

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

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<i>Application of</i> )	
)	
<b>DIRECTV ENTERPRISES, LLC</b> )	Call Sign: S2861
)	
For Minor Modification of Authorization to )	File No. SAT-MOD-_____
Launch and Operate DIRECTV KU-79W )	
_____ )	

**APPLICATION FOR MINOR MODIFICATION OF  
AUTHORITY TO LAUNCH AND OPERATE DIRECTV KU-79W**

On July 12, 2012, the Commission authorized DIRECTV Enterprises, LLC (“DIRECTV”) to launch and operate DIRECTV KU-79W, a Ku-band satellite, at the nominal 79° W.L. orbital location.<sup>1</sup> Over the year following that grant, DIRECTV refined its business plan for operations from this slot and adjusted the technical characteristics of its space station accordingly. The resulting parameters were incorporated into a non-contingent contract for construction of the satellite, which DIRECTV recently submitted to the Commission as required under Section 25.164(c) of the Commission’s rules and Paragraph 6a of the 79W Authorization.<sup>2</sup> Accordingly, in this Application, DIRECTV requests that its authorization be modified in the manner set forth herein so that it will conform to the parameters of the satellite currently under contract.

<sup>1</sup> See Grant Stamp, IBFS File No. SAT-LOA-20120316-00051 (July 12, 2012) (“79W Authorization”).

<sup>2</sup> See Letter from William M. Wiltshire to Marlene H. Dortch, IBFS File No. SAT-LOA-20120316-00051 (July 12, 2013).

The most significant changes in proposed operations are the deletion of the downlink beam serving the continental United States, and optimization of the remaining beam covering Mexico, Central America, and parts of the Caribbean. DIRECTV also seeks authority to operate at 78.8° W.L., a slight offset from its currently authorized location of 79.0° W.L. The changes proposed herein do not involve a request for additional orbital or spectrum resources, and thus should be deemed minor in nature.<sup>3</sup>

In accordance with Section 25.117(d)(1) of the Commission's rules, DIRECTV identifies in this Application only those items of information that should be changed from its original application. For ease of reference, DIRECTV is also submitting a complete Schedule S, which includes all of the revised technical information relevant to the satellite. DIRECTV hereby certifies that the remaining information in its original application has not changed.

#### **I. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST**

Since initiating service in 1994, DIRECTV has become the leading provider of DTH digital television services in the United States, with over 20 million subscribers. It currently has a fleet of eleven in-orbit spacecraft operating in the Ku- and Ka-bands, which have enabled DIRECTV to maintain and extend its leadership in HD services and to inaugurate 3D services as well. Its affiliate, DIRECTV Latin America ("DTVLA"), is the leading provider of DTH digital television services throughout Latin America, serving more than 16 million subscribers in over 10 countries using Ku-band satellites. This includes approximately 5.4 million subscribers served by DTVLA's affiliate Innova, S. de R.L. de C.V., commonly referred to as Sky Mexico, which is growing by

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<sup>3</sup> See 47 C.F.R. § 25.117(d)(2)(iii) (defining major modification requests that must be placed in a processing queue pursuant to Section 25.158). Note that the DIRECTV KU-79W satellite also includes a 17/24 GHz BSS payload. DIRECTV is not requesting authority to operate this payload at this time, but is including technical details associated with this payload in this application in the interest of completeness.

approximately one million subscribers per year despite intensifying competition. These companies strive to combine unique and compelling content with technological innovation and industry-leading customer service to make DIRECTV and DTVLA the clear choice among consumers throughout the Americas.

As originally envisioned and currently authorized, DIRECTV KU-79W would be capable of operating one downlink beam serving DIRECTV subscribers in the continental United States and a second downlink beam serving Sky Mexico subscribers in Mexico, Central America, and portions of the Caribbean. DIRECTV is currently in the process of constructing two Ka-band satellites (DIRECTV 14 and 15) that, when launched over the next two years, will add significant capacity for service to the United States.

In light of this, DIRECTV decided to delete the U.S. beam and optimize DIRECTV KU-79W for service to Mexico, where it can be used to expand DTVLA's capabilities in order to support the ongoing transition to HD services in Mexico. Transmitting programming in HD format requires significantly more capacity than transmitting the same programming in SD format. As more programmers migrate to HD, DTVLA will need to make sure that its system has the additional capacity available to handle the demands of an increasingly robust slate of HD programming. The need for additional capacity is especially acute in Mexico, where the existing use of a Ku-band satellite would ease the transition to the use of an additional Ku-band satellite. DTVLA will carry HD programming material which will be distributed from earth stations within Mexico and from DIRECTV broadcast facility locations within the U.S. The DIRECTV KU-79W system and associated ground Ku-band assets will be capable of transmitting approximately 120 channels of HD programming.

Granting this Application will serve the public interest in several ways. First, the Commission will enable DTVLA to increase the amount of HD programming available to subscribers in Mexico, providing them with access to the full panoply of HD programming available in the market as the amount of such programming continues to increase. Second, the ability to keep pace with HD programming demands will make DTVLA better able to compete against cable and telco multichannel video services in Mexico. Third, the rich and varied HD services offered from this orbital location will give subscribers additional incentive to upgrade to digital television sets, further promoting the digital transition in Mexico and (derivatively) the United States. And fourth, by providing an attractive platform for niche programming in HD format (*e.g.*, international, foreign language, minority-focused), DTVLA will greatly increase the incentive programmers have to produce HD programming that might be of particular appeal to audiences underserved by existing HD fare, including Spanish-language viewers in the United States.

For all of these reasons, DIRECTV submits that the Commission should grant this Application as expeditiously as possible.

## **II. INFORMATION REQUIRED UNDER SEC. 25.114 OF THE COMMISSION'S RULES, AS REVISED**

In this section, we present those aspects of DIRECTV's original application for authority to operate DIRECTV KU-79W that it proposes to modify. For ease of comparison, the subsection headings in the discussion below correspond to the headings of the relevant subsections from the original application. This section relates only to the Ku-band payload for which authorization is requested. Information on the 17/24 GHz BSS payload is provided in Section III.

#### **4. General Description of Overall System Facilities, Operations and Services**

As discussed in Section I above, DIRECTV has modified the design of this satellite such that it will transmit one (rather than two) downlink beam, with coverage of Mexico, Central America, and parts of the Caribbean.

##### **5.2.2 Downlink Transmissions**

The downlink beam will use 123.5 Watt TWTAs which, when combined with the transmit antenna gain, results in a maximum EIRP of 53 dBW. The peak transmit antenna gain and associated contours are specified in the accompanying Schedule S (see also Section 7.2).

##### **5.3 TT&C Subsystem**

Normal on-station commands will be received through a global horn command antenna, while on-station telemetry will also be transmitted through this global horn. The minimum cross-polarization isolation for the on-station command and telemetry antenna is 27 dB.<sup>4</sup>

#### **6. Orbital Locations**

DIRECTV seeks authority to operate the DIRECTV KU-79W satellite at 78.8° W.L. (*see also* Section 18 and GSO Orbit tab of Schedule S).

##### **7.1 Uplink Beams**

The receive antenna gain contours for the DIRECTV KU-79W are provided in GXT format in the accompanying Schedule S and are also graphically depicted in Appendix B hereto. The uplink beam will have a minimum cross-polarization isolation of 27 dB.

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<sup>4</sup> DIRECTV is filing herewith a request for waiver of Section 25.210(i)(1) of the Commission's rules, applicable to Sections 5.3, 7.1, and 7.2 of the Application.

## **7.2 Downlink Beams**

The transmit antenna gain contours for the DIRECTV KU-79W are provided in GXT format in the accompanying Schedule S and are also graphically depicted in Appendix B hereto. The downlink beam will have a minimum cross-polarization isolation of 27 dB.

## **7.3 TT&C Beams**

The TT&C on-station coverage will be provided by a global transmit/receive horn for command and telemetry. The antenna pattern for this global horn is shown in Appendix B as Figure B-5.

## **8.2 Link Performance**

A representative link budget for the communications payload of DIRECTV KU-79W is shown in Appendix A as Table A-1. Representative link budgets for the telemetry and command links are shown in Appendix C as Tables C-1 and C-2, respectively.

## **12. Physical Characteristics of the Space Station**

Based on its current satellite construction contract, DIRECTV anticipates that the key spacecraft characteristics for DIRECTV KU-79W will be as summarized in the appropriate sections of the accompanying Schedule S.

## **13. Spacecraft Bus Subsystem**

The spacecraft bus characteristics are provided in the accompanying Schedule S.

## **18. Orbital Debris Mitigation**

### ***Safe Flight Profiles***

DIRECTV has assessed and limited the probability of DIRECTV KU-79W becoming a source of debris by collisions with large debris or other operational space stations through detailed and conscientious mission planning. DIRECTV has reviewed

the list of licensed systems and systems that are under consideration by the Commission for the nominal 79° W.L. orbital location it has requested. In addition, in order to address non-U.S. licensed systems, DIRECTV has reviewed the list of satellite networks in the vicinity of 78.8° W.L. for which a request for coordination has been submitted to the ITU. Only those networks that are operating, or are planned to be operating, within  $\pm 0.2^\circ$  have been taken into account in this review.

As a consequence of this review, DIRECTV has determined that no other system is currently licensed by the Commission for, or is currently operating at, the nominal 79° W.L. location. DIRECTV intends to operate DIRECTV KU-79W at the 78.8° W.L. position.

With regard to ITU filings within  $\pm 0.2$  degrees of 78.8° W.L., the only requests for coordination the ITU has published are for a Luxemburg satellite network (LUX-G5-63) at 79° W.L and for a Spanish satellite network (HISPASAT-9) also at 79° W.L. DIRECTV can find no evidence that a satellite construction contract has been awarded for either of these networks. Nevertheless, DIRECTV will continue to monitor this situation and revisit this issue if needed.

Frequency and physical coordination during orbital drift cannot be undertaken until the launch vehicle manufacturer is selected and a launch plan has been developed. No pre-operational orbits requiring special temporary authority are currently anticipated.

### ***Post-Mission Disposal***

Consistent with the requirements of Section 25.283(a) of the Commission's rules, at the end of the operational life of the satellite, DIRECTV will maneuver DIRECTV KU-79W into a disposal orbit with an altitude no less than that calculated using the IADC formula:

$$36,021 \text{ km} + (1000 \cdot C_R \cdot A/m)$$

where  $C_R$  is the solar pressure radiation coefficient of the spacecraft, and  $A/m$  is the Area to mass ratio, in square meters per kilogram, of the spacecraft. In calculating the disposal orbit, DIRECTV has used simplifying assumptions as permitted under the Commission's orbital debris policies.<sup>5</sup> For reference, the effective Area to mass ratio ( $C_R \cdot A/m$ ) of the DIRECTV KU-79W spacecraft is 0.04 m<sup>2</sup>/kg, resulting in a minimum perigee disposal altitude under the IADC formula of at most 280.4 kilometers above the geostationary orbit. DIRECTV intends to boost DIRECTV KU-79W to at least this height, and in fact will target a height of approximately 300 km above geostationary altitude.

DIRECTV currently intends to allocate and reserve approximately 10 kg of propellant for final orbit raising maneuvers to this altitude. This value was determined through a detailed launch vehicle propellant budget analysis applied to the parameters of one of DIRECTV's most recently designed satellites. In addition, DIRECTV has assessed fuel gauging uncertainty and this budgeted propellant provides an adequate margin of fuel reserve to ensure that the disposal orbit will be achieved despite such uncertainty.

### **III. INFORMATION ON 17/24 GHz BSS PAYLOAD**

The DIRECTV KU-79W spacecraft includes a 17/24 GHz BSS payload. DIRECTV does not seek authority from the Commission to operate this payload at this time. Nonetheless, it provides below general information on the characteristics and capabilities of that payload.

The 17/24 GHz BSS payload consists of two 500 MHz transponders, one for each sense of polarization (*i.e.*, RHCP and LHCP). Given their wide bandwidth, these transponders are capable of supporting a wide variety of carrier types. It is currently envisioned that 36 MHz carriers will be the nominal type carrier supported. The

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<sup>5</sup> *Mitigation of Orbital Debris*, 19 FCC Red. 11567, ¶ 70 (2004).



emission designator for the uplink and downlink for this carrier type will be 36M0G7W and the allocated bandwidth for these emissions is 36 MHz.

With the wideband transponder design for the 17/24 GHz BSS payload, there is no input multiplexer filtering. Received signals will be frequency translated and routed to a channel amplifier with selectable fixed/Automatic Level Control (“ALC”) modes prior to final amplification. The fixed gain mode will have at least 19 dB of gain adjustment with a step size of 1 dB. The ALC will hold the output level constant over an input dynamic range of at least 17 dB and will have a minimum output level adjustment of 13 dB in 0.5 dB increments.

The 17/24 GHz BSS payload will use 58 Watt TWTAs which, when combined with the transmit antenna gain, results in a maximum downlink EIRP of 52.5 dBW. The peak transmit antenna gain and associated contours are specified in the accompanying Schedule S. Given the wideband design of this payload, there is no output multiplexer filtering.

A representative link budget for the 17/24 GHz BSS payload of DIRECTV KU-79W is shown in Appendix A as Table A-2. The transmit and receive antenna gain contours for the 17/24 GHz BSS payload are provided in GXT format in the accompanying Schedule S and are also graphically depicted in Appendix B hereto.

As DIRECTV is not applying for authority to operate the 17/24 GHz BSS payload on DIRECTV KU-79W at this time, predicted far off-axis gain performance of the 17 GHz transmit antenna associated with this payload is not being supplied. However, in order to address potential future compatibility of this payload with operational DBS satellites, DIRECTV includes the simple analysis in Table 1 below.

Max EIRP from Sched S (dBW/36 MHz)	52.5
Peak TX Antenna gain from Sched S (dBi)	37.9
Max power into antenna (dBW/36 MHz)	14.6
Max power density into antenna (dBW/100 kHz)	-11.0
Max off axis predicted antenna gain (dBi)	0
Max off-axis EIRP density (dBW/100 kHz)	-11.0
Coordination trigger value (dBW/m <sup>2</sup> /100 kHz)	-117
Reqd spreading loss to meet coord trigger (dB-m <sup>2</sup> )	106.0
Reqd distance to achieve spreading loss (km)	56.5
Geocentric orbital separation equal to 56.5 km (deg)	0.077

**Table 1. Far off-axis 17 GHz PFD analysis for DIRECTV KU-79W**

This analysis demonstrates that, using the maximum EIRP included in the Schedule S and assuming a conservative far off-axis gain of 0 dBi for the 17 GHz transmit antenna, emissions from DIRECTV KU-79W would comply with the -117 dBW/m<sup>2</sup>/100 kHz coordination trigger value specified in Section 25.264 at an orbital separation of 0.077°.

Similarly, using the maximum EIRP of the 17/24 GHz BSS payload specified in the Schedule S, it is straightforward to calculate maximum PFD on the Earth's surface from this satellite as: 53 dBW/36 MHz – 162.4 dB/m<sup>2</sup> spreading loss – 10\*log(36) bandwidth normalizing factor. This calculation results in a maximum PFD of -125 dBW/m<sup>2</sup>/MHz. This value is lower than the lowest value specified in the regional PFD requirements of Section 25.208(w), and lower than the lowest value specified in 25.208(c) for the 17.7-17.8 GHz band.

DIRECTV believes that, because it is not seeking a 17/24 GHz BSS license at this time, it is not required to submit the information required of applicants. Nonetheless, out of an abundance of caution, DIRECTV has requested waivers of such requirements to the extent necessary.



## ENGINEERING CERTIFICATION

The undersigned hereby certifies to the Federal Communications Commission as follows:

- (i) I am the technically qualified person responsible for the engineering information contained in the foregoing Application,
- (ii) I am familiar with Part 25 of the Commission's Rules, and
- (iii) I have either prepared or reviewed the engineering information contained in the foregoing Application, and it is complete and accurate to the best of my knowledge and belief.

Signed:

/s/

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Jack Wengryniuk

July 18, 2013

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Date

## **APPENDIX A**

### **DIRECTV KU-79W LINK BUDGET ANALYSIS**

<b>DIRECTV KU-79W</b>	<b>Mexico</b>	<b>Clear Sky</b>	<b>Rain Dn</b>
<b>Uplink C/N (thermal), dB</b>	Transmit power, dBW	8.0	10.0
	Transmit power density dBW/Hz	-66.8	-64.8
	Transmit losses, dB	-2.0	-2.0
	Ground antenna gain, dB	59.8	59.8
	Antenna pointing loss, dB	-0.5	-0.5
	Free space loss, dB	-207.6	-207.6
	Atmospheric loss, dB	-0.2	-0.2
	Uplink rain loss, dB	0.0	-2.0
	Satellite G/T, dB/K	14.0	14.0
	Bandwidth, dB-Hz	74.0	74.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
<b>Total Uplink C/N</b>		<b>26.1</b>	<b>26.1</b>
<b>Downlink C/N (thermal),dB</b>	Satellite EIRP, dBW/36 MHz	53.0	53.0
	Free space loss, dB	-206.0	-206.0
	Atmospheric loss, dB	-0.2	-0.2
	Downlink rain loss, dB	0.0	-2.5
	Rain temp increase, dB	0.0	-2.7
	Rcv. antenna pointing loss, dB	-0.5	-0.5
	Ground G/T, dB/K	15.2	15.2
	Bandwidth, dB-Hz	74.0	74.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
<b>Total Downlink C/N</b>		<b>16.1</b>	<b>10.9</b>
		<b>Clear Sky</b>	<b>Rain Dn</b>
<b>Totals</b>	Uplink C/N (thermal), dB	26.1	26.1
	Downlink C/N (thermal), dB	16.1	10.9
	x-pol interference, dB	20.0	20.0
	C/I from ASI	11.8	11.8
	<b>Total C/(N+I), dB</b>	<b>9.9</b>	<b>8.0</b>
	<b>Required C/(N+I), dB</b>	<b>6.4</b>	<b>6.4</b>
	<b>Margin, dB</b>	<b>3.5</b>	<b>1.6</b>

**Table A-1. DIRECTV KU-79W Ku-band Link Budget**

<b>DIRECTV KU-79W</b>	<b>Mexico</b>	<b>Clear Sky</b>	<b>Rain</b>
<b>Uplink C/N (thermal), dB</b>	Transmit power, dBW	11.0	16.0
	Transmit power density dBW/Hz	-63.8	-58.8
	Transmit losses, dB	-2.0	-2.0
	Ground antenna gain, dB	64.7	64.7
	Antenna pointing loss, dB	-0.5	-0.5
	Free space loss, dB	-212.4	-212.4
	Atmospheric loss, dB	-0.2	-0.2
	Uplink rain loss, dB	0.0	-5.0
	Satellite G/T, dB/K	11.0	11.0
	Bandwidth, dB-Hz	74.0	74.0
	Boltzmann's constant, dBW/Hz-K	228.6	228.6
<b>Total Uplink C/N</b>		<b>26.1</b>	<b>26.1</b>
<b>Downlink C/N (thermal),dB</b>	Satellite EIRP, dBW/36 MHz	52.5	52.5
	Free space loss, dB	-209.4	-209.4
	Atmospheric loss, dB	-0.2	-0.2
	Downlink rain loss, dB	0.0	-5.8
	Rain temp increase, dB	0.0	-3.9
	Rcv. antenna pointing loss, dB	-0.5	-0.5
	Ground G/T, dB/K	21.4	21.4
	Bandwidth, dB-Hz	74.0	74.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
<b>Total Downlink C/N</b>		<b>18.4</b>	<b>8.7</b>
		<b>Clear Sky</b>	<b>Rain</b>
<b>Totals</b>	Uplink C/N (thermal), dB	26.1	26.1
	Downlink C/N (thermal), dB	18.4	8.7
	x-pol interference, dB	20.0	20.0
	C/I from ASI	15.4	15.4
	<b>Total C/(N+I), dB</b>	<b>12.5</b>	<b>7.5</b>
	<b>Required C/(N+I), dB</b>	<b>6.4</b>	<b>6.4</b>
	<b>Margin, dB</b>	<b>6.1</b>	<b>1.1</b>

**Table A-2. DIRECTV KU-79W 17/24 GHz BSS Link Budget**

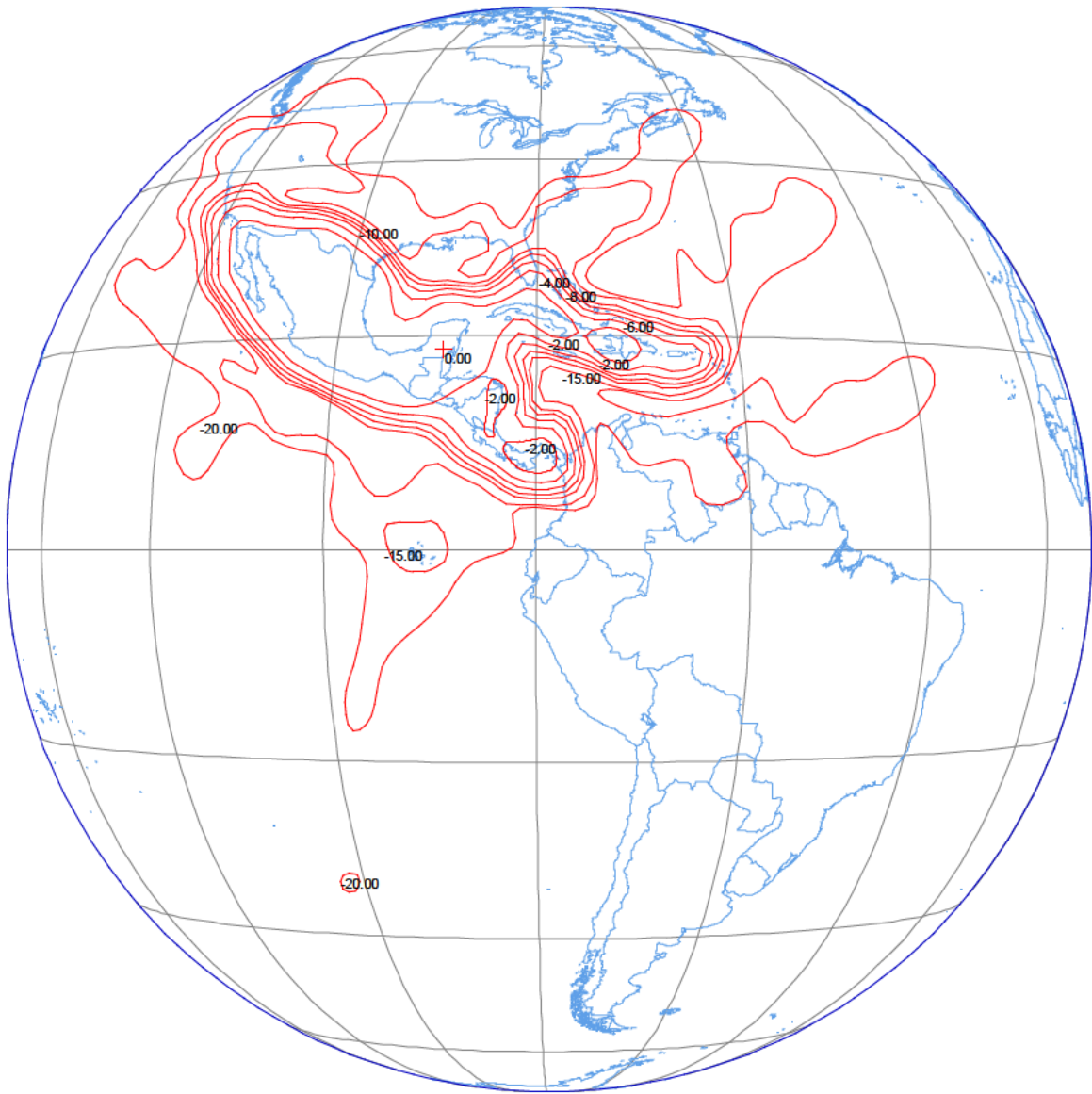
## **APPENDIX B**

### **ANTENNA BEAM CONTOURS**





**Figure B-1. DIRECTV KU-79W Ku-Band Receive Beam**



**Figure B-2. DIRECTV KU-79W Ku-Band Transmit Beam**



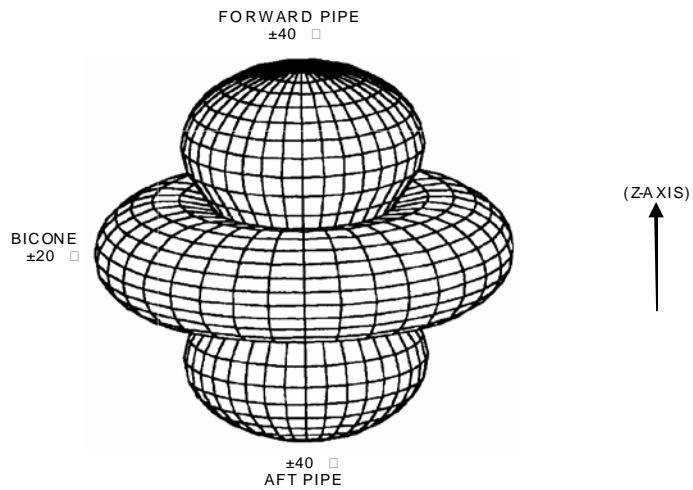
**Figure B-3. DIRECTV KU-79W 17/24 GHz BSS Receive Beam**



**Figure B-4. DIRECTV KU-79W 17/24 GHz BSS Transmit Beam**



**Figure B-5. DIRECTV KU-79W TTAC TX/RX Global Horn**



**Figure B-6. DIRECTV KU-79W Wide Beam TT&C Antenna Coverage**

## **APPENDIX C**

### **TT&C LINK BUDGETS**

Satellite EIRP (dBW/106 kHz)	15.0	15.0
Free space loss, dB	-206.0	-206.0
Atmospheric loss, dB	-0.2	-0.2
Downlink rain loss, dB	0.0	-2.5
Rain temp increase, dB	0.0	-2.2
Rcv. antenna pointing loss, dB	-0.5	-0.5
Ground G/T, dB/K	35.9	35.9
Bandwidth, dB-Hz	50.3	50.3
Boltzmann's constant, dBW/Hz K	228.6	228.6
Total Downlink C/N (dB)	22.5	17.8
Reqd C/N (dB)	10.0	10.0
Margin (dB)	12.5	7.8

**Table C-1. DIRECTV KU-79W On-Station Telemetry Link Budget**

CMD Frequency (MHz)	14005.0
Sat. min flux density (dBW/m <sup>2</sup> )	-96.0
Isotropioc area (dB-m <sup>2</sup> )	-44.4
Antenna gain (dBi)	25.8
Receive losses (dB)	19.0
CMD rcvr input power (dBm)	-105.6
CMD rcvr threshold (dBm)	-122.0
Margin (dB)	18.4

**Table C-2. DIRECTV KU-79W On-Station Command Link Budget**