conditions, dB): 5.3

-------- OPERATING CONDITIONS -------

Trans. Attenuator Setting (dB): 7
Input Backoff (dB): 3.8
Output Backoff (dB): *
(C/Im) - Nominal (dB): *
Required System Margin (dB): 1.0
Uplink Co-Chan (C/I) (dB): 27.0
Downlink Co-Chan (C/I) (dB): 27.0
Downlink Pointing Error (dB): 0.5
Min. Uplink Rain Margin (dB): 0.0
Min. Dnlink Rain Margin (dB): 0.0

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------

Satellite Name	PAS1	ISVIIA
Satellite Longitude	45.0	40.5
Uplink Power Density or C/I (dBW/Hz)	-46	-43
Uplink Polarization Advantage (dB)	0.0	1.5
Dnlink EIRP Density or C/I (dBW/Hz)	-43.1	-45.1
Dnlink Polarization Advantage (dB)	0.0	1.5

---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------

Satellite Azimuth (deg) : 31.5 Satellite Elevation (deg): 56.2
Gain at Specified Uplink Freq. (dB): 47.0
Path Loss at Specified Uplink Freq. (dB): 199.7

---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------

Satellite Azimuth (deg) : 26.0 Satellite Elevation (deg): 46.5
Gain at Specified Downlink Freq. (dB): 41.4
Path Loss at Specified Downlink Freq. (dB): 196.0
G/T at Specified Downlink Freq. (dB/K): 21.1

DSAT3Z2 (Version 2.1), 02-16-1995 11:51:16 *** PanAmSat Engineering ***

T1 DATA CARRIERS IN SOUTH AMERICA

Satellite : PAS-3	
Uplink Beam:LATIN,_1H	Uplink Chan:11C
Tx Es Loc. :CORDOBA,_ARG	Tx Es Diam.:4.6m
Dnlink Beam:LATIN,_1V	Dnlink Chan:11C
Rx Es Loc. :BRASILIA	Rx Es Diam.:3.7m

LINK PERFORMANCE (1544 KBPS QPSK R1/2)

UPLINK		
EARTH STATION EIRP	(DBW)	55.1
PATH LOSS (CLEAR SKY)	(DB)	199.8
SATURATION FLUX DENSITY	(DBW/M2)	-89.2
INPUT BACKOFF (TOTAL)	(DB)	3.8
INPUT BACKOFF (PER CARRIER)	(DB)	18.1
SATELLITE G/T	(DB/K)	0.2
C/N - THERMAL NOISE	(DB)	21.2
C/I - CO-CHANNEL INTERFERENCE	(DB)	26.6
C/I - ADJ SAT INTF (PAS1)	(DB)	19.7
C/I - ADJ SAT INTF (ISVIIA)	(DB)	20.7
C/(N+I) UPLINK	(DB)	15.4
C/I - INTERMODULATION	(DB)	16.8
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	37.2
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	17.7
SATELLITE EIRP (PER CARRIER)	(DBW)	19.5
PATH LOSS (CLEAR SKY)	(DB)	195.7
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	21.1
C/N THERMAL NOISE	(DB)	10.0
C/I - CO-CHANNEL INTERFERENCE	(DB)	26.6
C/I - ADJ SAT INTF (PAS1)	(DB)	19.5
C/I - ADJ SAT INTF (ISVIIA)	(DB)	25.5
C/(N+I) DOWNLINK	(DB)	9.3
C/(N+I) TOTAL	(DB)	7.8
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	6.8

ALLOCATED BW (KHZ/CARRIER)=	2200.00:	OCCUPIED BW (KHZ/CARRIER)=	1970.00
E.S. RF POWER (WATTS/CARRIER)=	6.46:	Uplink Power Density (dBW/Hz)=	-53.92
NUMBER OF CARRIERS PER TRANS.=	24.55:	Dnlink EIRP Density (dBW/Hz)=	-42.69
% TRANS BW (PER CARRIER)=	4.074:	Maximum EIRP Density (dBW/Hz)=	-42.06
% TRANS POWER (PER CARRIER)=	3.752:	Dnlink Flux Den.(dBW/m2/4KHz)=	-168.80

DSAT3Z2 (Version 2.2), 02-16-1995 11:52:27 *** PanAmSat Engineering ***

DATA INPUT FOR T1 DATA CARRIERS IN SOUTH AMERICA

--- TRANSMIT EARTH STATION DATA -----

Location	: CORDOBA,_ARG
Latitude (deg N)	: -31.400
Longitude (deg W)	: 64.183
Diameter (m)	: 4.6
Tx Gain (dB)	: 46.9
Manufacturer/Model	: STANDARD/

---- RECEIVE EARTH STATION DATA -----

Location	: BRASILIA
Latitude (deg N)	: -15.783
Longitude (deg W)	: 47.917
Diameter (m)	: 3.7
Rx Gain (dB)	: 41.2
Feed Loss (dB)	: 0.20
Ant. Temp.(deg K)	: 25
LNA Temp.(deg K)	: 65
Nominal G/T (dB/K)	: *
Manufacturer/Model	: STANDARD/

SATELLITE NAME	: PAS-3
SATELLITE LONGITUDE	: 43
TRANSPONDER BW (MHZ)	: 54.0
TRANSPONDER TYPE	: LSSPA_PAS2
CARRIERS/TRANSPONDER	: *

-------------- Uplink ---------------

Beam: LATIN,_1H
Chan: 11C

Uplink Frequency (GHz)	: 6.265
G/T, Beam Center (dB/K)	: 0.65
G/T Toward Tx ES (dB/K)	: 0.2
SFD Toward Tx ES (dBW/m2)	: -89.2

------------- Downlink --------------

Beam: LATIN,_1V
Chan: 11C

Downlink Frequency (GHz)	: 4.040
EIRP, Beam Center (dBW)	: 37.83
EIRP Toward Rx ES (dBW)	: 37.2

----- DIGITAL CARRIER PARAMETERS ----

Information Rate (kBps)	: 1544
Modulation Type	: QPSK
Code Rate	: R1/2
Overhead\Other Info.	: PAS
Occupied Bandwidth (kHz)	: 1970.0
Allocated Bandwidth (kHz)	: 2200.0
C/N (clear sky, dB)	: 6.8
C/N (rain conditions, dB)	: 5.7

-------- OPERATING CONDITIONS -------

Trans. Attenuator Setting (dB)	: 7
Input Backoff (dB)	: 3.8
Output Backoff (dB)	: *
(C/Im) - Nominal (dB)	: *
Required System Margin (dB)	: 1.0
Uplink Co-Chan (C/I) (dB)	: 27.0
Downlink Co-Chan (C/I) (dB)	: 27.0
Downlink Pointing Error (dB)	: 0.5
Min. Uplink Rain Margin (dB)	: 0.0
Min. Dnlink Rain Margin (dB)	: 0.0

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------

Satellite Name	: PAS1	ISVIIA
Satellite Longitude	: 45.0	40.5
Uplink Power Density or C/I (dBW/Hz)	: -46	-43
Uplink Polarization Advantage (dB)	: 0.0	1.5
Dnlink EIRP Density or C/I (dBW/Hz)	: -43.1	-45.1
Dnlink Polarization Advantage (dB)	: 0.0	1.5

---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------

Satellite Azimuth (deg) : 36.6 Satellite Elevation (deg): 46.8
Gain at Specified Uplink Freq. (dB): 47.0
Path Loss at Specified Uplink Freq. (dB): 199.8

---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------

Satellite Azimuth (deg) : 17.6 Satellite Elevation (deg): 70.6
Gain at Specified Downlink Freq. (dB): 41.4
Path Loss at Specified Downlink Freq. (dB): 195.7
G/T at Specified Downlink Freq. (dB/K): 21.1

DSAT3Z2 (Version 2.1), 02-16-1995 11:52:45 *** PanAmSat Engineering ***

7KHZ AUDIO SCPC CARRIERS IN SOUTH AMERICA

Satellite : PAS-3	
Uplink Beam:LATIN,_1H	Uplink Chan:11C
Tx Es Loc. :CORDOBA,_ARG	Tx Es Diam.:4.6m
Dnlink Beam:LATIN,_1V	Dnlink Chan:11C
Rx Es Loc. :BRASILIA	Rx Es Diam.:3.7m

LINK PERFORMANCE (7.0kHz KBPS SCPC Audio)

UPLINK		
EARTH STATION EIRP	(DBW)	58.4
PATH LOSS (CLEAR SKY)	(DB)	199.8
SATURATION FLUX DENSITY	(DBW/M2)	-89.2
INPUT BACKOFF (TOTAL)	(DB)	3.8
INPUT BACKOFF (PER CARRIER)	(DB)	14.8
SATELLITE G/T	(DB/K)	0.2
C/N - THERMAL NOISE	(DB)	37.4
C/I - CO-CHANNEL INTERFERENCE	(DB)	41.6
C/I - ADJ SAT INTF (PAS1)	(DB)	35.9
C/I - ADJ SAT INTF (ISVIIA)	(DB)	37.0
C/(N+I) UPLINK	(DB)	31.5
C/I - INTERMODULATION	(DB)	33.1
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	37.2
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	14.4
SATELLITE EIRP (PER CARRIER)	(DBW)	22.8
PATH LOSS (CLEAR SKY)	(DB)	195.7
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	21.1
C/N THERMAL NOISE	(DB)	26.2
C/I - CO-CHANNEL INTERFERENCE	(DB)	41.6
C/I - ADJ SAT INTF (PAS1)	(DB)	35.7
C/I - ADJ SAT INTF (ISVIIA)	(DB)	41.8
C/(N+I) DOWNLINK	(DB)	25.6
C/(N+I) TOTAL	(DB)	24.0
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	23.0

ALLOCATED BW (KHZ/CARRIER)=	150.00:	OCCUPIED BW (KHZ/CARRIER)=	100.00
E.S. RF POWER (WATTS/CARRIER)=	13.80:	Uplink Power Density (dBW/Hz)=	-37.68
NUMBER OF CARRIERS PER TRANS.=	12.48:	Dnlink EIRP Density (dBW/Hz)=	-26.45
% TRANS BW (PER CARRIER)=	0.278:	Maximum EIRP Density (dBW/Hz)=	-25.82
% TRANS POWER (PER CARRIER)=	8.011:	Dnlink Flux Den.(dBW/m2/4KHz)=	-152.56

DSAT3Z2 (Version 2.2), 02-16-1995 11:53:47 *** PanAmSat Engineering ***

DATA INPUT FOR 7KHZ AUDIO SCPC CARRIERS IN SOUTH AMERICA

--- TRANSMIT EARTH STATION DATA -----

Location	: CORDOBA,_ARG
Latitude (deg N)	: -31.400
Longitude (deg W)	: 64.183
Diameter (m)	: 4.6
Tx Gain (dB)	: 46.9
Manufacturer/Model	: STANDARD/

---- RECEIVE EARTH STATION DATA -----

Location	: BRASILIA
Latitude (deg N)	: -15.783
Longitude (deg W)	: 47.917
Diameter (m)	: 3.7
Rx Gain (dB)	: 41.2
Feed Loss (dB)	: 0.20
Ant. Temp.(deg K)	: 25
LNA Temp.(deg K)	: 65
Nominal G/T (dB/K)	: *
Manufacturer/Model	: STANDARD/

SATELLITE NAME	: PAS-3
SATELLITE LONGITUDE	: 43
TRANSPONDER BW (MHZ)	: 54.0
TRANSPONDER TYPE	: LSSPA_PAS2
CARRIERS/TRANSPONDER	: *

-------------- Uplink ---------------

Beam: LATIN,_1H
Chan: 11C

Uplink Frequency (GHz)	: 6.265
G/T, Beam Center (dB/K)	: 0.65
G/T Toward Tx ES (dB/K)	: 0.2
SFD Toward Tx ES (dBW/m2)	: -89.2

------------- Downlink --------------

Beam: LATIN,_1V
Chan: 11C

Downlink Frequency (GHz)	: 4.040
EIRP, Beam Center (dBW)	: 37.83
EIRP Toward Rx ES (dBW)	: 37.2

----- DIGITAL CARRIER PARAMETERS ----

Information Rate (kBps)	: 7.0kHz
Modulation Type	: SCPC
Code Rate	: Audio
Overhead\Other Info.	: N/A
Occupied Bandwidth (kHz)	: 100
Allocated Bandwidth (kHz)	: 150.0
C/N (clear sky, dB)	: 23.0
C/N (rain conditions, dB)	: 10.5

-------- OPERATING CONDITIONS -------

Trans. Attenuator Setting (dB)	: 7
Input Backoff (dB)	: 3.8
Output Backoff (dB)	: *
(C/Im) - Nominal (dB)	: *
Required System Margin (dB)	: 1.0
Uplink Co-Chan (C/I) (dB)	: 27.0
Downlink Co-Chan (C/I) (dB)	: 27.0
Downlink Pointing Error (dB)	: 0.5
Min. Uplink Rain Margin (dB)	: 0.0
Min. Dnlink Rain Margin (dB)	: 0.0

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------

Satellite Name	: PAS1	ISVIIA
Satellite Longitude	: 45.0	40.5
Uplink Power Density or C/I (dBW/Hz)	: -46	-43
Uplink Polarization Advantage (dB)	: 0.0	1.5
Dnlink EIRP Density or C/I (dBW/Hz)	: -43.1	-45.1
Dnlink Polarization Advantage (dB)	: 0.0	1.5

---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------

Satellite Azimuth (deg) : 36.6 Satellite Elevation (deg): 46.8
Gain at Specified Uplink Freq. (dB): 47.0
Path Loss at Specified Uplink Freq. (dB): 199.8

---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------

Satellite Azimuth (deg) : 17.6 Satellite Elevation (deg): 70.6
Gain at Specified Downlink Freq. (dB): 41.4
Path Loss at Specified Downlink Freq. (dB): 195.7
G/T at Specified Downlink Freq. (dB/K): 21.1

DSAT3Z2 (Version 2.1), 02-16-1995 11:54:08 *** PanAmSat Engineering ***

AUDIO SEDAT CARRIER IN SOUTH AMERICA

Satellite : PAS-3	
Uplink Beam:LATIN,_1H	Uplink Chan:11C
Tx Es Loc. :CORDOBA,_ARG	Tx Es Diam.:4.6m
Dnlink Beam:LATIN,_1V	Dnlink Chan:11C
Rx Es Loc. :BRASILIA	Rx Es Diam.:3.7m

LINK PERFORMANCE (2048 KBPS QPSK R1/2)

UPLINK		
EARTH STATION EIRP	(DBW)	55.8
PATH LOSS (CLEAR SKY)	(DB)	199.8
SATURATION FLUX DENSITY	(DBW/M2)	-89.2
INPUT BACKOFF (TOTAL)	(DB)	3.8
INPUT BACKOFF (PER CARRIER)	(DB)	17.4
SATELLITE G/T	(DB/K)	0.2
C/N - THERMAL NOISE	(DB)	20.7
C/I - CO-CHANNEL INTERFERENCE	(DB)	26.0
C/I - ADJ SAT INTF (PAS1)	(DB)	19.2
C/I - ADJ SAT INTF (ISVIIA)	(DB)	20.2
C/(N+I) UPLINK	(DB)	14.9
C/I - INTERMODULATION	(DB)	16.3
DOWNLINK	(DB)	
SATELLITE EIRP (TOTAL)	(DBW)	37.2
OUTPUT BACKOFF (TOTAL)	(DB)	3.5
OUTPUT BACKOFF (PER CARRIER)	(DB)	17.1
SATELLITE EIRP (PER CARRIER)	(DBW)	20.1
PATH LOSS (CLEAR SKY)	(DB)	195.7
EARTH STATION POINTING ERROR	(DB)	0.5
EARTH STATION G/T (CLEAR-SKY)	(DB/K)	21.1
C/N THERMAL NOISE	(DB)	9.5
C/I - CO-CHANNEL INTERFERENCE	(DB)	26.0
C/I - ADJ SAT INTF (PAS1)	(DB)	19.0
C/I - ADJ SAT INTF (ISVIIA)	(DB)	25.0
C/(N+I) DOWNLINK	(DB)	8.8
C/(N+I) TOTAL	(DB)	7.3
REQUIRED SYSTEM MARGIN	(DB)	1.0
NET C/(N+I)	(DB)	6.3

ALLOCATED BW (KHZ/CARRIER)=	3000.00:	OCCUPIED BW (KHZ/CARRIER)=	2573.00
E.S. RF POWER (WATTS/CARRIER)=	7.53:	Uplink Power Density (dBW/Hz)=	-54.42
NUMBER OF CARRIERS PER TRANS.=	18.00:	Dnlink EIRP Density (dBW/Hz)=	-43.19
% TRANS BW (PER CARRIER)=	5.556:	Maximum EIRP Density (dBW/Hz)=	-42.56
% TRANS POWER (PER CARRIER)=	4.373:	Dnlink Flux Den.(dBW/m2/4KHz)=	-169.29

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DATA INPUT FOR AUDIO SEDAT CARRIER IN SOUTH AMERICA

--- TRANSMIT EARTH STATION DATA -----

```
Location              : CORDOBA,_ARG
Latitude   (deg N): -31.400
Longitude  (deg W): 64.183
Diameter        (m): 4.6
Tx Gain        (dB): 46.9
Manufacturer/Model: STANDARD/
```

---- RECEIVE EARTH STATION DATA -----

```
Location              : BRASILIA
Latitude    (deg N): -15.783
Longitude   (deg W): 47.917
Diameter         (m): 3.7
Rx Gain         (dB): 41.2
Feed Loss       (dB): 0.20
Ant.  Temp.(deg K): 25
LNA   Temp.(deg K): 65
Nominal G/T (dB/K): *
Manufacturer/Model: STANDARD/
```

```
SATELLITE NAME        : PAS-3
SATELLITE LONGITUDE : 43
TRANSPONDER BW (MHZ): 54.0
TRANSPONDER TYPE     : LSSPA_PAS2
CARRIERS/TRANSPONDER: *
```

-------------- Uplink ---------------

```
Beam: LATIN,_1H
Chan: 11C
Uplink Frequency     (GHz): 6.265
G/T, Beam Center    (dB/K): 0.65
G/T Toward Tx ES    (dB/K): 0.2
SFD Toward Tx ES (dBW/m2): -89.2
```

------------- Downlink -------------

```
Beam: LATIN,_1V
Chan: 11C
Downlink Frequency (GHz): 4.040
EIRP, Beam Center   (dBW): 37.83
EIRP Toward Rx ES   (dBW): 37.2
```

----- DIGITAL CARRIER PARAMETERS ----

```
Information Rate    (kBps): 2048
Modulation Type            : QPSK
Code Rate                  : R1/2
Overhead\Other Info.       : SEDAT
Occupied Bandwidth  (kHz): 2573
Allocated Bandwidth (kHz): 3000.0
C/N         (clear sky, dB): 6.3
C/N (rain conditions, dB): 5.7
```

-------- OPERATING CONDITIONS -------

```
Trans. Attenuator Setting (dB): 7
Input Backoff              (dB): 3.8
Output Backoff             (dB): *
(C/Im) - Nominal           (dB): *
Required System Margin     (dB): 1.0
Uplink    Co-Chan (C/I)    (dB): 27.0
Downlink Co-Chan (C/I)     (dB): 27.0
Downlink Pointing Error    (dB): 0.5
Min. Uplink Rain Margin    (dB): 0.0
Min. Dnlink Rain Margin    (dB): 0.0
```

---------- ADJACENT SATELLITE INTERFERENCE ASSUMPTIONS ----------

Satellite Name	: PAS1	ISVIIA
Satellite Longitude	: 45.0	40.5
Uplink Power Density or C/I (dBW/Hz)	: -46	-43
Uplink Polarization Advantage (dB)	: 0.0	1.5
Dnlink EIRP Density or C/I (dBW/Hz)	: -43.1	-45.1
Dnlink Polarization Advantage (dB)	: 0.0	1.5

---------- CALCULATED TRANSMIT EARTH STATION PARAMETERS ---------

```
Satellite Azimuth (deg)  :   36.6   Satellite Elevation (deg):  46.8
Gain at Specified Uplink Freq.        (dB):   47.0
Path Loss at Specified Uplink Freq.   (dB):  199.8
```

---------- CALCULATED RECEIVE EARTH STATION PARAMETERS ----------

```
Satellite Azimuth (deg)  :   17.6   Satellite Elevation (deg):  70.6
Gain at Specified Downlink Freq.       (dB):   41.4
Path Loss at Specified Downlink Freq. (dB):  195.7
G/T  at Specified Downlink Freq.     (dB/K):   21.1
```

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