Table B-3. Parameter List for Ku-band (Bogota - CONUS) Interference Analysis

LINK PARAMETER	UP LINK		DOWN LINK		UNITS
	Other GSO	Own GSO	Other GSO	Own GSO	
Orbital Separation	2		2		deg.
Signal frequency	13	13	11	11	GHz
Tx Power (Earth/Satellite)	50	200	35	25	W
Amplifier Backoff	0	0	0	0	dB
Tx Losses	0.3	0.3	0.5	0.5	dB
Number of Carriers	1	1	1	1	
Slant Range	36000	36000	36000	36000	km
Earth-Station Tx Antenna Size	5	2.5			m
Earth-Station Rx Antenna Size			2.5	2.5	m
Earth-Station Tx Ant. Peak Gain	54.8	48.8			dBi
Earth-Station Rx Ant. Peak Gain			47.5	47.5	dBi
Satellite Tx Ant. Peak Gain			37	37	dBi
Satellite Rx Ant. Peak Gain	37	30.2			dBi
Signal Bandwidth	30	138	30	138	MHz
Rx Noise Temperature	1500	365	200	73	°K

Table B-4. Parameter List for Ku-band (CONUS - Bogota) Interference Analysis

LINK PARAMETER	UP LINK		DOWN LINK		UNITS
	Other GSO	Own GSO	Other GSO	Own GSO	
Orbital Separation	2		2		deg.
Signal frequency	13	13	11	11	GHz
Tx Power (Earth/Satellite)	50	100	35	100	W
Amplifier Backoff	0	0	0	0	dB
Tx Losses	0.3	0.3	0.5	0.5	dB
Number of Carriers	1	1	1	1	
Slant Range	36000	36000	36000	36000	km
Earth-Station Tx Antenna Size	5	2.5			m
Earth-Station Rx Antenna Size			2.5	2.5	m
Earth-Station Tx Ant. Peak Gain	54.8	48.8			dBi
Earth-Station Rx Ant. Peak Gain			47.5	47.5	dBi
Satellite Tx Ant. Peak Gain			37	29.8	dBi
Satellite Rx Ant. Peak Gain	37	37			dBi
Signal Bandwidth	30	138	30	138	MHz
Rx Noise Temperature	1500	365	200	73	°K

A C/I analysis was performed to determine whether Expressway™ could share spectrum with a hypothetical GSO FSS system operating at V-band, referred to here as System-X. System-X has earth station and space station characteristics identical to those of Expressway™ except that its earth station antenna gain pattern

is modeled on the reference antenna radiation pattern of Appendix 29, Annex III of the international Radio Regulations. In the interference scenario, an Expressway™ satellite and a System-X satellite are spaced 2° apart on the geostationary arc. The earth stations for both systems are considered to be co-located. The interference calculations for this scenario, appearing below in Table B-5 indicate that 2° sharing is feasible under these conditions.

Table B-5. Interference Analysis between Expressway™ and System-X

PARAMETER	UPLINK		DOWNLINK		UPLINK		DOWNLINK		UNITS
	Desired Other	Interf. Own	Desired Other	Interf. Own	Interf. Other	Desired Own	Interf. Other	Desired Own	
Signal frequency	48.7	48.7	41	41	48.7	48.7	41	41	GHz
+ TX Power	14.8	14.8	20.0	20.0	14.8	14.8	20.0	20.0	dBW
- TX Loss	1	1	1	1	1	1	1	1	dB
- HPA Backoff	3	3	2	2	3	3	2	2	dB
+ TX Ant. Gain	59.5	20.4	49.0	52.0	20.4	59.5	52.0	49.0	dBi
- Per Carrier Loss	0.0	0.0	10.0	10.0	0.0	0.0	10.0	10.0	dB
= Tx EIRP	70.3	31.2	56.0	59.0	31.2	70.3	59.0	56.0	dBW
- Space Loss	217.3	217.3	215.8	215.8	217.3	217.3	215.8	215.8	dB
- Atmospheric Loss	5.1	5.1	3	3	5.1	5.1	3	3	dB
+ Rx Ant. Gain	49.0	52.0	58.0	20.4	52.0	49.0	20.4	58.0	dBi
= Carrier Power (C)	-103.2		-104.8			-103.2		-104.8	dBW
= Interfer. Power (I)		-139.3		-139.4	-139.3		-139.4		dBW
- Rx Noise Temp.	28.1	28.1	26.6	26.6	28.1	28.1	26.6	26.6	dBK
- Boltzmann's Const.	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	dBW/K-Hz
C/No or I/No	97.3	61.2	97.1	62.5	61.2	97.3	62.5	97.1	dB-Hz
C/I_{up} or C/I_{down}	36.1	(up)	34.6	(down)	36.1	(up)	34.6	(down)	dB
C/I_{total}		32.3	(total)			32.3	(total)		dB
- Signal Bandwidth	84.5	84.5	84.5	84.5	84.5	84.5	84.5	84.5	dB-Hz
Co/No or Io/No	12.8	-23.3	12.6	-22.0	-23.3	12.8	-22.0	12.6	dB-Hz
Co/Io_{up} or Co/Io_{down}	36.1	(up)	34.6	(down)	36.1	(up)	34.6	(down)	dB
Co/Io total		32.3	(total)			32.3	(total)		dB

Single satellite

C/I analyses were also performed to determine whether Expressway™ could share spectrum with a hypothetical GSO FSS system operating in the Ku-band, referred to here as System-Y. System-Y has earth station and space station characteristics derived from operational Ku-band satellite systems. The System-Y transponder bandwidth is assumed to be 30 MHz for satellite television signal transmissions. In the interference scenarios, an Expressway™ satellite and a System-Y satellite are spaced 2° apart on the geostationary arc. The earth stations for both systems are considered to be co-located. The interference calculations for these scenarios appear below. Table B-6 shows interference calculations between

Expressway™ 1° x 3° Ku-band beams and System-Y, while Tables B-7 and B-8 show interference calculations between System-Y and Expressway™ 6° Ku-band beams. These calculations show that 2° sharing is feasible for both 1° X 3° and 6° beams.

Table B-6. Interference Analysis between Expressway™ (1° X 3° Beam) and System-Y

PARAMETER	UPLINK		DOWNLINK		UPLINK		DOWNLINK		UNITS
	Desired Other	Interf. Own	Desired Other	Interf. Own	Interf. Other	Desired Own	Interf. Other	Desired Own	
Signal frequency	13	13	11	11	13	13	11	11	GHz
+ TX Power	17.0	20.0	15.4	14.0	17.0	20.0	15.4	14.0	dBW
- TX Loss	0.3	0.3	0.5	0.5	0.3	0.3	0.5	0.5	dB
- HPA Backoff	0	0	0	0	0	0	0	0	dB
+ TX Ant. Gain	54.8	20.4	34.0	37.0	20.4	48.8	37.0	34.0	dBi
- Per Carrier Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	dB
= Tx EIRP	71.5	40.1	48.9	50.5	37.1	68.5	51.9	47.5	dBW
- Space Loss	205.9	205.9	204.4	204.4	205.9	205.9	204.4	204.4	dB
- Atmospheric Loss	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	dB
+ Rx Ant. Gain	34.0	37.0	49.2	20.4	37.0	34.0	20.4	47.5	dBi
= Carrier Power (C)	-100.7		-106.6			-103.7		-109.7	dBW
= Interfer. Power (I)		-129.1		-133.8	-132.1		-132.4		dBW
- Rx Noise Temp.	31.8	31.8	23.0	23.0	25.6	25.6	18.6	18.6	dBK
- Boltzmann's Const.	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	dBW/K-Hz
C/No or I/No	96.2	67.8	99.0	71.8	70.9	99.3	77.6	100.2	dB-Hz
C/I_{up} or C/I_{down}	28.4	(up)	27.3	(down)	28.4	(up)	22.6	(down)	dB
C/I_{total}		24.8	(total)			21.6	(total)		dB
- Signal Bandwidth	74.8	83.8	74.8	83.8	74.8	83.8	74.8	83.8	dB-Hz
Co/No or Io/No	21.4	-16.0	24.3	-12.0	-3.8	15.5	2.8	16.4	dB/Hz
Co/Io_{up} or Co/Io_{down}	37.4	(up)	36.3	(down)	19.4	(up)	13.6	(down)	dB
Co/Io total		33.8	(total)			12.6	(total)		dB

Single satellite

Table B-7. Interference Analysis between Expressway™ (Bogota - CONUS link) and System-Y

PARAMETER	UPLINK		DOWNLINK		UPLINK		DOWNLINK		UNITS
	Desired Other	Interf. Own	Desired Other	Interf. Own	Interf. Other	Desired Own	Interf. Other	Desired Own	
Signal frequency	13	13	11	11	13	13	11	11	GHz
+ TX Power	17.0	23.0	15.4	14.0	17.0	23.0	15.4	14.0	dBW
- TX Loss	0.3	0.3	0.5	0.5	0.3	0.3	0.5	0.5	dB
- HPA Backoff	0	0	0	0	0	0	0	0	dB
+ TX Ant. Gain	54.1	20.4	34.0	37.0	20.4	48.8	37.0	34.0	dBi
- Per Carrier Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	dB
= Tx EIRP	70.8	43.1	48.9	50.5	37.1	71.5	51.9	47.5	dBW
- Space Loss	205.9	205.9	204.4	204.4	205.9	205.9	204.4	204.4	dB
- Atmospheric Loss	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	dB
+ Rx Ant. Gain	34.0	37.0	47.5	20.4	30.2	27.2	20.4	47.5	dBi
= Carrier Power (C)	-101.4		-108.3			-107.5		-109.7	dBW
= Interfer. Power (I)		-126.0		-133.8	-138.9		-132.4		dBW
- Rx Noise Temp.	31.8	31.8	23.0	23.0	25.6	25.6	18.6	18.6	dBK
- Boltzmann's Const.	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	dBW/K-Hz
C/No or I/No	95.5	70.8	97.3	71.8	64.1	95.5	77.6	100.2	dB-Hz
C/I_{up} or C/I_{down}	24.7	(up)	25.6	(down)	31.4	(up)	22.5	(down)	dB
C/I_{total}		22.1	(total)			22.1	(total)		dB
- Signal Bandwidth	74.8	81.4	74.8	81.4	74.8	81.4	74.8	81.4	dB-Hz
Co/No or Io/No	20.7	-10.6	22.6	-9.6	-10.6	14.1	2.8	18.8	dB/Hz
Co/Io_{up} or Co/Io_{down}	31.3	(up)	32.2	(down)	24.8	(up)	16.0	(down)	dB
Co/Io total		28.7	(total)			15.5	(total)		dB

Single satellite

Table B-8. Interference Analysis between Expressway™ (CONUS - Bogota link) and System-Y

PARAMETER	UPLINK		DOWNLINK		UPLINK		DOWNLINK		UNITS
	Desired Other	Interf. Own	Desired Other	Interf. Own	Interf. Other	Desired Own	Interf. Other	Desired Own	
Signal frequency	13	13	11	11	13	13	11	11	GHz
+ TX Power	17.0	20.0	15.4	20.0	17.0	20.0	15.4	20.0	dBW
- TX Loss	0.3	0.3	0.5	0.5	0.3	0.3	0.5	0.5	dB
- HPA Backoff	0	0	0	0	0	0	0	0	dB
+ TX Ant. Gain	54.1	20.4	34.0	29.8	20.4	48.8	37.0	26.8	dBi
- Per Carrier Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	dB
= Tx EIRP	70.8	40.1	48.9	49.3	37.1	68.5	51.9	46.3	dBW
- Space Loss	205.9	205.9	204.4	204.4	205.9	205.9	204.4	204.4	dB
- Atmospheric Loss	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	dB
+ Rx Ant. Gain	34.0	37.0	47.5	20.4	37.0	34.0	20.4	47.5	dBi
= Carrier Power (C)	-101.4		-108.3			-103.7		-110.9	dBW
= Interfer. Power (I)		-129.1		-135.0	-132.1		-132.4		dBW
- Rx Noise Temp.	31.8	31.8	23.0	23.0	25.6	25.6	18.6	18.6	dBK
- Boltzmann's Const.	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	-228.6	dBW/K-Hz
C/No or I/No	95.5	67.8	97.3	70.6	70.9	99.3	77.6	99.1	dB-Hz
C/I_{up} or C/I_{down}	27.7	(up)	26.7	(down)	28.4	(up)	21.5	(down)	dB
C/I_{total}		24.2	(total)			20.7	(total)		dB
- Signal Bandwidth	74.8	81.4	74.8	81.4	74.8	81.4	74.8	81.4	dB-Hz
Co/No or Io/No	20.7	-13.6	22.6	-10.8	-3.8	17.9	2.8	17.7	dB/Hz
Co/Io_{up} or Co/Io_{down}	34.3	(up)	33.4	(down)	21.7	(up)	14.8	(down)	dB
Co/Io total		30.8	(total)			14.0	(total)		dB

Single satellite

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Appendix C
Antenna Coverage

APPENDIX C: ANTENNA COVERAGE

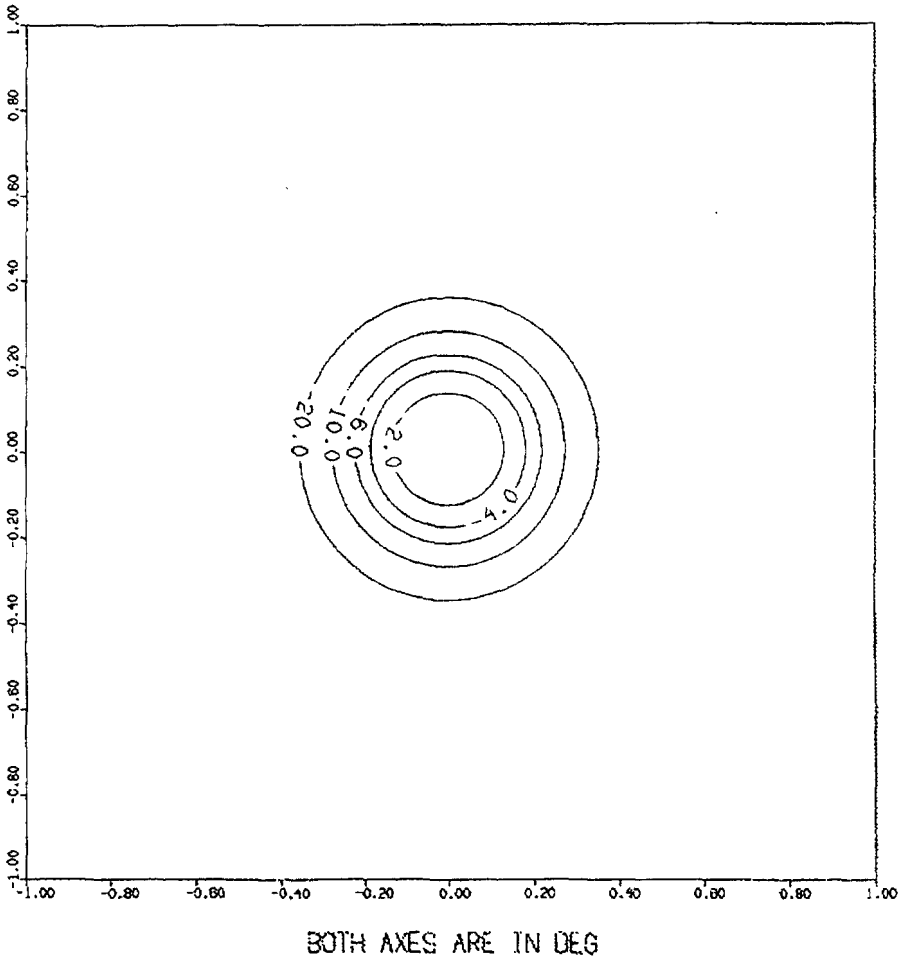

Figure C-1. V-Band Receive/Transmit Spot Beam Contours (G_{max} = 52 dBi, G/T=23.4 dB/K)

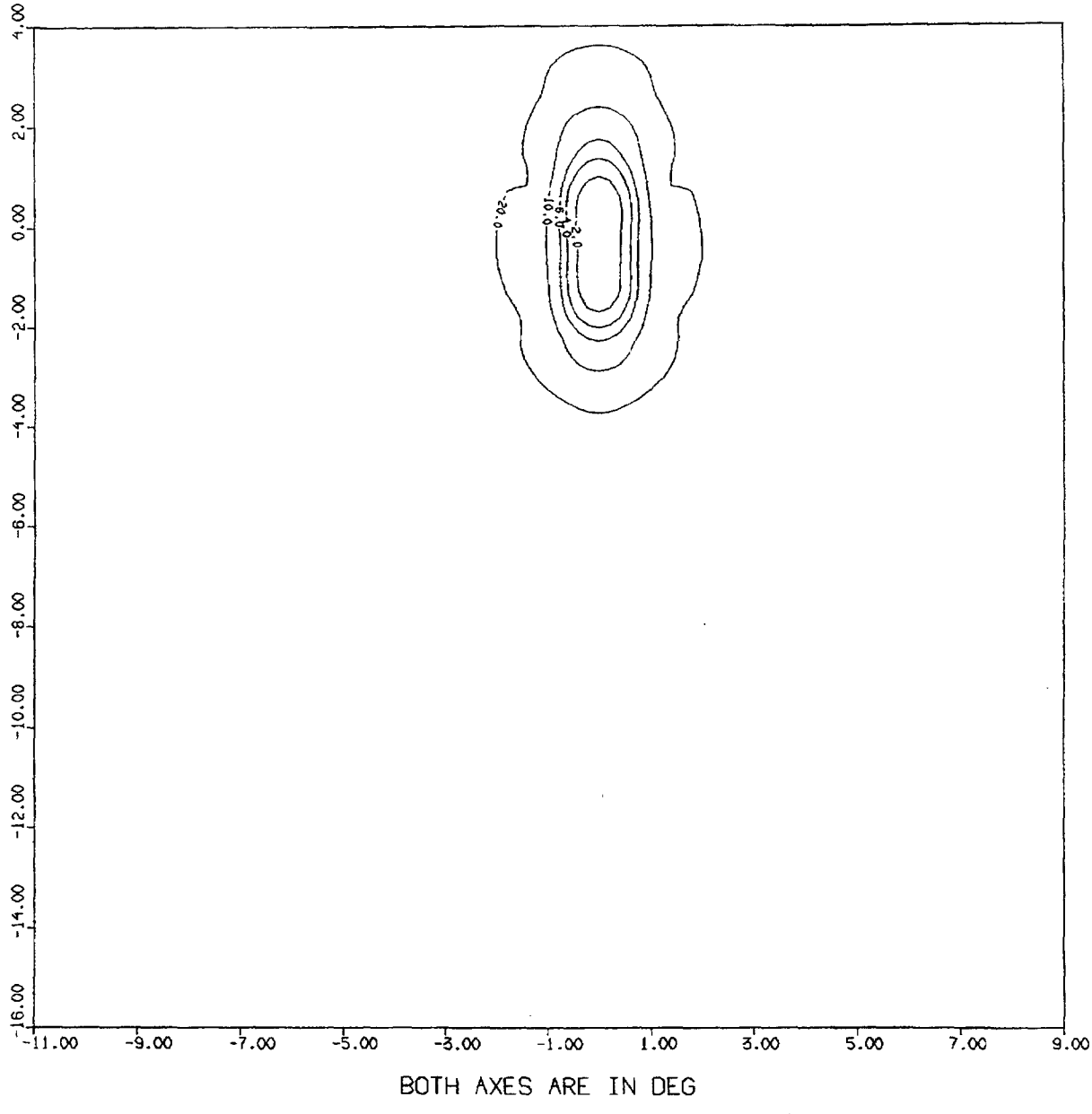

Figure C-2. Ku-Band Receive/Transmit Elliptical (1°X3°) Beam Contours

(G_{max} = 37 dBi, G/T = 10.4 dB/K)

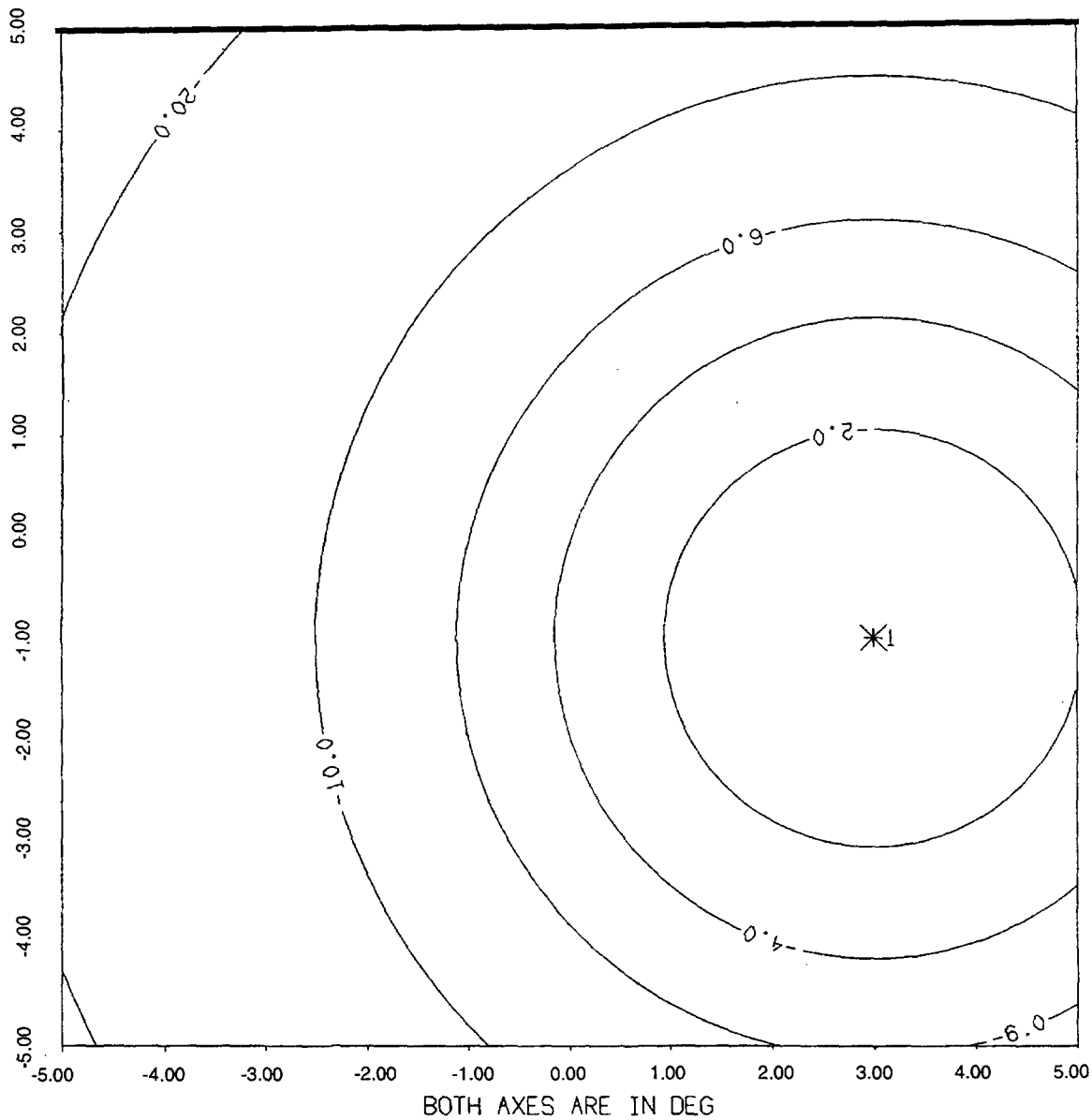

Figure C-3. Ku-Band Receive Hemispherical Area Beam Contours

(G_{max} = 30.2 dBi, G/T = 4.1 dB/K)

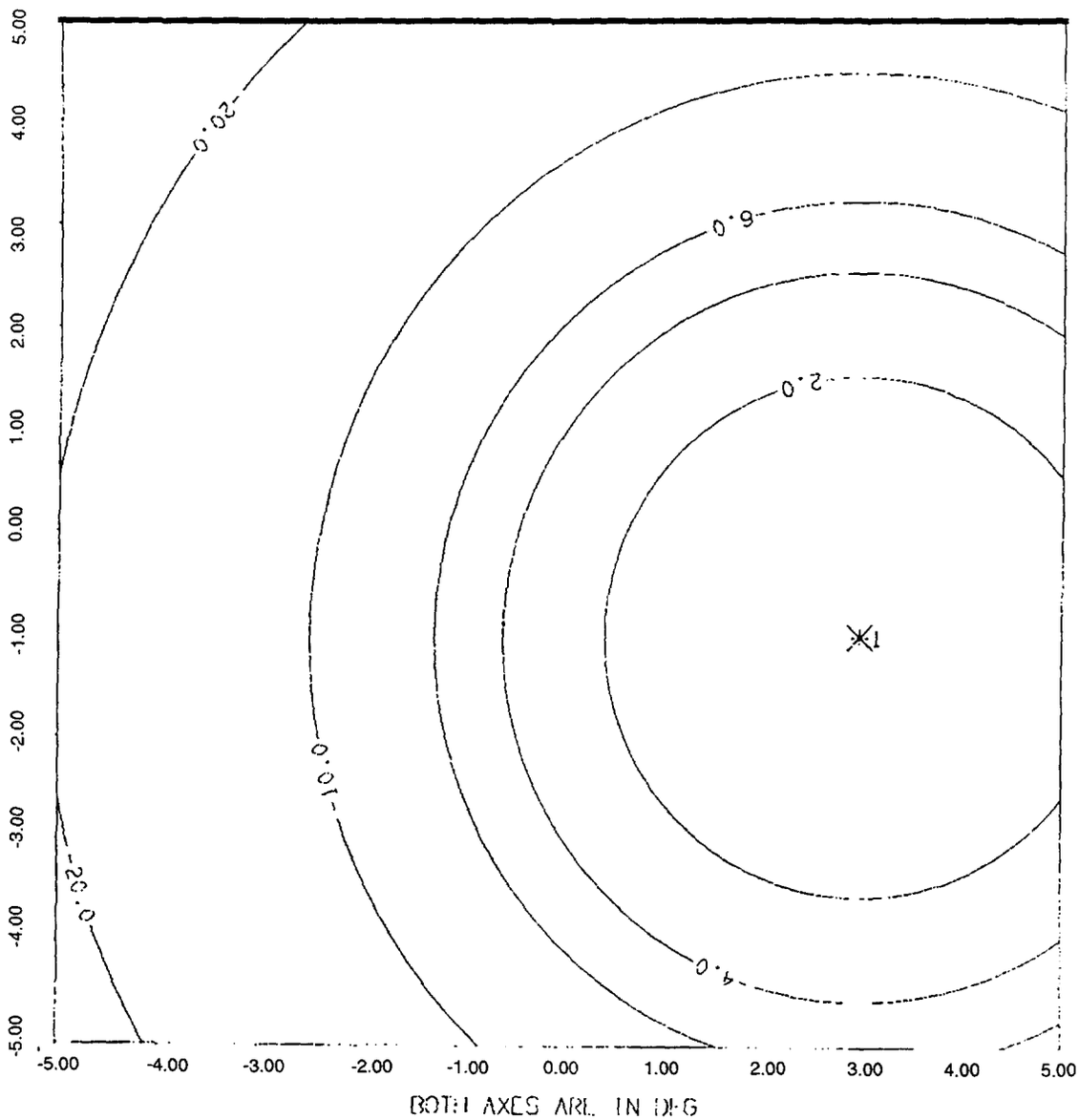

Figure C-4. Ku-Band Transmit Hemispherical Area Beam Contours (G_{max} = 29.8 dBi)

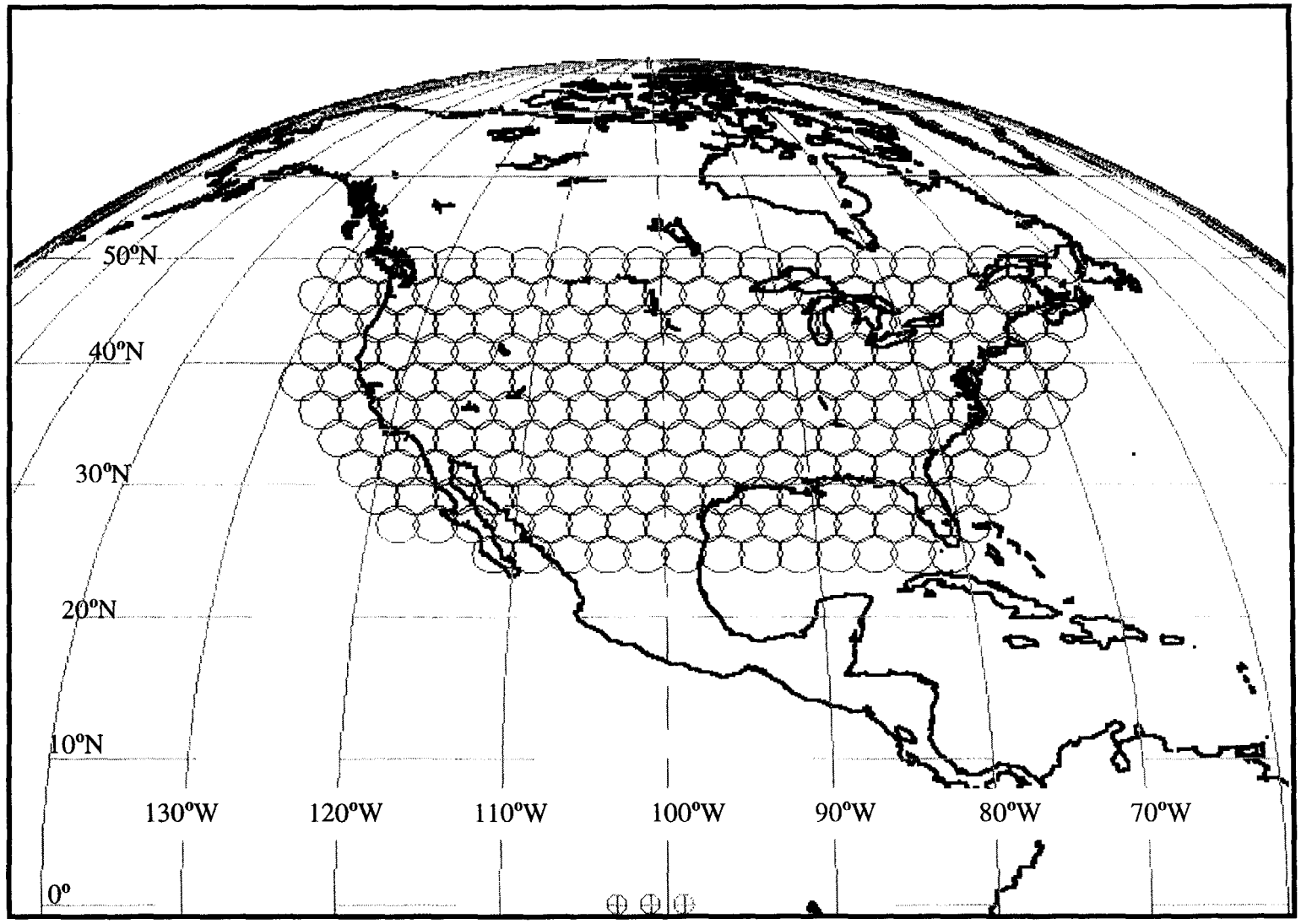

Figure C-5. V-Band Beams at 99°W, 101°W, and 103°W Orbital Positions

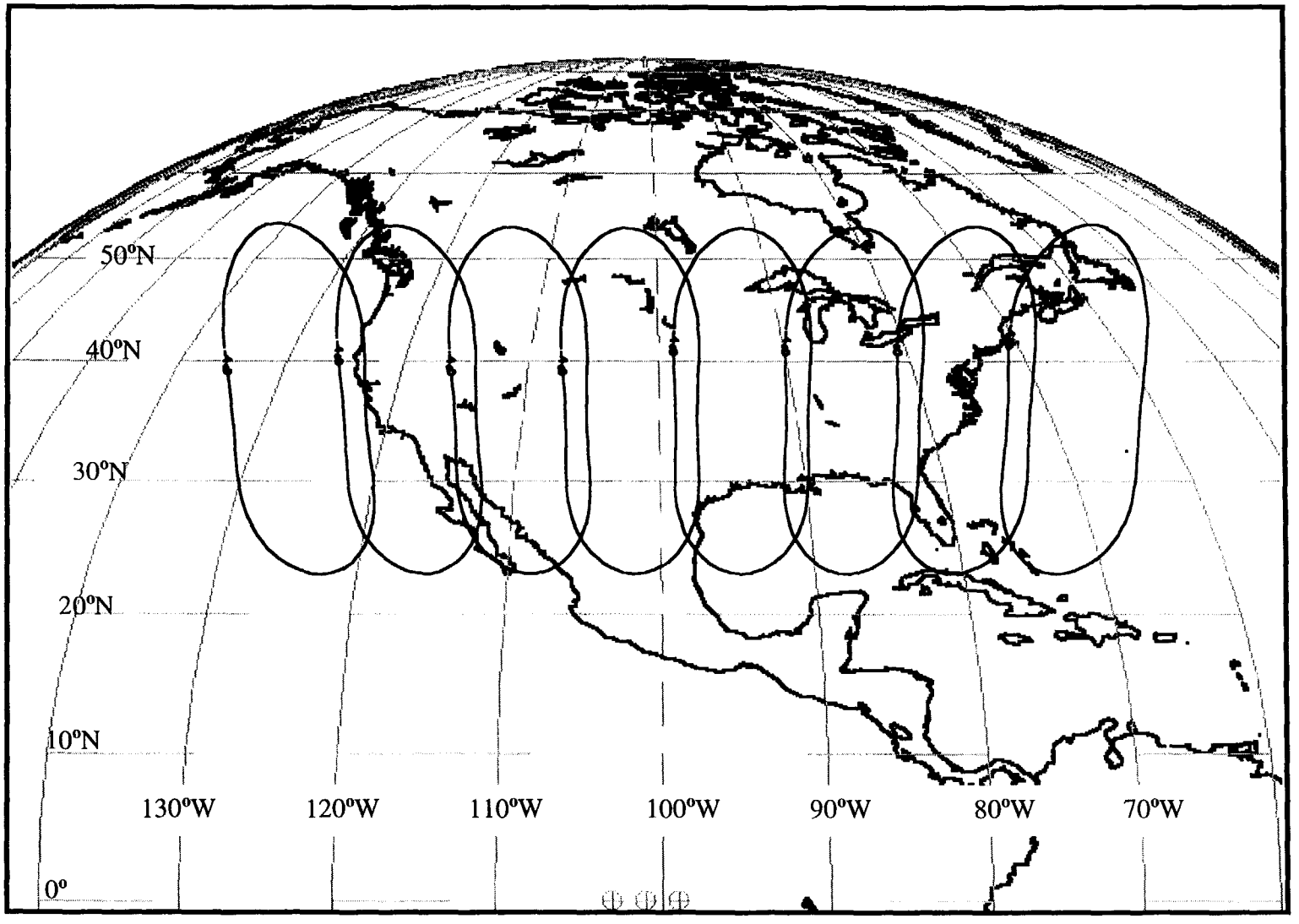

Figure C-6. Ku-Band Beams at 99°W, 101°W, and 103°W Orbital Positions

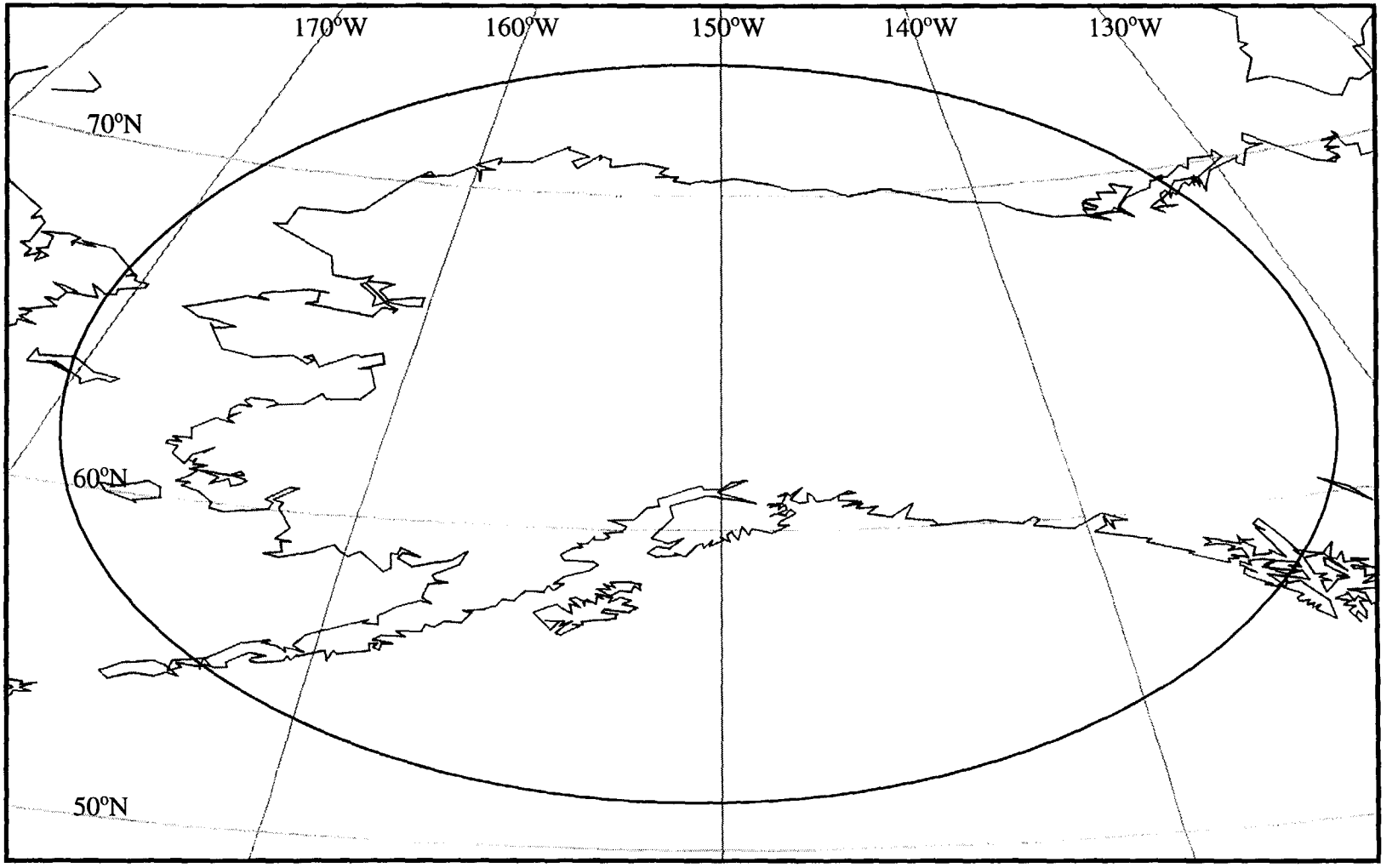

Figure C-7. Receive/Transmit Alaska Beam at 103°W Orbital Position

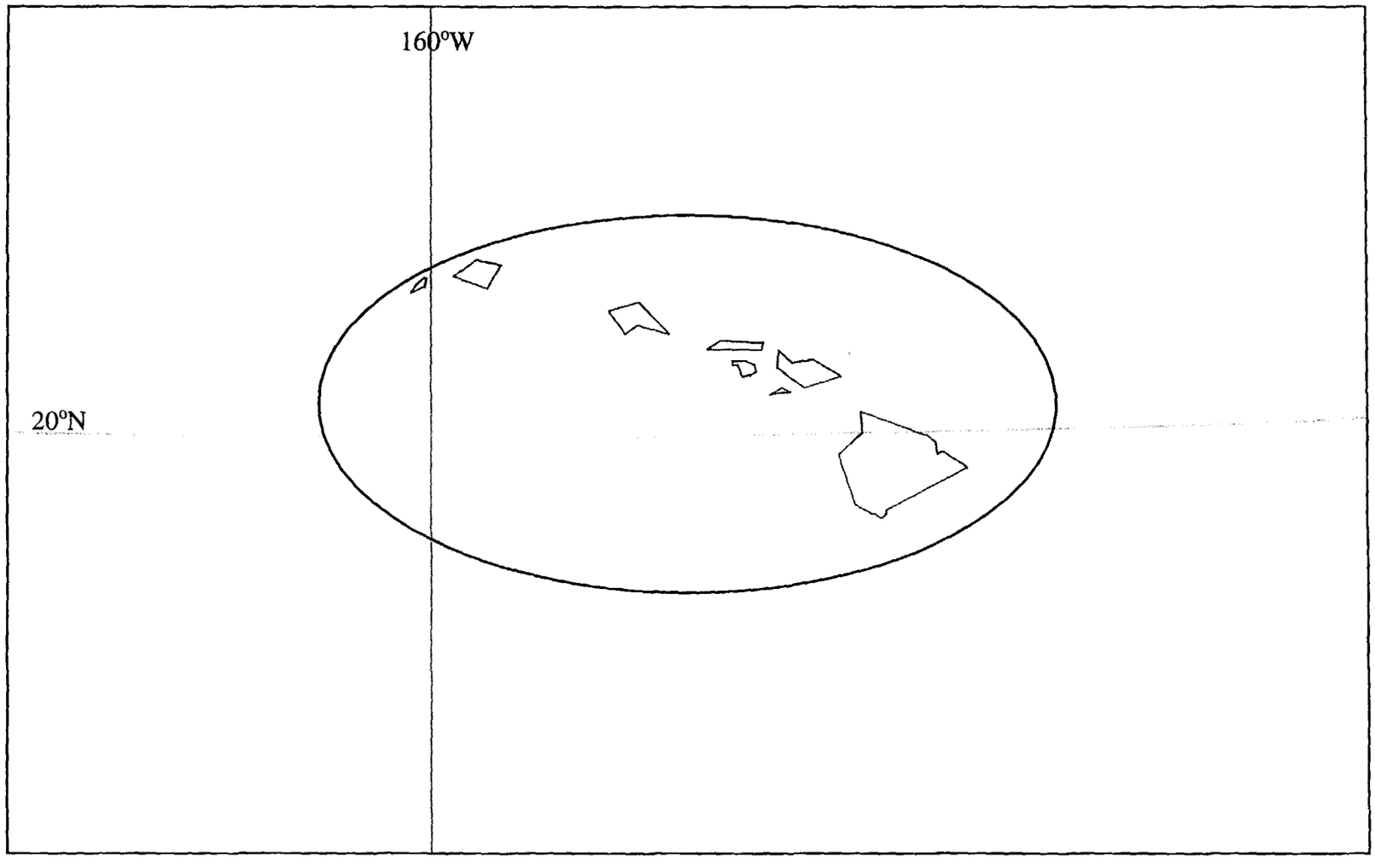

Figure C-8. Receive/Transmit Hawaii Beam at 103°W Orbital Position

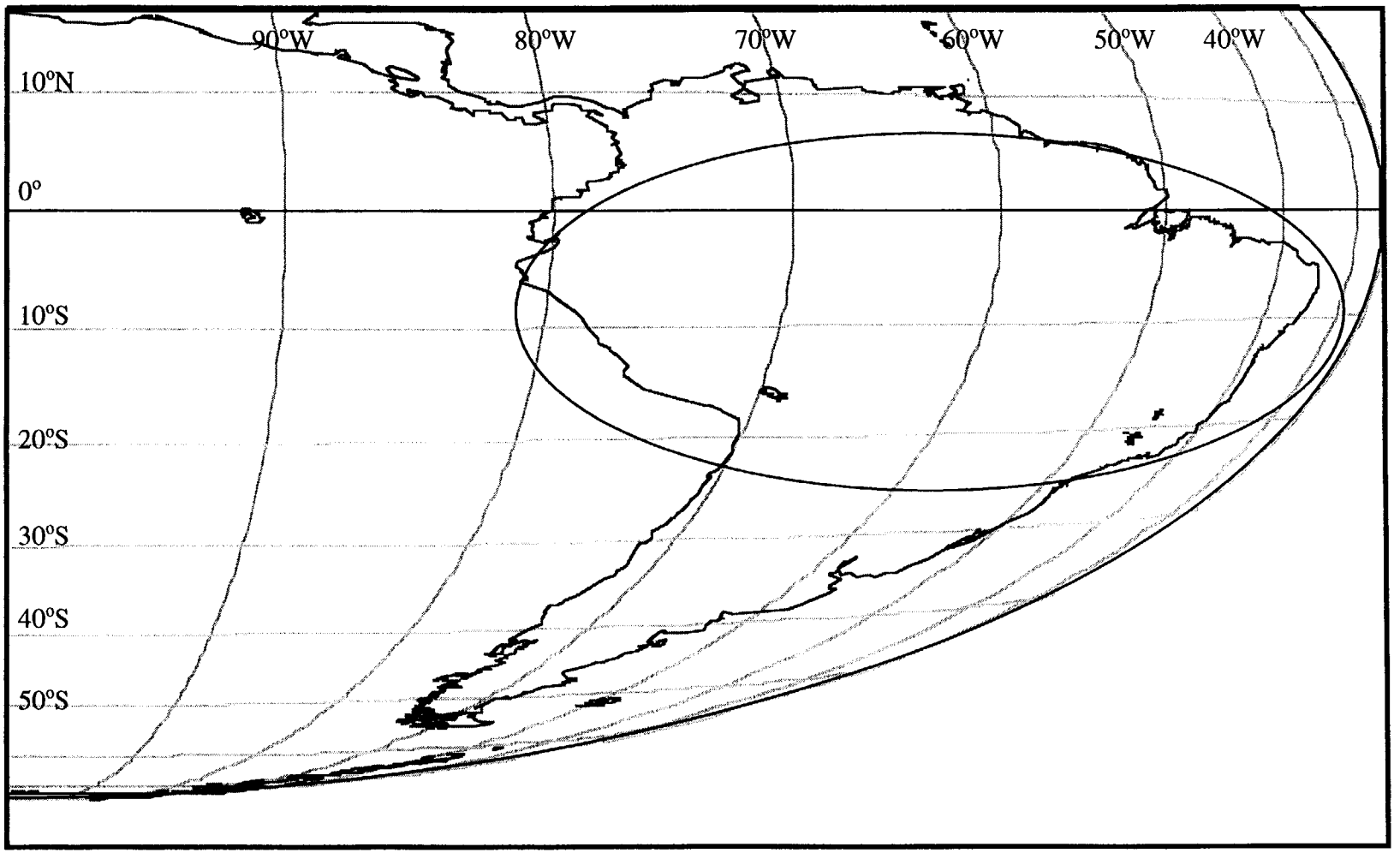

Figure C-9. Receive Ku-Band 6° Beam at 99°W, 101°W, and 103°W Orbital Positions

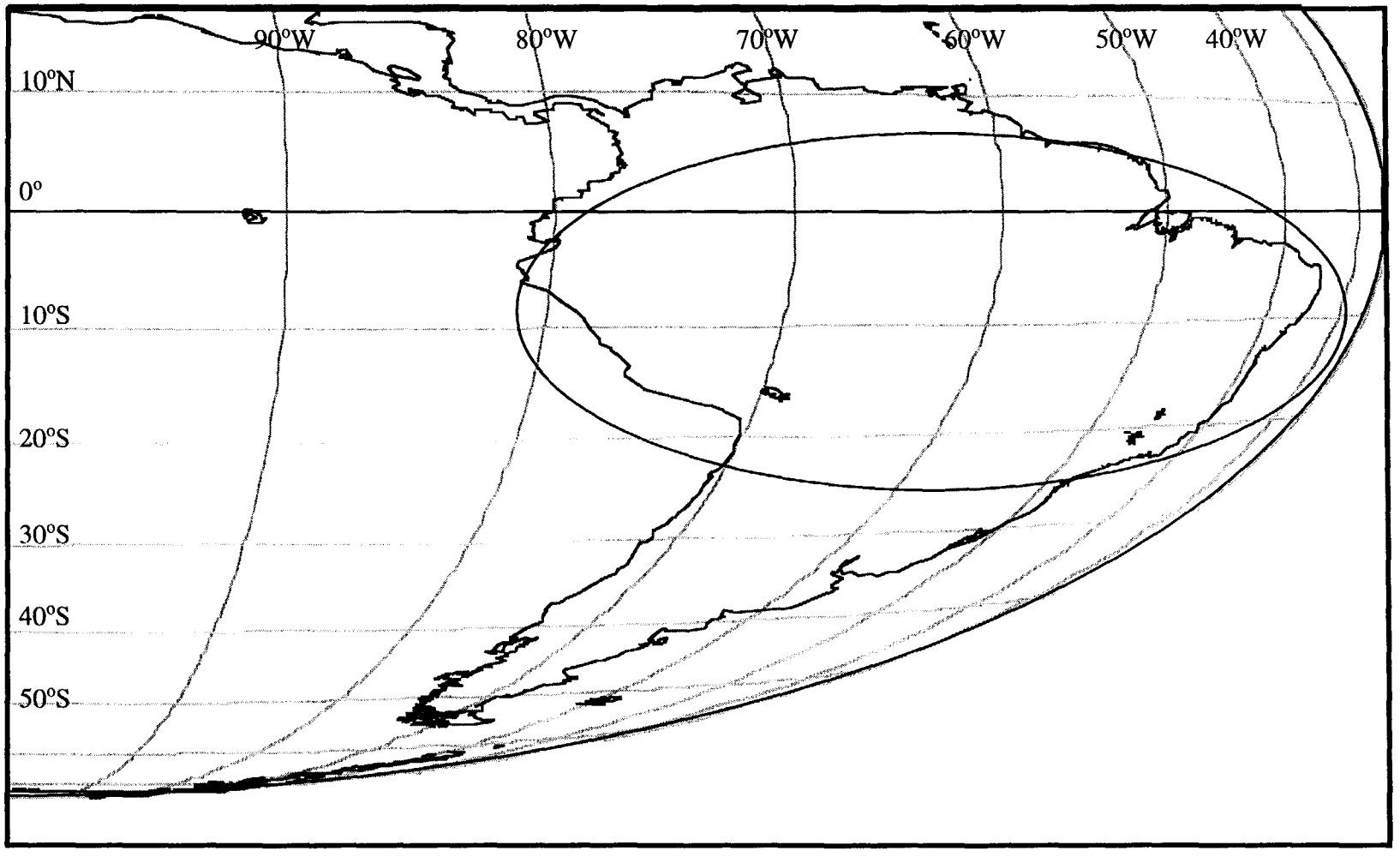

Figure C-10. Transmit Ku-Band 6° Beam at 99°W, 101°W, and 103°W Orbital Positions

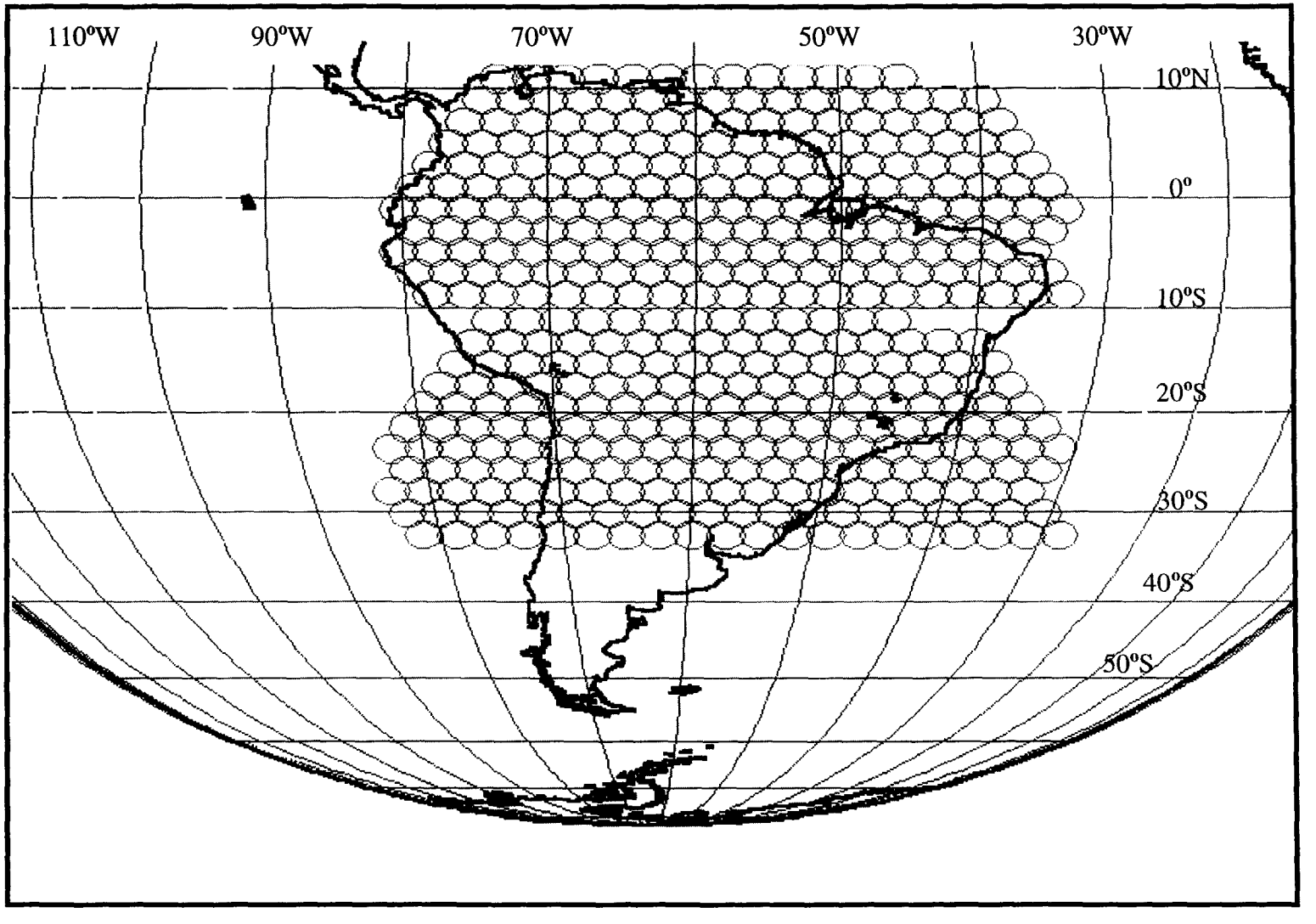

Figure C-11. V-Band Beams at 53°W and 63°W Orbital Positions

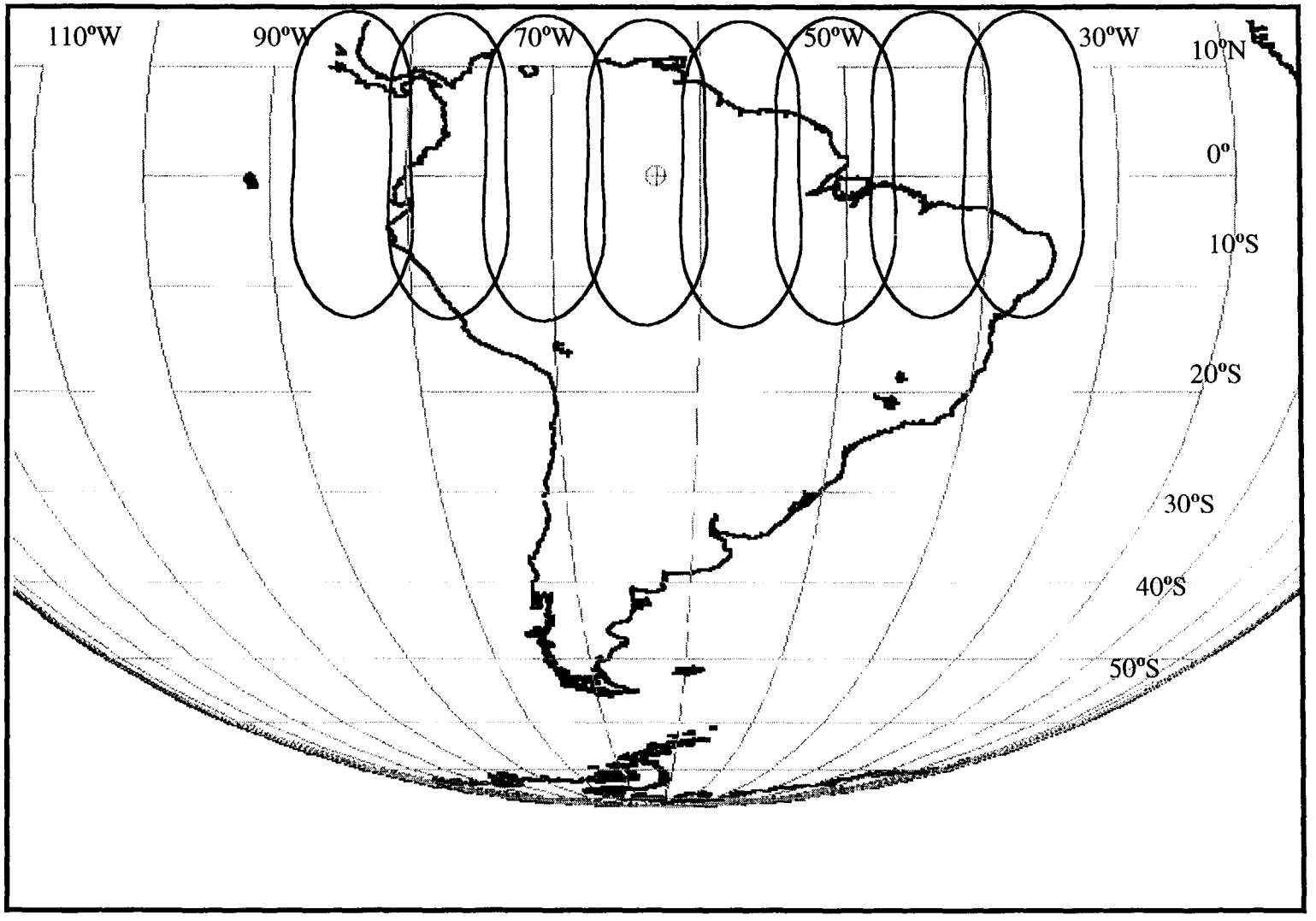

Figure C-12. Ku-Band Beams at 63°W Orbital Position

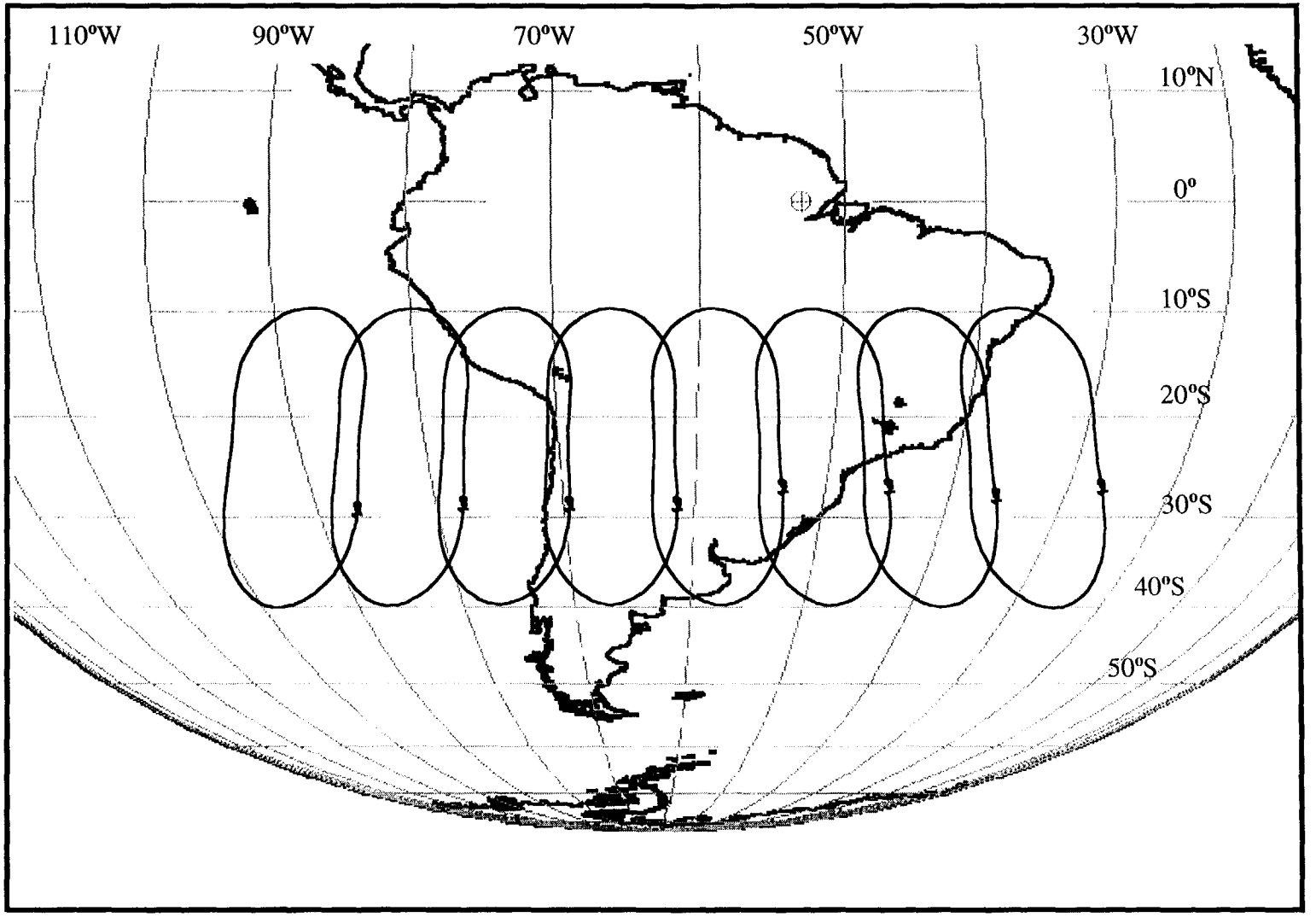

Figure C-13. Ku-Band Beams at 53°W Orbital Position

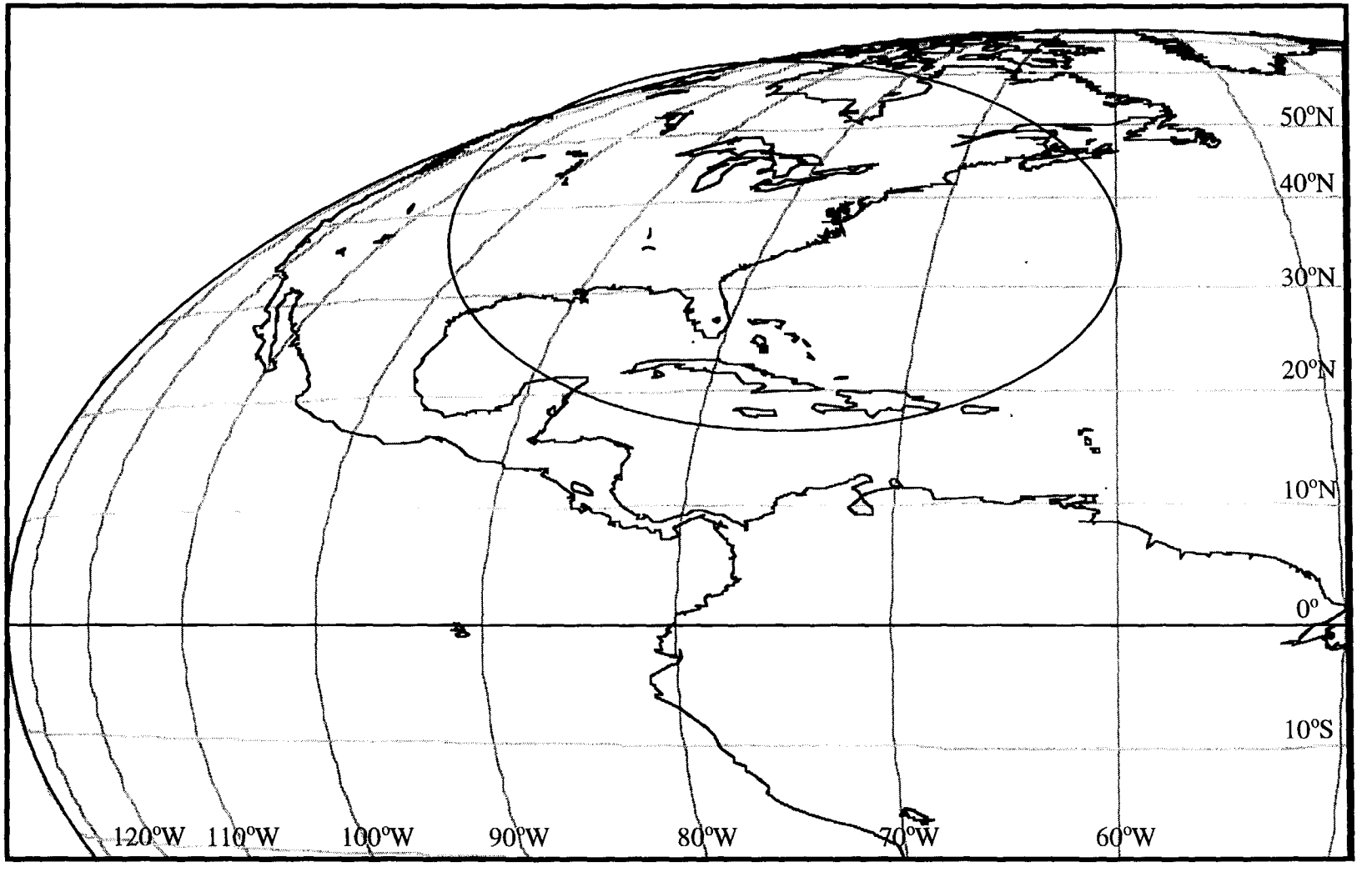

Figure C-14. Receive Ku-Band 6° Beam at 53°W and 63°W Orbital Positions

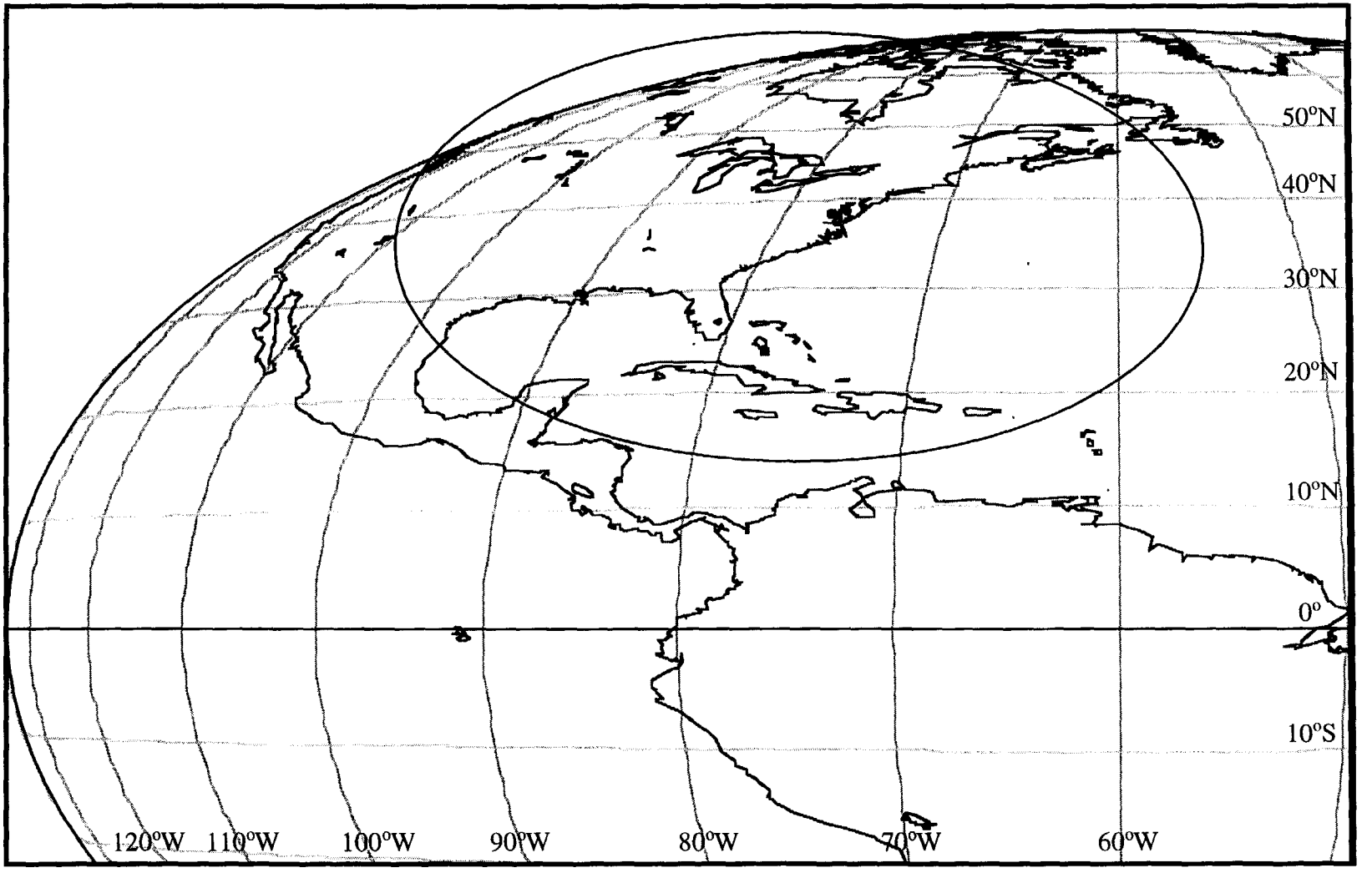

Figure C-15. Transmit Ku-Band 6° Beam at 53°W and 63°W Orbital Positions

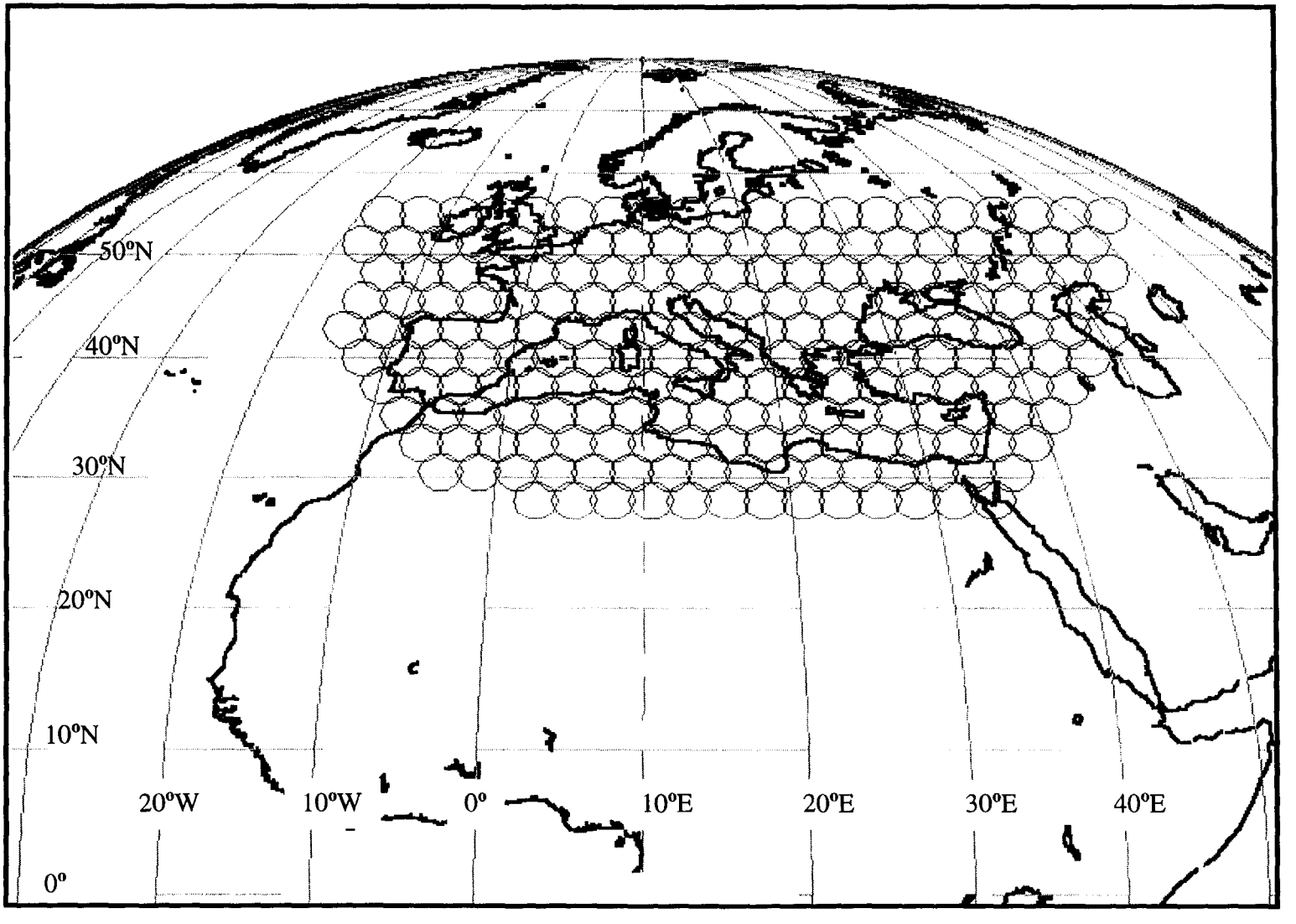

Figure C-16. V-Band Beams at 8.5°E Orbital Position