



File # SAT-MOD-20041122-00212
with attached conditions

Call Sign S2133 Grant Date Feb 10, 2005
(or other identifier)

Approved by OMB
3060-0678

Term Dates

From See Conditions To: See Conditions

Approved: [Signature] *Chief Satellite Engineering Branch*
Robert G. Nelson

Date & Time Filed: Nov 22 2004 10:01:18:006AM
File Number: SAT-MOD-20041122-00212

| | |
|--|--------------|
| FCC APPLICATION FOR SPACE AND EARTH STATION:MOD OR AMD – MAIN FORM | FCC Use Only |
| FCC 312 MAIN FORM FOR OFFICIAL USE ONLY | |

APPLICANT INFORMATION

Enter a description of this application to identify it on the main menu:

DIRECTV GROUP F312 SW2 S2133 (@ 99.2 WL)

| | | | |
|------------------------------|--------------------------|----------------------|------------------------|
| 1-8. Legal Name of Applicant | | | |
| Name: | The DIRECTV Group, Inc. | Phone Number: | 310-964-0725 |
| DBA Name: | | Fax Number: | 310-964-0843 |
| Street: | 2250 E. Imperial Highway | E-Mail: | dapattillo@directv.com |
| City: | El Segundo | State: | CA |
| Country: | USA | Zipcode: | 90245 - |
| Attention: | David Pattillo | | |

Attachment
Conditions of Authorization
February 10, 2005

1. The DIRECTV Group, Inc.'s ("DIRECTV") request, File No. SAT-MOD-20041122-00212, to modify its authorization, SAT-MOD-20040614-00113, Call Sign S2133, to relocate its authorized orbital location from 99.05° W.L. to 99.20° W.L. IS GRANTED. Accordingly, DIRECTV is authorized to launch and operate its SPACEWAY-2 Ka-band satellite into the 99.20° W.L. orbit location, in the 18.365-18.53 GHz, 18.57-18.735 GHz, 19.7-20.2 GHz, 28.36-28.525 GHz, 29.26-29.425 GHz, and 29.5-30.0 GHz frequency bands in accordance with the terms, conditions, and technical specifications set forth in its application, this Attachment, and the Federal Communications Commission's ("Commission") Rules.
2. All conditions of the November 4, 2004 grant with the exception of the assigned orbital location otherwise remain in effect.¹
3. DIRECTV is afforded thirty days from the date of release of this grant and authorization to decline this authorization as conditioned. Failure to respond within this period will constitute formal acceptance of the authorization as conditioned.
4. This Grant is issued pursuant to Section 0.261 of the Commission's rules on delegated authority, 47 C.F.R. § 0.261, and is effective upon release. Petitions for reconsideration under Section 1.106 or applications for review under Section 1.115 of the Commission's rules, 47 C.F.R. §§ 1.106, 1.115, may be filed within 30 days of the date of the public notice indicating that this action was taken.

¹ See The DirecTV Group, Inc. SAT-MOD-20040614-00113, Grant November 4, 2004 Attached Conditions of Grant, modifying previous authorization – see In the Matter of Hughes Communications Galaxy Inc. Application for Authority to Construct, Launch, and Operate a Ka-band Satellite System in the Fixed Satellite Service and a Ku-band Broadcast Communications Satellite System, Order and Authorization, 13 FCC Rcd 1351 (1997) ("Hughes Authorization Order"), See also In the Matter of Hughes Communications Galaxy Inc. Application for Authority to Construct, Launch, and Operate a Ka-band Satellite System in the Fixed Satellite Service and a Ku-band, Order and Authorization, 16 FCC Rcd 2470 (200 1) ("Hughes ISL Milestone Authorization Order"); and See also In the Matter of Hughes Communications Galaxy Inc. Application for Authority to Construct, Launch, and Operate a Ka-band Satellite System in the Fixed Satellite Service and a Ku-band, Order and Authorization, 16 FCC Rcd 12627 (200 1).

9-16. Name of Contact Representative (If other than applicant)

| | | | |
|-----------------------|---|----------------------|---------------|
| Name: | William M. Wiltshire | Phone Number: | 202-730-1350 |
| Company: | Harris, Wiltshire & Grannis LLP | Fax Number: | 202-730-1301 |
| Street: | 1200 Eighteenth St., N.W. 12th Floor | E-Mail: | |
| City: | Washington | State: | DC |
| Country: | USA | Zipcode: | 20036- |
| Contact Title: | | Relationship: | Legal Counsel |

CLASSIFICATION OF FILING

17. Choose the button next to the classification that applies to this filing for both questions a. and b. Choose only one for 17a and only one for 17b.

- a1. Earth Station
- a2. Space Station

- (N/A) b1. Application for License of New Station
- (N/A) b2. Application for Registration of New Domestic Receive-Only Station
- (N/A) b3. Amendment to a Pending Application
- (N/A) b4. Modification of License or Registration
- b5. Assignment of License or Registration
- b6. Transfer of Control of License or Registration
- (N/A) b7. Notification of Minor Modification
- (N/A) b8. Application for License of New Receive-Only Station Using Non-U.S. Licensed Satellite
- (N/A) b9. Letter of Intent to Use Non-U.S. Licensed Satellite to Provide Service in the United States
- (N/A) b10. Other (Please specify)

| | |
|--|---|
| <p>17c. Is a fee submitted with this application?</p> <p><input checked="" type="radio"/> If Yes, complete and attach FCC Form 159. If No, indicate reason for fee exemption (see 47 C.F.R. Section 1.1114).</p> <p><input type="radio"/> Governmental Entity <input type="radio"/> Noncommercial educational licensee</p> <p><input type="radio"/> Other (please explain):</p> | |
| <p>17d.</p> <p>Fee Classification BFY – Space Station Modification (Geostationary)</p> | |
| <p>18. If this filing is in reference to an existing station, enter:</p> <p>(a) Call sign of station: S2133</p> | <p>19. If this filing is an amendment to a pending application enter both fields, if this filing is a modification please enter only the file number:</p> <p>(a) Date pending application was filed: (b) File number: SATMOD2004061400113</p> |

TYPE OF SERVICE

20. NATURE OF SERVICE: This filing is for an authorization to provide or use the following type(s) of service(s): Select all that apply:

- a. Fixed Satellite
- b. Mobile Satellite
- c. Radiodetermination Satellite
- d. Earth Exploration Satellite
- e. Direct to Home Fixed Satellite
- f. Digital Audio Radio Service
- g. Other (please specify)

21. STATUS: Choose the button next to the applicable status. Choose only one.

- Common Carrier Non-Common Carrier

22. If earth station applicant, check all that apply.

- Using U.S. licensed satellites
- Using Non-U.S. licensed satellites

23. If applicant is providing INTERNATIONAL COMMON CARRIER service, see instructions regarding Sec. 214 filings. Choose one. Are these facilities:

- Connected to a Public Switched Network Not connected to a Public Switched Network N/A

24. FREQUENCY BAND(S): Place an 'X' in the box(es) next to all applicable frequency band(s).

- a. C-Band (4/6 GHz) b. Ku-Band (12/14 GHz)
- c. Other (Please specify upper and lower frequencies in MHz.)

Frequency Lower: 18300

Frequency Upper: 30000

(Please specify additional frequencies in an attachment)

TYPE OF STATION

25. CLASS OF STATION: Choose the button next to the class of station that applies. Choose only one.

- a. Fixed Earth Station
- b. Temporary-Fixed Earth Station
- c. 12/14 GHz VSAT Network
- d. Mobile Earth Station
- e. Geostationary Space Station
- f. Non-Geostationary Space Station
- g. Other (please specify)

26. TYPE OF EARTH STATION FACILITY:

- Transmit/Receive Transmit-Only Receive-Only N/A

"For Space Station applications, select N/A."

PURPOSE OF MODIFICATION

27. The purpose of this proposed modification is to: (Place an 'X' in the box(es) next to all that apply.)

- a — authorization to add new emission designator and related service
- b — authorization to change emission designator and related service
- c — authorization to increase EIRP and EIRP density
- d — authorization to replace antenna
- e — authorization to add antenna
- f — authorization to relocate fixed station
- g — authorization to change frequency(ies)
- h — authorization to add frequency
- i — authorization to add Points of Communication (satellites & countries)
- j — authorization to change Points of Communication (satellites & countries)
- k — authorization for facilities for which environmental assessment and radiation hazard reporting is required
- l — authorization to change orbit location
- m — authorization to perform fleet management
- n — authorization to extend milestones
- o — Other (Please specify)

ENVIRONMENTAL POLICY

28. Would a Commission grant of any proposal in this application or amendment have a significant environmental impact as defined by 47 CFR 1.1307? If YES, submit the statement as required by Sections 1.1308 and 1.1311 of the Commission's rules, 47 C.F.R. 1.1308 and 1.1311, as an exhibit to this application. A Radiation Hazard Study must accompany all applications for new transmitting facilities, major modifications, or major amendments. Yes No

ALIEN OWNERSHIP Earth station applicants not proposing to provide broadcast, common carrier, aeronautical en route or aeronautical fixed radio station services are not required to respond to Items 30–34.

| | |
|---|---|
| 29. Is the applicant a foreign government or the representative of any foreign government? | <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A |
| 30. Is the applicant an alien or the representative of an alien? | <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A |
| 31. Is the applicant a corporation organized under the laws of any foreign government? | <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A |
| 32. Is the applicant a corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country? | <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A |

33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country? Yes No N/A

34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as an exhibit an identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote. Exhibit A

BASIC QUALIFICATIONS

35. Does the Applicant request any waivers or exemptions from any of the Commission's Rules? Yes No
If Yes, attach as an exhibit, copies of the requests for waivers or exceptions with supporting documents.

36. Has the applicant or any party to this application or amendment had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as an exhibit, an explanation of circumstances. Yes No

37. Has the applicant, or any party to this application or amendment, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? If Yes, attach as an exhibit, an explanation of circumstances.

Yes No

38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement or any other means or unfair methods of competition? If Yes, attach as an exhibit, an explanation of circumstances

Yes No

39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceding two items? If yes, attach as an exhibit, an explanation of the circumstances.

Yes No

40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit the names, address, and citizenship of those stockholders owning a record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries. Also list the names and addresses of the officers and directors of the Filer. Exhibit B

41. By checking Yes, the undersigned certifies, that neither applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application"; for these purposes.

Yes No

42a. Does the applicant intend to use a non-U.S. licensed satellite to provide service in the United States? If Yes, answer 42b and attach an exhibit providing the information specified in 47 C.F.R. 25.137, as appropriate. If No, proceed to question 43.

Yes No

42b. What administration has licensed or is in the process of licensing the space station? If no license will be issued, what administration has coordinated or is in the process of coordinating the space station?

43. Description. (Summarize the nature of the application and the services to be provided). (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

The DIRECTV Group, Inc. seeks to modify its existing license to operate at 99.2 WL rather than 99.05 WL. Please see Exhibit C for further information.

Exhibit C

CERTIFICATION

The Applicant waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise, and requests an authorization in accordance with this application. The applicant certifies that grant of this application would not cause the applicant to be in violation of the spectrum aggregation limit in 47 CFR Part 20. All statements made in exhibits are a material part hereof and are incorporated herein as if set out in full in this application. The undersigned, individually and for the applicant, hereby certifies that all statements made in this application and in all attached exhibits are true, complete and correct to the best of his or her knowledge and belief, and are made in good faith.

44. Applicant is a (an): (Choose the button next to applicable response.)

- Individual
- Unincorporated Association
- Partnership
- Corporation
- Governmental Entity
- Other (please specify)

45. Name of Person Signing
Romulo Pontual

→

46. Title of Person Signing
Exec. VP & Chief Technology Officer

**WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND / OR IMPRISONMENT
(U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION
(U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).**

FCC NOTICE REQUIRED BY THE PAPERWORK REDUCTION ACT

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THE FOREGOING NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104-13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507.

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

| | |
|---|------------------|
| _____) | |
| <i>Application of</i>) | |
|) | |
| THE DIRECTV GROUP, INC.) | Call Sign: S2133 |
|) | |
| For Minor Modification to Offset) | File No. _____ |
| Operation of the SPACEWAY 2) | |
| Ka-band Satellite from 99.05° W.L. to) | |
| 99.2° W.L.) | |
| _____) | |

APPLICATION FOR MINOR MODIFICATION

The DIRECTV Group, Inc. (“DIRECTV”) hereby requests that the Commission modify its authorization for a geostationary Ka-band satellite system at the nominal 99° W.L. orbital location¹ to allow DIRECTV to operate at a slight offset – specifically, at 99.2° W.L. This very minor repositioning of the satellite (combined with a similar offset of a companion Ka-band satellite at 103° W.L.) will have major benefits for subscribers receiving Direct-to-Home (“DTH”) satellite services from this slot, as it will enable them to receive a high-quality signal using a smaller dish, and will thereby promote competition as well. In addition, this slight offset will enhance orbital management and decrease the likelihood of in-orbit collision with other satellites. Moreover, as demonstrated herein, the proposed minor modification is anticipated by Commission rules and will not increase harmful interference to any other satellite system. In fact, the only satellite operator potentially affected is a

¹ See Public Notice, DA 04-3529 (rel. Nov. 5, 2004) (granting modification application for SPACEWAY 2 satellite) (“Mod PN”).

DIRECTV subsidiary licensed to operate at the nominal 101° W.L. slot, which will still be able to use its Ka-band frequencies for their intended purpose.

DIRECTV intends to launch its SPACEWAY 2 satellite in the spring of next year. Accordingly, expedited consideration of this Application is warranted.

I. CHANGES TO PREVIOUS TECHNICAL INFORMATION

In this Application, DIRECTV seeks neither additional spectrum nor additional orbital resources, but only a slight offset from its current licensed location consistent with the Commission's rules. In accordance with Section 25.117(d)(1) of the Commission's rules, DIRECTV identifies in this Application and Technical Annex only those items of information that have changed from its station license and associated application.²

DIRECTV hereby certifies that the remaining information in its station license and associated application has not changed.

In this case, the only aspects of the satellite's operations reflected in the Technical Annex that will change as a result of moving the satellite from 99.05° W.L.³ to 99.2° W.L. will be:

- Slightly revised sample link budgets for operations at this slightly offset location.
- Slightly revised sample link budgets for Ka-band operations from the nominal 101° W.L. orbital location, demonstrating that moving SPACEWAY 2 toward that slot will

² This Application also includes revised ownership information that reflects the reincorporation of News Corporation in the United States.

³ At the time the Commission assigned Ka-band orbital locations in the first processing round, the applicants for orbital locations between 95° W.L. and 105° W.L. agreed to operate their satellites with a nominal 0.05° offset to the west in order to increase separation from a Luxembourg satellite filing at 93.2° W.L. See *Assignment of Orbital Locations to Space Stations in the Ka-Band*, 13 FCC Rcd. 1030, Appendix A (Int'l Bur. 1997). This offset was recently made part of the SPACEWAY 2 authorization. See Mod PN at 2.

not cause harmful interference to its intended service.⁴ (The requested western offset will move the satellite away from the Ka-band slots to the east (including at 97° W.L.), and so will not increase interference to operations at those locations.)

Because moving the satellite only 0.15° will have a *de minimis* affect on the predicted gain contours, revised contours have not been submitted.

II. THE PROPOSED MODIFICATION WOULD SERVE THE PUBLIC INTEREST

DIRECTV is currently authorized to operate a Ka-band system at the 99.05° W.L. orbital location. As contemplated under Section 25.210(j)(3) of the Commission's rules,⁵ DIRECTV requests that it be authorized to operate at a slight offset from this nominal location, at 99.2° W.L. Although the requested offset is very small – just 0.15° W.L. – it will create large benefits for consumers through improved system performance. Specifically, when combined with a similar (albeit eastward) offset DIRECTV has requested for the companion SPACEWAY 1 Ka-band satellite authorized to operate at 103° W.L., this very slight relocation of the satellite will enable DIRECTV to reduce the size of the satellite dish used by consumers to receive DIRECTV's Ka-band DTH signals. As a result, DIRECTV subscribers will be able to use a single dish of a consumer-friendly size to receive high definition programming (including HD local-into-local signals) from two Ka-band slots, as well as programming from DIRECTV's DBS slots at 101° W.L., 110° W.L., and 119° W.L. This will promote consumer acceptance of DIRECTV's new HD services and help

⁴ Note that these revised link budgets for 101° W.L. actually reflect operations of DIRECTV 8 from 100.85° W.L. and also include the effect of the companion shift of the SPACEWAY 1 satellite from 103.05° W.L. to 102.8° W.L.

⁵ 47 C.F.R. § 25.210(j)(3) (operations may be authorized at assigned orbital longitudes offset by 0.05° or multiples thereof from the nominal orbital location specified in the station authorization).

DIRECTV continue to provide robust competition to cable operators and other multichannel video programming distributors, to the benefit of the American public.

Moreover, DIRECTV's proposal will achieve this improved performance and enhanced competition without causing harmful interference to any other operator. In fact, as common sense would indicate, by moving slightly away from the adjacent 97° W.L. Ka-band orbital location licensed to EchoStar, DIRECTV will not increase interference to that slot (or any other slots located further East). The proposed offset will move SPACEWAY 2 slightly closer to the 101° W.L. Ka-band orbital location licensed to a DIRECTV subsidiary (DIRECTV Enterprises, LLC), which is planning to launch and operate DIRECTV 8, a hybrid DBS/Ka-band satellite, next year. However, as the attached Technical Annex demonstrates, the proposed offset will not prevent DIRECTV 8 from using its Ka-band payload for its intended function of backhauling local programming from remote sites to DIRECTV's broadcast centers.

In addition, this slight offset will allow DIRECTV to operate SPACEWAY 2 in a station keeping volume that does not overlap with the other space station (Galaxy IV(R)) operating at the nominal 99° W.L. orbital location.⁶ This proposal will therefore advance the Commission's goal of decreasing the risk of in-orbit collision between space stations⁷ and also enhance the efficiency with which orbital resources are used.

⁶ No other U.S. systems are currently seeking Commission authorization to operate at this nominal orbital location. Internationally, Canada, France, and United Kingdom currently have coordination requests on file at the ITU for satellite networks at 99° W.L., but DIRECTV has found no evidence that satellite construction contracts have been awarded for any of these networks, and the FAA Commercial Space Station Second Quarter 2004 Report shows no pending launch for any of these networks.

⁷ See, e.g., *Mitigation of Orbital Debris*, 19 FCC Rcd. 11567, 11588 (2004)(adopting requirements for GEO applicants to assess and coordinate station keeping volumes of any known satellites located at, or reasonably expected to be located at, a requested orbital location).

Thus, the proposed offset will have a direct and positive impact on the customer experience of the DIRECTV service, further enhance competition, and enhance orbital risk management – all without negatively impacting the operations of the DIRECTV system or any other satellite system. The public interest clearly would be served by a grant of the Application.

III. WAIVER PURSUANT TO SECTION 304 OF THE COMMUNICATIONS ACT

In accordance with Section 304 of the Communications Act of 1934, as amended, 47 U.S.C. § 304, DIRECTV hereby 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.

IV. CONCLUSION

The proposed 0.15° offset of SPACEWAY 2 from its currently licensed orbital location will enable DIRECTV to use a more consumer-friendly receive antenna that will allow it to continue to provide the most potent competition possible to entrenched cable operators. Moreover, this important improvement in performance for DIRECTV's system will not compromise the operational abilities of any other satellite system, and in fact will allow for safer and more effective management of orbital resources.

For these reasons, DIRECTV submits that the proposed minor modification request is in the public interest and respectfully requests that the Commission expeditiously grant this request.

Respectfully submitted,

THE DIRECTV GROUP, INC.

By: /s/
Romulo Pontual
Executive Vice President and Chief
Technology Officer

ENGINEERING CERTIFICATION

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

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

Signed:

/s/

Jack Wengryniuk
Senior Director
DIRECTV Operations Inc.

November 18, 2004

Date

TECHNICAL

ANNEX

SPACEWAY 2 Offset Operation Link Budget – DTH

| SPACEWAY 2 A Band DTH, 99.2W | New York | Clear Sky | Rain Dn |
|----------------------------------|--|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 5.1 | 5.1 |
| Los Angeles | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.8 | 66.8 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.4 | -213.4 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 15.8 | 15.8 |
| | Bandwidth, dB-Hz | -73.0 | -73.0 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 26.3 | 26.3 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/24 MHz | 58.4 | 58.4 |
| New York | Free space loss, dB | -210.1 | -210.1 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -4.1 |
| | Rain temp increase, dB | 0.0 | -3.2 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Antenna wetting + noise increase, dB | 0.0 | -1.0 |
| | Ground G/T, dB/K | 19.1 | 19.1 |
| | Bandwidth, dB-Hz | -73.0 | -73.0 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 21.5 | 13.2 |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 26.3 | 26.3 |
| | Downlink C/N (thermal), dB | 21.5 | 13.2 |
| | Total inter and intra-system C/I, dB (incl. x-pol, ASI, ACI, ABI, TX E/S) | 18.5 | 18.5 |
| | Total C/(N+I), dB | 16.3 | 11.9 |
| | Required C/(N+I), dB (includes implementation margin) | 8.9 | 8.9 |
| | Margin, dB | 7.4 | 3.0 |

SPACEWAY 2 Offset Operation Link Budget – 24 MHz Backhaul

| SPACEWAY 2 B Band Backhaul, 99.2W | CRK-LA Backhaul | Clear Sky | Rain Dn |
|--------------------------------------|--|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 10.2 | 10.2 |
| Castle Rock | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.7 | 66.7 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.3 | -213.3 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 13.1 | 13.1 |
| | Bandwidth, dB-Hz | -73.0 | -73.0 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 28.7 | 28.7 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/24 MHz | 24.0 | 24.0 |
| Los Angeles | Free space loss, dB | -209.3 | -209.3 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -1.4 |
| | Rain temp increase, dB | 0.0 | -1.5 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Antenna wetting + noise increase, dB | 0.0 | -1.0 |
| | Ground G/T, dB/K | 39.3 | 39.3 |
| | Bandwidth, dB-Hz | -73.0 | -73.0 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 8.2 | 4.3 |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 28.7 | 28.7 |
| | Downlink C/N (thermal), dB | 8.2 | 4.3 |
| | Total inter and intra-system C/I, dB (incl. x-pol, ASI, ACI, ABI, TX E/S) | 13.4 | 13.4 |
| | Total C/(N+I), dB | 7.0 | 3.8 |
| | Required C/(N+I), dB (includes implementation margin) | 1.9 | 1.9 |
| | Margin, dB | 5.1 | 1.9 |

SPACEWAY 2 Offset Operation Link Budget – 36 MHz Backhaul

| SPACEWAY 2 B Band Backhaul, 99.2W | CRK-LA Backhaul | Clear Sky | Rain Dn |
|--------------------------------------|--|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 12.0 | 12.0 |
| Castle Rock | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.7 | 66.7 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.3 | -213.3 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 13.1 | 13.1 |
| | Bandwidth, dB-Hz | -74.8 | -74.8 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 28.7 | 28.7 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/36 MHz | 27.0 | 27.0 |
| Los Angeles | Free space loss, dB | -209.3 | -209.3 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -1.4 |
| | Rain temp increase, dB | 0.0 | -1.5 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Antenna wetting + noise increase, dB | 0.0 | -1.0 |
| | Ground G/T, dB/K | 39.3 | 39.3 |
| | Bandwidth, dB-Hz | -74.8 | -74.8 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 9.4 | 5.5 |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 28.7 | 28.7 |
| | Downlink C/N (thermal), dB | 9.4 | 5.5 |
| | Total inter and intra-system C/I, dB (incl. x-pol, ASI, ACI, ABI, TX E/S) | 14.6 | 14.6 |
| | Total C/(N+I), dB | 8.2 | 5.0 |
| | Required C/(N+I), dB (includes implementation margin) | 1.9 | 1.9 |
| | Margin, dB | 6.3 | 3.1 |

SPACEWAY 2 Offset Operation Link Budget – 54 MHz Backhaul

| SPACEWAY 2 B Band Backhaul, 99.2W | CRK-LA Backhaul | Clear Sky | Rain Dn |
|--------------------------------------|--|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 12.7 | 12.7 |
| Castle Rock | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.7 | 66.7 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.3 | -213.3 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 13.1 | 13.1 |
| | Bandwidth, dB-Hz | -76.5 | -76.5 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 27.6 | 27.6 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/54 MHz | 27.0 | 27.0 |
| Los Angeles | Free space loss, dB | -209.3 | -209.3 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -1.4 |
| | Rain temp increase, dB | 0.0 | -1.5 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Antenna wetting + noise increase, dB | 0.0 | -1.0 |
| | Ground G/T, dB/K | 39.3 | 39.3 |
| | Bandwidth, dB-Hz | -76.5 | -76.5 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 7.6 | 3.7 |
| | | | |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 27.6 | 27.6 |
| | Downlink C/N (thermal), dB | 7.6 | 3.7 |
| | Total inter and intra-system C/I, dB (incl. x-pol, ASI, ACI, ABI, TX E/S) | 12.9 | 12.9 |
| | | | |
| | Total C/(N+I), dB | 6.5 | 3.2 |
| | Required C/(N+I), dB (includes implementation margin) | 1.9 | 1.9 |
| | | | |
| | Margin, dB | 4.6 | 1.3 |

DIRECTV 8 Pinched Operation Ka Band Link Budget – 24 MHz Backhaul

| DIRECTV 8 Ka Band, 100.85W | Backhaul – PINCHED | Clear Sky | Rain Dn |
|----------------------------------|---------------------------------|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 13.7 | 13.7 |
| Castle Rock | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.8 | 66.8 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.3 | -213.3 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 8.9 | 8.9 |
| | Bandwidth, dB-Hz | -73.0 | -73.0 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 28.1 | 28.1 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/24 MHz | 41.8 | 41.8 |
| Los Angeles | Free space loss, dB | -209.9 | -209.9 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -9.3 |
| | Rain temp increase, dB | 0.0 | -3.7 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Ground G/T, dB/K | 41.0 | 41.0 |
| | Bandwidth, dB-Hz | -73.0 | -73.0 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 27.0 | 13.9 |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 28.1 | 28.1 |
| | Downlink C/N (thermal), dB | 27.0 | 13.9 |
| | x-pol interference, dB | 22.9 | 22.9 |
| | Aggregate C/I from ASI | 29.3 | 29.3 |
| | Aggregate C/I from TX E/S (U/L) | 35.6 | 35.6 |
| | Total C/(N+I), dB | 19.9 | 13.1 |
| | Required C/(N+I), dB | 9.0 | 9.0 |
| | Margin, dB | 10.9 | 4.1 |

DIRECTV 8 Pinched Operation Ka Band Link Budget – 36 MHz Backhaul

| DIRECTV 8 Ka Band, 100.85W | Backhaul – PINCHED | Clear Sky | Rain Dn |
|----------------------------------|---------------------------------|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 13.7 | 13.7 |
| Castle Rock | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.8 | 66.8 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.3 | -213.3 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 8.9 | 8.9 |
| | Bandwidth, dB-Hz | -75.5 | -75.5 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 25.6 | 25.6 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/36 MHz | 41.8 | 41.8 |
| Los Angeles | Free space loss, dB | -209.9 | -209.9 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -9.3 |
| | Rain temp increase, dB | 0.0 | -3.7 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Ground G/T, dB/K | 41.0 | 41.0 |
| | Bandwidth, dB-Hz | -75.5 | -75.5 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 24.5 | 11.4 |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 25.6 | 25.6 |
| | Downlink C/N (thermal), dB | 24.5 | 11.4 |
| | x-pol interference, dB | 22.9 | 22.9 |
| | Aggregate C/I from ASI | 27.5 | 27.5 |
| | Aggregate C/I from TX E/S (U/L) | 33.9 | 33.9 |
| | Total C/(N+I), dB | 18.6 | 10.9 |
| | Required C/(N+I), dB | 9.0 | 9.0 |
| | Margin, dB | 9.6 | 1.9 |

DIRECTV 8 Pinched Operation Ka Band Link Budget – 54 MHz Backhaul

| DIRECTV 8 Ka Band, 100.85W | Backhaul – PINCHED | Clear Sky | Rain Dn |
|----------------------------------|---------------------------------|------------------|----------------|
| Uplink C/N (thermal), dB | Transmit power, dBW | 13.7 | 13.7 |
| Castle Rock | Transmit losses, dB | -2.0 | -2.0 |
| | Ground antenna gain, dB | 66.8 | 66.8 |
| | Antenna pointing loss, dB | -0.5 | -0.5 |
| | Free space loss, dB | -213.3 | -213.3 |
| | Atmospheric loss, dB | -1.1 | -1.1 |
| | Uplink rain loss, dB | 0.0 | 0.0 |
| | Satellite G/T, dB/K | 8.9 | 8.9 |
| | Bandwidth, dB-Hz | -76.5 | -76.5 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Uplink C/N | | 24.6 | 24.6 |
| Downlink C/N (thermal),dB | Satellite EIRP, dBW/54 MHz | 41.8 | 41.8 |
| Los Angeles | Free space loss, dB | -209.9 | -209.9 |
| | Atmospheric loss, dB | -1.0 | -1.0 |
| | Downlink rain loss, dB | 0.0 | -9.3 |
| | Rain temp increase, dB | 0.0 | -3.7 |
| | Rcv. antenna pointing loss, dB | -0.5 | -0.5 |
| | Ground G/T, dB/K | 41.0 | 41.0 |
| | Bandwidth, dB-Hz | -76.5 | -76.5 |
| | Boltzmann's constant, dBW/Hz K | 228.6 | 228.6 |
| Total Downlink C/N | | 23.5 | 10.4 |
| | | Clear Sky | Rain Dn |
| Totals | Uplink C/N (thermal), dB | 24.6 | 24.6 |
| | Downlink C/N (thermal), dB | 23.5 | 10.4 |
| | x-pol interference, dB | 22.9 | 22.9 |
| | Aggregate C/I from ASI | 25.8 | 25.8 |
| | Aggregate C/I from TX E/S (U/L) | 32.1 | 32.1 |
| | Total C/(N+I), dB | 17.9 | 9.9 |
| | Required C/(N+I), dB | 9.0 | 9.0 |
| | Margin, dB | 8.9 | 0.9 |