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

Application of	)	
DIRECTV ENTERPRISES, LLC	)	File No. _____
For Authorization to Operate DIRECTV 1R, a Direct Broadcast Satellite, as an In-Orbit Spare at 109.8° W.L.	)	

APPLICATION FOR AUTHORIZATION TO OPERATE DIRECTV 1R, A DIRECT BROADCAST SATELLITE

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APPLICATION FOR AUTHORIZATION TO OPERATE DIRECTV 1R, A DIRECT BROADCAST SATELLITE

DIRECTV Enterprises, LLC ("DIRECTV") hereby requests authorization to operate DIRECTV 1R, a satellite in the Direct Broadcast Satellite ("DBS") service, at the 109.8° W.L. orbital location. This satellite will operate as an in-orbit spare for DIRECTV's existing fleet of DBS satellites, prepared to ensure continuity of service to millions of DIRECTV subscribers. Although the only authority necessary at this time relates to the telemetry, tracking, and control ("TT&C") functions necessary to stationkeep the satellite, DIRECTV is providing all information related to the satellite's communications functions in the interest of a complete record.

I. BACKGROUND

DIRECTV currently operates a DBS system consisting of six high-power DBS satellites at the nominal 101° W.L., 110° W.L., 119° W.L. and 72.5° W.L. orbital locations, as well as five Ka-band satellites at three orbital locations. Using these assets, DIRECTV offers more than 2,000 digital video and audio channels of entertainment,

educational and informational programming to more than 19 million subscribers throughout the United States who receive this programming using small dish antennas.

From its launch in October 1999 until March 2007, DIRECTV 1R operated under a Commission-issued license at the 101° W.L. orbital location.[1] In 2007, the satellite was relocated to the 72.5° W.L. position allocated to Canada under the ITU's Region 2 Plan for the Broadcast Satellite Service, at which time the satellite's U.S. license was terminated.[2] The satellite currently operates pursuant to a Canadian authorization to provide local-into-local programming to DIRECTV subscribers in four markets. The arrangement between DIRECTV and Telesat Canada for operation at 72.5° W.L. will soon expire, and DIRECTV will transition the last four of the markets previously served from that location to its other satellites in its fleet. Accordingly, DIRECTV seeks to re-license DIRECTV 1R once again as a U.S.-flagged space station that will act as an in-orbit spare at the nominal 110° W.L. orbital location.[3]

II. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST

Authorizing DIRECTV to operate the DIRECTV 1R satellite as an in-orbit spare will increase the reliability of DIRECTV's satellite constellation. The satellite will afford DIRECTV the flexibility of back-up capabilities over all of the DBS channels at all three of the orbital locations at which DIRECTV is authorized to provide DBS services. This

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1 *See DIRECTV Enterprises, Inc.*, 14 FCC Rcd. 13159 (Int'l Bur. 1999).

2 *See* Stamp Grant, IBFS File No. SAT-STA-20061213-00149 (granted Mar. 8, 2007); Public Notice, Rep. No. SES-00909, IBFS File No. SES-MFS-20061213-02157 (Mar. 14, 2007) (together, authorizing relocation of DIRECTV 1R and receipt of signals from that Canadian orbital location by small receive dishes in the U.S.).

3 DIRECTV will file a separate application for special temporary authority to cover DIRECTV 1R's drift from 72.5° W.L. to 110° W.L.

capability will provide important redundancy for a service that consumers expect to receive without interruption and with the highest possible signal quality.

As a back-up satellite, DIRECTV 1R will be prepared to provide full, 50-state coverage via three national beam transponders from 110° W.L., or could be involved in various fleet management maneuvers in case of a satellite anomaly at either of DIRECTV's other DBS orbital locations at 101° W.L. or 119° W.L. This capability will ensure continuity of service to the millions of DIRECTV subscribers (including those in Alaska and Hawaii) who currently receive service from these orbital locations. It will thereby ensure that DIRECTV continues to provide a robust and compelling video services offering to consumers and to make intensive use of valuable orbital/spectrum resources. Moreover, because DIRECTV currently seeks only authority to stationkeep DIRECTV 1R at the nominal 110° W.L. orbital location where DIRECTV is already authorized to operate, the satellite will be able to relocate there with no discernible impact on the current interference environment and without the need for any further filings at the ITU.

For the foregoing reasons, DIRECTV requests that the Commission grant this application as expeditiously as possible.

III. INFORMATION REQUIRED UNDER SEC. 25.114 OF THE COMMISSION'S RULES

1. Name, Address, and Telephone Number of Applicant

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(310) 964-0700

2. Name, Address, and Telephone Number of Counsel

William M. Wiltshire
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1200 Eighteenth Street, N.W.
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(202) 730-1300

3. Type of Authorization Requested

DIRECTV hereby applies for authority to operate a DBS satellite, DIRECTV 1R, at the 109.8° W.L. orbital location, where it will be effectively collocated with another DIRECTV satellite and operate in inclined orbit in order to conserve fuel. DIRECTV 1R will serve as an in-orbit spare, and thus at present requires authorization for TT&C functions only. Although DIRECTV would therefore seek additional authority before operating the satellite's communications payload, it provides information on that payload below.

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

DIRECTV 1R will consist of a geostationary satellite located at the 109.8° W.L. orbital location and associated ground station equipment. DIRECTV 1R is a high-power satellite designed to provide DBS service in the AP30/30A bands (12.2-12.7 GHz (space-to-Earth) and 17.3-17.8 GHz (Earth-to-space)). It is capable of providing 32 operating uplink and downlink Ku-band transponders in both right hand and left hand circular

polarizations ("RHCP" and "LHCP")[4], transmitting national digital video and audio entertainment to millions of customers in the United States using small receive antennas. Each transponder has a usable bandwidth of 24 MHz. National beam coverage encompasses the contiguous 48 states (CONUS) plus Alaska and Hawaii. However, in this application, DIRECTV seeks authority only for the TT&C functions, which will be provided at the edges of the 12.2-12.7 GHz (space-to-earth) and 17.3-17.8 GHz (Earth-to-space) bands.

5. Operational Characteristics

5.1 Frequency and Polarization Plan

Details of the frequency and polarization plan of the DIRECTV 1R satellite, including TT&C functions, are included in the accompanying Schedule S, which is hereby incorporated by reference as if fully set forth herein. The interconnection capability of the DIRECTV 1R transponders is also shown in the accompanying Schedule S. The emission designator for transmission of communications signals in the uplink and downlink is 24M0G7W. The allocated bandwidth for this emission is 24 MHz.

5.2 Communications Payload

5.2.1 Uplink Transmissions

In the communications payload, the Ku-band uplink frequency band (from 17.3-17.8 GHz) is frequency translated by the receivers with an LO frequency of 5.1 GHz to the 12.2-12.7 GHz transmit band and channelized by the input mulitplexers and channel filters. The filtered and frequency translated signals are amplified by Driver Limiter Amplifiers (DLAs) that provide the necessary channel amplification to drive the

[4] Note that DIRECTV 1R would operate at the 110° W.L. location only on the three channels currently authorized to DIRECTV at that location.

associated Microwave Power Amplifiers (MPAs) to their nominal operating point. The DLAs provide two basic modes of operation: fixed gain mode and limiter mode. The fixed gain mode has 15 dB of gain adjustment with a step size of 1 dB. The limiter mode holds the output level constant over an input dynamic range of 18 dB and has an output level adjustment of 15.5 dB in 0.5 dB increments.

The G/T performance for DIRECTV 1R at 109.8° W.L. for the receive antenna in the direction of the feeder uplink site location is shown in the accompanying Schedule S. Note that the peak G/T value occurs at beam peak and that this value of G/T decreases, dB-for-dB, as the uplink location moves away from beam peak. The DIRECTV 1R receive channel filters limit the bandwidth of the received signals. A normalized response of a representative input channel filter is shown in Figure 5-1.

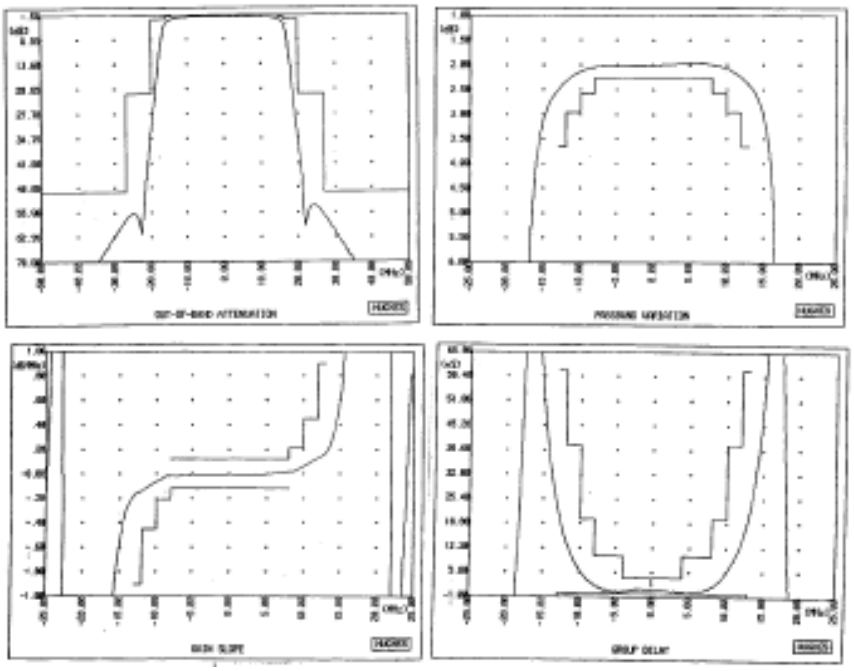

Figure 5-1. Normalized Response Characteristic of Representative DIRECTV 1R IMUX Channel Filter

5.2.2 Downlink Transmissions

The Ku-band national coverage downlink beam channels use dual combined 100W MPA units. The performance of these MPAs and the resultant maximum downlink EIRP at beam peak are summarized in the accompanying Schedule S.

DIRECTV 1R will employ output multiplexer ("OMUX") filters after the MPAs. A normalized response of a representative output channel filter is shown in Figure 5-2.

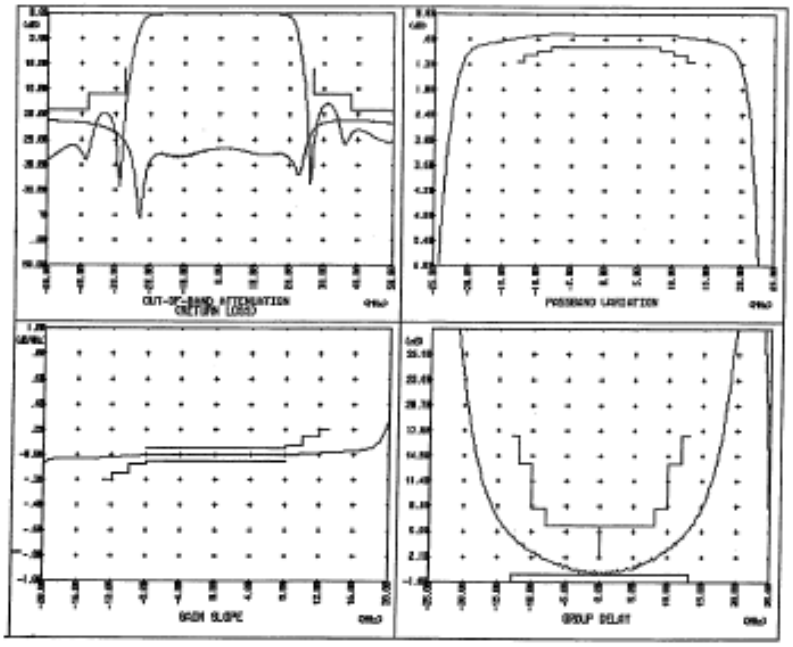

Figure 5-2. Normalized Response Characteristic of Representative DIRECTV 1R OMUX Channel Filter

5.3 TT&C Subsystem

The TT&C subsystem provides redundant telemetry, tracking, and command channels for the spacecraft. The principal functions of the subsystem are:

1. Reception and amplification of the radio frequency command uplinks and demodulation of baseband for subsequent signal processing and command distribution.
2. Modulation, up-conversion, amplification, and transmission of all telemetry data.
3. Reception and retransmission of ground-station-generated ranging signals.

Normal on-station commands are received through a planar Beacon Tracking Array ("BTA") antenna, and on-station telemetry is transmitted through the national beam communications transmit antenna. The BTA consists of a planar slotted waveguide array with three outputs: Sum pattern, Azimuth difference and Elevation difference. The sum pattern gain is approximately 36 dB and it is this BTA output that is ultimately routed to the command receiver. The TT&C on-station frequency and polarization plan is shown in the accompanying Schedule S. The telemetry and command link performance is summarized in the link budget analysis in Appendix C. The antenna patterns for the TT&C subsystem are discussed in Section 7.3 below. The emission designators associated with the TT&C subsystem are 800KF2D for both command and telemetry. The associated allocated bandwidth is 800 kHz for each of these emissions.

6. Orbital Locations

The DIRECTV 1R satellite will be placed at the 109.8° W.L. orbital location. DIRECTV is authorized to operate over three channels in the DBS bands (17.3-17.8 GHz (Earth-to-space)/12.2-12.7 GHz (space-to-Earth)) at this orbital location, and to conduct TT&C operations at the band edges.

7. Predicted Spacecraft Antenna Gain Contours

7.1 Uplink Beams

The satellite will receive signals from the DIRECTV broadcast center in Los Angeles, CA, in the frequency band 17.3-17.8 GHz using LHCP and RHCP. The receive antenna gain contours are included in GXT format in the accompanying Schedule S and are also set forth in Appendix B hereto. All uplink beams have a minimum cross-polarization isolation of 30 dB.

7.2 Downlink Beams

The national coverage antenna pattern for DIRECTV 1R includes service to CONUS, Alaska and Hawaii across the frequency band 12.2-12.7 GHz using LHCP and RHCP. The transmit antenna gain contours for this antenna are included in GXT format in the accompanying Schedule S and are also set forth in Appendix B hereto. All downlink beams have a minimum cross-polarization isolation of 30 dB.

7.3 TT&C Beams

The on-station TT&C coverage is provided through a planar BTA antenna for command receive, and through the CONUS transmit communications antenna, discussed in Section 7.2, for telemetry. The receive antenna gain pattern for the BTA is shown in Appendix B.

8. Service Description, Link Description and Performance Analysis, Earth Station Parameters

8.1 Service Description

DIRECTV will use the DIRECTV 1R satellite as an in-orbit spare, capable of retransmitting digital video and audio entertainment, educational and informational programming if necessary as a replacement for one of DIRECTV's other DBS satellites.

With the DIRECTV 1R spacecraft and DIRECTV's other existing DBS satellites, these services are provided to over 19 million customers throughout the United States who receive this programming using small dish antennas.

8.2 Link Performance

Representative communications link budgets are shown in Appendix A. Note that these budgets assume a receive antenna of 45 cm and also include an entry for adjacent satellite interference from neighboring DBS satellites nominally spaced nine degrees away. Representative link budgets for telemetry and command links are shown in Appendix C.

8.3 Earth Station Parameters

There are essentially two types of earth stations used in the DIRECTV 1R DBS network: feeder-link earth stations and subscriber terminals. The feeder-link stations are relatively large transmit antennas, typically 9 to 13 meters, that track the satellite electronically and are used for transmitting programming material from the DIRECTV broadcast centers to the satellite and performing TT&C functions with the satellite. The subscriber terminals for CONUS are effectively 45 cm receive antennas that are installed at the customers' premises and have fixed pointing, which is optimized at installation. Subscriber terminals for reception in Alaska and Hawaii may need to be somewhat larger.

9. Satellite Orbit Characteristics

The DIRECTV 1R satellite will be maintained in inclined geosynchronous orbit at its nominal orbital location with an East-to-West drift tolerance of ±0.05° and an initial North-to-South inclination of approximately 0.3° with an expected increase in inclination

of 0.9° per year. When providing service, the antenna axis attitude will be maintained so as to keep the beam pointing error within 0.1 degrees.

10. Power Flux Density

There are no power flux density limits in the DBS bands.

11. Arrangement for tracking, telemetry, and control

DIRECTV 1R's TT&C operations will be performed by Intelsat. The control center is located in Long Beach, CA. The primary TT&C uplink will come from DIRECTV'S Los Angeles Broadcast Center in Los Angeles, CA. The backup TT&C uplink will come from DIRECTV's Castle Rock Broadcast Center, in Castle Rock, CO.

12. Physical Characteristics of the Space Station

The physical characteristics of the DIRECTV 1R satellite are as provided in the accompanying Schedule S.

13. Common Carrier Status

DIRECTV intends to operate DIRECTV 1R on a non-broadcast, non-common carrier basis, as it operates its current DBS satellite capacity at its other orbital locations. DIRECTV may sell and/or lease a portion of its capacity on a non-common carrier basis for complementary business purposes.

14. Schedule

DIRECTV 1R was launched in October 1999, and has been successfully operating in-orbit since that time pursuant to U.S. and Canadian authorizations.

16. Public interest Considerations

See Section II above.

17. Interference Analysis

Modification of the Region 2 Plan for DIRECTV 1R at 110° W.L. (nominal) will not be necessary. The analysis under Annex 1 of Appendix 30 that was performed for USABSS-16 is applicable to DIRECTV 1R as DIRECTV 1R will operate within the technical envelope of that ITU filing. No further analysis needs to be submitted to the ITU. The USABSS-16 analysis provides sufficient technical detail to show that DIRECTV 1R will operate satisfactorily if all assignments in the international Broadcast Satellite Service and feeder link plans were implemented. This analysis is provided in Annex 1.

18. Orbital Debris Mitigation

This section provides the information required under Section 25.114(d)(14) of the Commission's rules.

Spacecraft Hardware Design

DIRECTV has assessed and limited the amount of debris released in a planned manner during normal operations of DIRECTV 1R. No debris is generated during normal on-station operations, and DIRECTV does not intend to release debris during the planned course of operations of the satellite. The spacecraft will remain in a stable configuration, operating outside of the station keeping volume assigned to any other spacecraft.

DIRECTV has also considered the possibility of DIRECTV 1R becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control of the spacecraft and prevent post-mission disposal. As such, DIRECTV has taken steps to address this possibility by incorporating redundancy, shielding, separation

of components, and other physical characteristics into the satellite's design. For example, omni-directional antennas have been mounted on opposite sides of the spacecraft. The command receivers and decoders, telemetry encoders and transmitters, and the bus control electronics are fully redundant, physically separated, and located within a shielded area to minimize the probability of the spacecraft becoming a source of debris due to a collision.

Minimizing Accidental Explosions

DIRECTV has assessed and limited the probability of accidental explosion during and after completion of mission operations. The key areas reviewed for this purpose included leakage of propellant and mixing of fuel and oxidizer as well as battery pressure vessels. The basic propulsion design (including component and functional redundancy, and the placement of fuel tanks inside a central cylinder which provides a high level of shielding), propulsion subsystem component construction, preflight verification through both proof testing and analysis, and quality standards were designed to ensure a very low risk of propellant leakage and fuel and oxidizer mixing that can result in subsequent explosions. During the mission, batteries and various critical areas of the propulsion subsystem are continually monitored (for both pressure and temperature) to preclude conditions that could result in the remote possibility of explosion and subsequent generation of debris.

After DIRECTV 1R reaches its final disposal orbit, all on-board sources of stored energy will be depleted or secured, all fuel line valves will be left "open," and all batteries will be left in a permanent discharge state. The solar cells will be slewed away from the sun to minimize power generation. However, at the end of DIRECTV 1R's

operational life, the helium pressurant for the vessels that were used during orbit raising was permanently isolated from the propulsion system by firing a pyrotechnic valve at the beginning of on-orbit life. As a result, the residual gas (about 5%) cannot be vented at the end of life. In addition, xenon tanks have a regulator valve and cannot be vented after pressure drops below the set point of the valve. These tanks are well shielded, and the residual pressure in the tanks will be well below their maximum rating. Moreover, a leaking pressurized vessel could not cause the spacecraft to leave its storage orbit, as expulsion of pressurized gas would cause the spacecraft to tumble and the delta V (*i.e.*, the thrust) would be randomly distributed, and thus would have very little effect on the orbit apogee and perigee. In Section IV below, DIRECTV requests any necessary waiver of Sections 25.114(d)(14)(ii) and 25.283(c) in connection with the residual gas that will remain in these tanks at the end of the satellite's useful life.

Safe Flight Profiles

DIRECTV has assessed and limited the probability of DIRECTV 1R becoming a source of debris due to collisions with large debris or other operational space stations. DIRECTV has assessed the possibility of collision with satellites located at, or reasonably expected to be located at, the requested orbital location or assigned in the vicinity of that location.

Regarding avoidance of collisions with controlled objects, in general, if a geosynchronous satellite is controlled within its specified longitude and latitude stationkeeping limits, collision with another controlled object (excluding where the satellite is collocated with another object) is the direct result of that other object entering the allocated space. The instant application seeks authority for continued operation of

DIRECTV 1R at the 109.8° W.L. orbital location. DIRECTV is not aware of any other FCC or non-FCC licensed spacecraft that are operational or planned to be deployed at 109.8° W.L. or to nearby orbital locations such that there would be an overlap with the requested station keeping volume of DIRECTV 1R.

During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. When de-orbit of a spacecraft is required, the initial phase is treated as a satellite move, and the same precautions are used to ensure collision avoidance.

Post-Mission Disposal

Although not subject to the requirements of Section 25.283(a) of the Commission's rules,[5] at the end of the operational life of the satellite, DIRECTV will maneuver DIRECTV 1R into a disposal orbit with an altitude no less than that calculated using the IADC formula:

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

The calculated value of $C_R A/m$ in this instance is based on the following parameters:

C_R = Solar Pressure Radiation Coefficient = 1.2

A = Total Solar Pressure Area = 89 m^2

m = Dry Mass of Satellite = 1741 kg

Using these values in the IADC formula results in a minimum de-orbit altitude of 36,082 km, or approximately 296 km above geosynchronous altitude. To provide adequate margin, the nominal disposal orbit will be increased above this calculated value

[5] *See* 47 C.F.R. § 25.283(d).

of 36,082 km to a value of 36,086 km, resulting in a disposal orbit approximately 300 km above geosynchronous altitude. Approximately 7.5 kg of propellant will be allocated and reserved for final orbit raising maneuvers to this altitude. This value was determined through a detailed propellant budget analysis. 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.

IV. WAIVER REQUEST

To the extent necessary, DIRECTV seeks waiver of Sections 25.114(d)(14)(ii) and 25.283(c) of the Commission's rules in connection with the re-authorization of DIRECTV 1R. These rules address requirements relating to venting stored energy sources at the spacecraft's end of life.[6] DIRECTV 1R is a Boeing 601 model spacecraft and was constructed and launched years before the venting requirement in Section 25.283(c) was even proposed.[7] As described in more detail in Section 18 above, the helium tanks on the spacecraft were sealed following completion of launch phase and will therefore retain residual pressure at end of life. Given the spacecraft design, it is physically impossible for DIRECTV to vent the helium tanks in order to comply with Section 25.283(c).

Granting the requested waiver of these rules would be consistent with Commission precedent and policy, as the criteria justifying a waiver are present in this case.

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[6] Section 25.283(c) contains the substantive venting requirement, while Section 25.114(d)(14)(ii) requires applicants to submit information that addresses "whether stored energy will be removed at the spacecraft's end of life."

[7] *See Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, 17 FCC Rcd. 5586 (2002) (released March 18, 2002).

> The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[8]

Accordingly, the Commission has in the past waived these provisions on several occasions in extending the term of a satellite license for in-orbit spacecraft with similar limitations.[9] The Commission has even waived Section 25.283(c) in a number of cases to permit launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the space station design at a late stage of construction would pose an undue hardship.[10]

In the case of DIRECTV 1R, which was launched and operational years before the venting requirements were even proposed, there is no question of bringing the satellite into compliance with the rule. Because DIRECTV 1R is already in orbit, DIRECTV can do nothing to enable full venting of residual pressure in the helium tanks.

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[8] *PanAmSat Licensee Corp.*, 17 FCC Rcd. 10483, ¶ 22 (Int'l Bur. 2002) (footnotes omitted).

[9] *See, e.g., SES Americom, Inc.*, File No. SAT-MOD-20110718-00130 , Grant Stamp Attachment at ¶ 2 (granted Oct. 13, 2011) ("We grant the requested waiver because AMC-1 was launched before Section 25.283(c) became effective and compliance would require direct retrieval of the spacecraft, which is not currently possible"); *SES Americom, Inc*., File No. SAT-MOD-20101215-00261, Grant Stamp Attachment at ¶ 4 (granted Mar. 8, 2011) (same); *XM Radio Inc.*, File No. SAT-MOD-20100722-00165, Grant Stamp Attachment at ¶ 2 (granted Oct. 14, 2010) (same).

[10] *See, e.g., DIRECTV Enterprises, LLC*, File No. SAT-LOA-20090807-00086, Grant Stamp Attachment at ¶ 4 (granted Dec. 15, 2009) (granting a partial waiver of Section 25.283(c) for DIRECTV-14, a Boeing 702 model spacecraft, on grounds that requiring modification of the satellite would present an undue hardship *EchoStar Satellite Operating Corp.*, File No. SAT-LOA-20071221-00183, Grant Stamp Attachment at ¶ 4 (granted Mar. 12, 2008) (same for AMC-14, a Lockheed Martin A2100 model spacecraft); *PanAmSat Licensee Corp.*, File Nos. SAT-MOD-20070207-00027 and SAT-AMD-20070716-00102, Grant Stamp Attachment at ¶ 7 (granted Oct. 4, 2007) (same for Intelsat 11, an Orbital Sciences Star model spacecraft).

Given this reality, waiver is clearly warranted. There is no possible public interest benefit in requiring strict adherence to a rule with which the licensee is incapable of complying, and grant in these special and limited circumstances would not undermine the policy objective of the rule.

V. CONCLUSION

In summary, re-licensing the proposed space station will provide DIRECTV with a highly capable replacement DBS satellite that will ensure the continuation of high quality multichannel video service to millions of Americans. For these reasons, DIRECTV submits that the proposed satellite will serve the public interest and respectfully requests that the Commission expeditiously grant this application.

Respectfully submitted,

DIRECTV ENTERPRISES, LLC

By: __/s/_____
Romulo Pontual
Executive Vice President

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/

Jack Wengryniuk

December 2, 2011

Date

APPENDIX A

DIRECTV 1R Link Budget Analysis

Table A-1. DIRECTV 1R Link Budget – Syracuse, NY

D1R at 110W - BSS	Syracuse	Clear Sky	Rain Up/Dn
Uplink	Transmit power, dBW	12.9	18.2
Castle Rock	Transmit losses, dB	1.2	1.2
	Ground antenna gain, dB	65.0	65.0
	Antenna pointing loss, dB	0.5	0.5
	Free space loss, dB	209.0	209.0
	Atmospheric loss, dB	0.2	0.5
	Uplink rain loss, dB	0.0	5.0
	Satellite G/T, dB/K	2.5	2.5
	Bandwidth, dB-Hz	73.0	73.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Uplink C/N (thermal)		**25.1**	**25.1**
Downlink	Satellite EIRP, dBW/24 MHz	53.2	53.2
	Free space loss, dB	205.9	205.9
	Gaseous	0.14	0.14
	Cloud	0.37	0.37
	Scintillation	0.44	0.44
	Downlink rain loss, dB	0.0	2.6
	Rain temp increase, dB	0.0	3.3
	Rain + Atmos. Loss, dB	0.7	3.2
	Rcv. antenna pointing loss, dB	0.5	0.5
	Ground G/T, dB/K	13.0	13.0
	Bandwidth, dB-Hz	73.0	73.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Downlink C/N (thermal)		**14.7**	**8.9**
		Clear Sky	**Rain Up/Dn**
Totals	Uplink C/N (thermal), dB	25.1	25.1
	Downlink C/N (thermal), dB	14.7	8.9
	X-pol interference, dB	21.0	21.0
	Aggregate C/I from ASI	29.0	29.0
	Adjacent Channel C/I, dB	20.0	20.0
	Co-frequency C/I, dB	99.0	99.0
	Total C/(N+I), dB	**12.5**	**8.2**
	Required C/(N+I), dB	**7.6**	**7.6**
	Margin, dB	**4.9**	**0.6**

Table A-2. DIRECTV 1R Link Budget – Augusta, GA

D1R at 72.5W - BSS Used in filing	Augusta	Clear Sky	Rain Up/Dn
Uplink	Transmit power, dBW	12.9	18.2
Castle Rock	Transmit losses, dB	1.2	1.2
	Ground antenna gain, dB	65.0	65.0
	Antenna pointing loss, dB	0.5	0.5
	Free space loss, dB	209.0	209.0
	Atmospheric loss, dB	0.2	0.5
	Uplink rain loss, dB	0.0	5.0
	Satellite G/T, dB/K	2.5	2.5
	Bandwidth, dB-Hz	73.0	73.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Uplink C/N (thermal)		**25.1**	**25.1**
	Downlink		
Downlink	Satellite EIRP, dBW/24 MHz	55.7	55.7
	Free space loss, dB	205.8	205.8
	Gaseous	0.12	0.12
	Cloud	0.37	0.37
	Scintillation	0.33	0.33
	Downlink rain loss, dB	0.0	3.6
	Rain temp increase, dB	0.0	3.7
	Rain + Atmos Loss, dB	0.6	4.1
	Rcv. antenna pointing loss, dB	0.5	0.5
	Ground G/T, dB/K	13.0	13.0
	Bandwidth, dB-Hz	73.0	73.0
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Downlink C/N (thermal)		**17.4**	**10.1**
		Clear Sky	**Rain Up/Dn**
Totals	Uplink C/N (thermal), dB	25.1	25.1
	Downlink C/N (thermal), dB	17.4	10.1
	X-pol interference, dB	21.0	21.0
	Aggregate C/I from ASI	29.0	29.0
	Adjacent Channel C/I, dB	20.0	20.0
	Co-frequency C/I, dB	99.0	99.0
	Total C/(N+I), dB	**13.9**	**9.2**
	Required C/(N+I), dB	**5.4**	**5.4**
	Margin, dB	**8.5**	**3.8**

APPENDIX B

Antenna Beam Contours

Figure B-1. DIRECTV 1R National Receive Beam

Figure B-2. DIRECTV 1R National Transmit and On-station Telemetry Beam

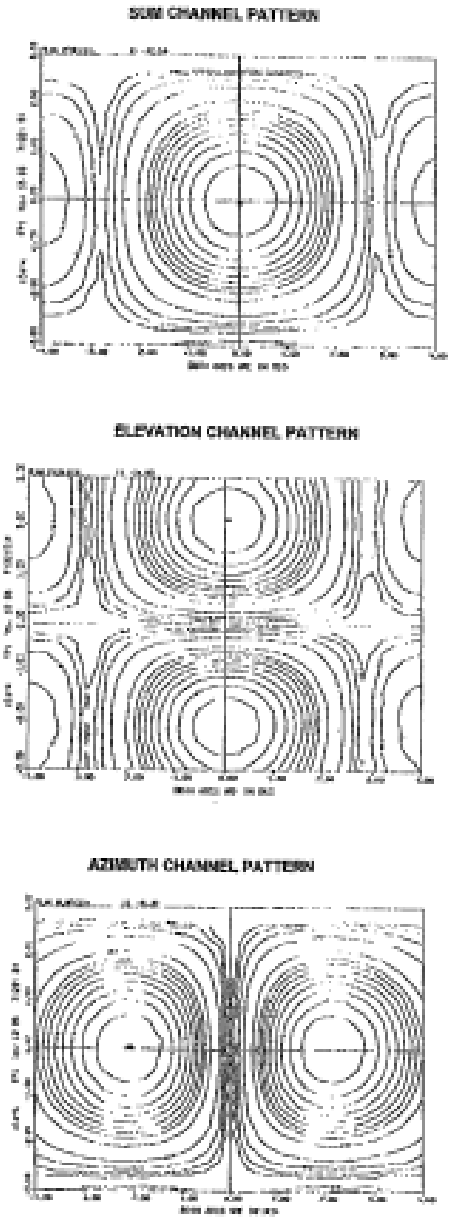


Figure B-3. DIRECTV 1R On-station Command Receive Beam

APPENDIX C

TT&C Link Budgets

Table C-1. On-Station Telemetry PCM Budget

DIRECTV 1 On-station Telemetry	CRBC	Units
EIRP	16.0	dBW
Dispersion loss	162.7	dB/m^2
Isotropic area	-43.5	dB-m^2
Ground Station G/T	39.0	dB/K
Boltzmann	-228.6	dBW/Hz-K
Downlink C/No	77.6	dB/Hz
Demod	5.0	dB
S/No	72.6	dB/Hz
Implementation loss	2.5	dB
Bit rate, 1000BPS	30	dB-Hz
Bit rate, 4000 BPS	36	dB-Hz
Eb/No, 1000 BPS	40.1	dB
Eb/No, 4000 BPS	34.1	dB
Eb/No, BER = 10E-6	11	dB
Margin, 1000 BPS	29.1	dB
Margin, 4000 BPS	23.1	dB

Table C-2. On-Station Command Link Budget

DIRECTV 1 On-station Command	CRBC	Units
Frequency	17 305	MHz
Ground station EIRP	83.0	dBW
Dispersion loss	162.7	dB
Incident flux density	-79.7	dBW/m^2
Command receiver threshold	-105.0	dBW/m^2
Margin	25.3	dB

ANNEX 1

ITU Radio Regulations Appendix 30 and 30A Interference Analyses

ANNEX 1 TO APPENDIX 30 FOR USABSS-16

1. Limits for the interference into frequency assignments in conformity with the Regions 1 and 3 Plan or with the Regions 1 and 3 List or into new or modified assignments in the Regions 1 and 3 List

Not applicable to Region 2 modifications.

2. Limits to the change in the overall equivalent protection margin for frequency assignments in conformity with the region 2 Plan

With respect to § 4.2.3 c) of Article 4, an administration in Region 2 is considered as being affected if the overall equivalent protection margin corresponding to a test point of its entry in the Region 2 Plan, including the cumulative effect of any previous modification to that Plan or any previous agreement, falls more than 0.25 dB below 0 dB, or, if already negative, more than 0.25 dB below the value resulting from:

– *the Region 2 Plan as established by the 1983 Conference; or*

– *a modification of the assignment in accordance with this Appendix; or*

– *a new entry in the Region 2 Plan under Article 4; or*

– *any agreement reached in accordance with this Appendix.*

A detailed interference analysis was performed using MSPACEg and the uplink and downlink shaped beams of USABSS-16. Results show that no administration is affected. The findings file for USABSS-16 is included at the back of this attachment (CONUS16 is the MSPACE beam name for USABSS-16).

3. Limits to the change in the power flux density to protect the broadcasting-satellite service in Regions 1 and 2 in the band 12.2-12.5 GHz and in Region 3 in the band 12.5-12.7 GHz

With respect to § 4.2.3 a), 4.2.3 b) or 4.2.3 f) of Article 4, as appropriate, an administration in Region 1 or 3 is considered as being affected if the proposed modification to the Region 2 Plan would result in exceeding the following power flux-densities values, at any test point in the service area of its overlapping frequency assignments:

-147 dB(W/(m^2 · 27 MHz))	for	$0° \le \theta < 0.23°$
$-135.7 + 17.74 \log \theta$ dB(W/(m^2 · 27 MHz))	for	$0.23° \le \theta < 2.0°$
$-136.7 + 1.66\ \theta^2$ dB(W/(m^2 · 27 MHz))	for	$2.0° \le \theta < 3.59°$
$-129.2 + 25 \log \theta$ dB(W/(m^2 · 27 MHz))	for	$3.59° \le \theta < 10.57°$
-103.6 dB(W/(m^2 · 27 MHz))	for	$10.57° \le \theta$

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies.

The closest Regions 1 and 3 BSS orbital location in the Regions 1 and 3 Plan or List is a French assignment at 160° W.L., which is 50° from the 110° W.L. orbital location. Therefore the -103.6 dBW/m^2/27 MHz level applies.

The maximum pfd for USABSS-16 is -106.4 dBW/m^2 · 24 MHz, or -106.9 dBW/m^2 · 27 MHz. The pfd limit of -103.6 dBW/m^2/27 MHz is not exceeded anywhere on the earth's surface. Therefore, USABSS-16 is in compliance with Section 3.

4. Limits to the power flux density to protect the terrestrial services of other administrations

With respect to § 4.2.3 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the consequence of the proposed modification to an existing assignment in the Region 2 Plan is to increase the power flux-density arriving on any part of the territory of that administration by more than 0.25 dB over that resulting from that frequency assignment in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference. The same administration is considered as not being affected if the value of the power flux-density anywhere in its territory does not exceed the limits expressed below.

With respect to § 4.1.1 d) or §4.2.3 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the proposed new assignment in the Regions 1 and 3 List, or if the proposed new frequency assignment in the Region 2 Plan, would result in exceeding a power flux-density, for any angle of arrival, at any point on its territory, of:

$$-148 \ \text{dB(W/(m}^2 \cdot \text{4 kHz))} \quad \text{for} \quad \theta \leq 5°$$

$$-148 + 0.5\,(\theta - 5) \ \text{dB(W/(m}^2 \cdot \text{4 kHz))} \quad \text{for} \quad 5° < \theta \leq 25°$$

$$-138 \ \text{dB(W/(m}^2 \cdot \text{4 kHz))} \quad \text{for} \quad 25° < \theta \leq 90°$$

where θ represents the angle of arrival.

The highest pfd on a Region 1 territory is -120 dBW/m^2 · 24 MHz, or -157.8 dBW/m^2 · 4 kHz, which occurs in easternmost Russia. The highest pfd on a Region 3 territory is -132.5 dBW/m^2 · 24 MHz, or -170.3 dBW/m^2 · 4 kHz, which occurs on Palmyra Island (USA). Both of these pfd values are below the strictist limit of -148 dBW/m^2 · 4 kHz.

Consistent with provision 4.2.3 d) of Article 4 of Appendix 30, these pfd limits apply to countires not having frequency assignment in the broadcasting-satellite service in the channel concerned. Since both Canada and Mexico, among other Region 2 countries, are assigned all 32 channels in the Plan, and therefore, will not be

deploying terrestrial services, Section 4 limits do not need to be met on their territories.

For other Region 2 countries, pfd values were obtained using the ITU GIMS program and the GIMS PFD Tool. PFD values of USABSS-16 were obtained for Region 2 territories for the three cases listed above: with look angles to USABSS-16 of less than 5 degrees, look angles between 5 and 25 degrees, and look angles between 25 and 90 degrees.

The figure on the next page shows the USABSS-16 transmit beam with elevation contours of 25 and 5 degrees. This figure shows the territories that lie at elevation angles for the three cases to be examined, and the antenna contours which are used to determine the off-axis gain value.

Excludes Canada and Mexico

$\theta \leq 5°$

The maximum USABSS-16 pfd to a Region 2 territory with < 5° elevation angle is -121.9 dBW/m^2 · 24 MHz, or -159.7 dBW/m^2 · 4 kHz, on the southwest coast of Greenland. This value is below the limit of -148 dBW/m^2 · 4 kHz.

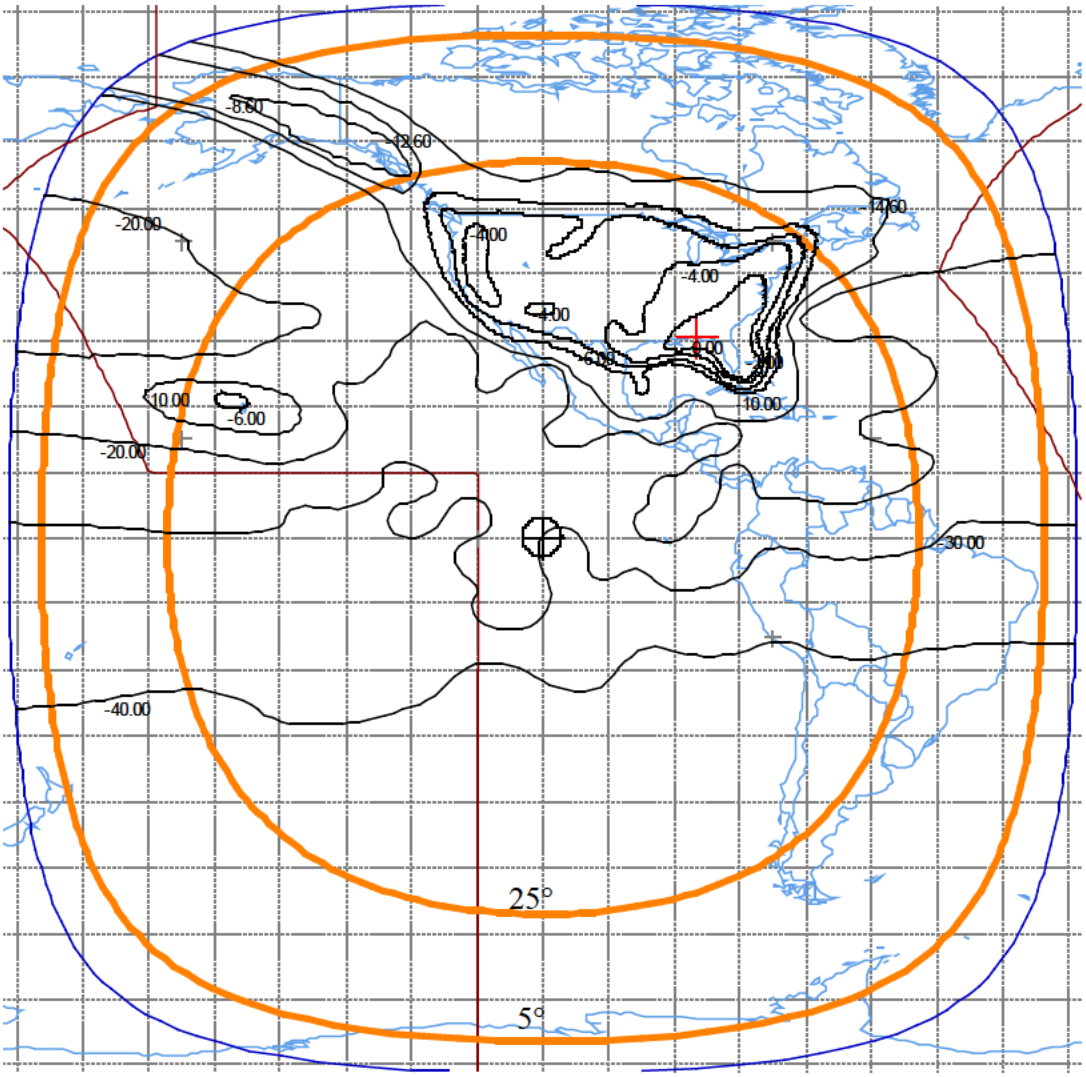
$5° < \theta \leq 25°$

The maximum USABSS-16 pfd to a Region 2 territory with an elevation angle between 5 and 25 degrees is -122.2 dBW/m^2 · 24 MHz, or -145.9 dBW/m^2 · 4 kHz, in Miquelon Island (Fr.). The elevation angle from Miquelon Island to 110 W.L. is 16.4 degrees. The pfd of -145.9 dBW/m^2 · 4 kHz is below the limit of -142.3 dBW/m^2 · 4 kHz for 16.4 degree elevation.

$25° < \theta \leq 90°$

The maximum USABSS-16 pfd to a Region 2 territory with > 25° elevation angle is -108.1 dBW/m^2 · 24 MHz, or -145.9 dBW/m^2 · 4 kHz, at Grand Bahamas Island. This is below the limit of -138 dBW/m^2 · 4 kHz.

USABSS-16 meets the pfd limits of Section 4 for all three cases, and is therefore in compliance with Section 4.



5. **(Not used.)**

6. **Limits to the change in the power flux density of assignments in the Regions 1 and 3 Plan or List to protect the fixed-satellite service (space-to-Earth) in the band 11.7-12.2 GHz in Region 2 or in the band 12.2-12.5 GHz in Region 3, and of assignments in the Region 2 Plan to protect the fixed-satellite service (space-to-Earth) in the band 12.5-12.7 GHz in Region 1 and in the band 12.2-12.7 GHz in Region 3**

With respect to § 4.2.3 e), an administration is considered as being affected if the proposed modification to the Region 2 Plan would result in an increase in the power flux-density over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 1 or 3 of 0.25 dB or more above that resulting from the frequency assignment in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference.

With respect to § 4.1.1 e) or 4.2.3 e) of Article 4, with the exception of cases covered by Note 1[11] below, an administration is considered as not being affected if the proposed new or modified assignment in the Regions 1 and 3 List, or if a proposed modification to the Region 2 Plan, gives a power flux-density anywhere over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 1, 2 or 3 of less than:

-186.5 dB(W/(m^2 · 40 kHz))	*for*	*0°*	*≤ θ < 0.054°*
-164.0 + 17.74 log θ dB(W/(m^2 · 40 kHz))	*for*	*0.054°*	*≤ θ < 2.0°*
-165.0 + 1.66 θ^2 dB(W/(m^2 · 40 kHz))	*for*	*2.0°*	*≤ θ < 3.59°*
-157.5 + 25 log θ dB(W/(m^2 · 40 kHz))	*for*	*3.59°*	*≤ θ < 10.57°*
-131.9 dB(W/(m^2 · 40 kHz))	*for*	*10.57°*	*≤ θ*

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies.

All Regions 1 and 3 FSS satellites are greater than 10.57 degrees from the 110° W orbit location. Therefore the -131.9 dB(W/(m^2 · 40 kHz)) level applies. As shown in the response to Section 4, the highest pfd on a Region 1 territory is -120 dBW/m^2 · 24 MHz, or -147.8 dBW/m^2 · 40 kHz, and the highest pfd on a Region 3 territory is -132.5 dBW/m^2 · 24 MHz, or -160.3 dBW/m^2 · 40 kHz. Both of these values are below the specified limit. Therefore, USABSS-16 is in compliance with Section 6.

7. Limits to the change in equivalent noise temperature to protect the fixed-satellite service (Earth-to-space) in Region 1 from modifications to the Region 2 Plan in the band 12.5-12.7 GHz

With respect to § 4.2.3 e) of Article 4, an administration of Region 1 is considered as being affected if the proposed modification to the Region 2 Plan would result in:

– *the value of ΔT/T resulting from the proposed modification is greater than the value of ΔT/T resulting from the assignment in the Region 2 Plan as of the date of entry into force of the Final Acts of the 1985 Conference; and*

– *the value of ΔT/T resulting from the proposed modification exceeds 6%,*

using the method of Appendix 8 (Case II).

A review of available ITU space network databases shows that there are no networks registered in the Earth-to-space direction in the frequency band 12.5-12.7 GHz. Therefore, no Region 1 space stations can be affected, and USABSS-16 is in compliance with Section 7.

[11] Note 1 pertains to Regions 1 and 3 only

MSPACEG Version 4.000 (MS Windows) 27.02.2004 09:45:33
ITU Appendices S30 & S30A Analysis in Region 2
ONLY VISIBLE TEST POINTS INCLUDED DOWN AND UP LINK SAT83 REGION 2 PLAN
Version: 28 May 2002 X
(Tolerance for margin degradation is 0.25 dB)

				Overall Equivalent Protection Margins (dB)				
Beam	Pos	Chan	TP	Clear Sky	Rain Faded	Worst Case	Reference	Decrease
CONUS16	-110.0	28	1	-10.17	-9.95	-10.17	0.00	-10.17
CONUS16	-110.0	28	2	-11.29	-11.05	-11.29	0.00	-11.29
CONUS16	-110.0	28	3	-12.49	-12.24	-12.49	0.00	-12.49
CONUS16	-110.0	28	4	-10.87	-10.74	-10.87	0.00	-10.87
CONUS16	-110.0	28	5	-9.92	-9.74	-9.92	0.00	-9.92
CONUS16	-110.0	28	6	-10.82	-10.49	-10.82	0.00	-10.82
CONUS16	-110.0	28	7	-11.56	-11.40	-11.56	0.00	-11.56
CONUS16	-110.0	28	8	-12.20	-11.99	-12.20	0.00	-12.20
CONUS16	-110.0	28	9	-12.61	-12.45	-12.61	0.00	-12.61
CONUS16	-110.0	28	10	-10.06	-10.00	-10.06	0.00	-10.06
CONUS16	-110.0	28	11	-13.57	-13.38	-13.57	0.00	-13.57
CONUS16	-110.0	28	12	-13.87	-13.52	-13.87	0.00	-13.87
CONUS16	-110.0	28	13	-12.35	-12.20	-12.35	0.00	-12.35
CONUS16	-110.0	28	14	-9.71	-9.47	-9.71	0.00	-9.71
CONUS16	-110.0	28	15	-11.11	-10.97	-11.11	0.00	-11.11
CONUS16	-110.0	28	16	-12.05	-11.91	-12.05	0.00	-12.05
CONUS16	-110.0	28	17	-11.38	-11.29	-11.38	0.00	-11.38
CONUS16	-110.0	28	18	-17.71	-17.70	-17.71	0.00	-17.71
CONUS16	-110.0	28	19	-10.78	-10.69	-10.78	0.00	-10.78
CONUS16	-110.0	28	20	-8.65	-8.51	-8.65	0.00	-8.65
CONUS16	-110.0	30	1	-9.82	-9.59	-9.82	0.00	-9.82
CONUS16	-110.0	30	2	-11.37	-11.14	-11.37	0.00	-11.37
CONUS16	-110.0	30	3	-11.59	-11.29	-11.59	0.00	-11.59
CONUS16	-110.0	30	4	-10.95	-10.82	-10.95	0.00	-10.95
CONUS16	-110.0	30	5	-9.99	-9.81	-9.99	0.00	-9.99
CONUS16	-110.0	30	6	-10.93	-10.60	-10.93	0.00	-10.93
CONUS16	-110.0	30	7	-11.68	-11.53	-11.68	0.00	-11.68
CONUS16	-110.0	30	8	-12.28	-12.06	-12.28	0.00	-12.28
CONUS16	-110.0	30	9	-12.65	-12.50	-12.65	0.00	-12.65
CONUS16	-110.0	30	10	-9.73	-9.63	-9.73	0.00	-9.73
CONUS16	-110.0	30	11	-13.61	-13.42	-13.61	0.00	-13.61
CONUS16	-110.0	30	12	-14.08	-13.75	-14.08	0.00	-14.08
CONUS16	-110.0	30	13	-12.38	-12.23	-12.38	0.00	-12.38
CONUS16	-110.0	30	14	-9.82	-9.58	-9.82	0.00	-9.82
CONUS16	-110.0	30	15	-11.17	-11.04	-11.17	0.00	-11.17
CONUS16	-110.0	30	16	-12.11	-11.97	-12.11	0.00	-12.11
CONUS16	-110.0	30	17	-11.61	-11.52	-11.61	0.00	-11.61
CONUS16	-110.0	30	18	-17.23	-17.18	-17.23	0.00	-17.23
CONUS16	-110.0	30	19	-10.87	-10.78	-10.87	0.00	-10.87
CONUS16	-110.0	30	20	-9.00	-8.88	-9.00	0.00	-9.00
CONUS16	-110.0	32	1	-9.58	-9.34	-9.58	0.00	-9.58
CONUS16	-110.0	32	2	-11.12	-10.88	-11.12	0.00	-11.12
CONUS16	-110.0	32	3	-11.33	-11.01	-11.33	0.00	-11.33
CONUS16	-110.0	32	4	-10.68	-10.56	-10.68	0.00	-10.68
CONUS16	-110.0	32	5	-9.76	-9.58	-9.76	0.00	-9.76
CONUS16	-110.0	32	6	-10.68	-10.34	-10.68	0.00	-10.68
CONUS16	-110.0	32	7	-11.53	-11.38	-11.53	0.00	-11.53
CONUS16	-110.0	32	8	-12.11	-11.89	-12.11	0.00	-12.11
CONUS16	-110.0	32	9	-12.55	-12.40	-12.55	0.00	-12.55
CONUS16	-110.0	32	10	-9.53	-9.42	-9.53	0.00	-9.53
CONUS16	-110.0	32	11	-13.50	-13.32	-13.50	0.00	-13.50
CONUS16	-110.0	32	12	-13.91	-13.57	-13.91	0.00	-13.91
CONUS16	-110.0	32	13	-12.26	-12.11	-12.26	0.00	-12.26
CONUS16	-110.0	32	14	-9.48	-9.24	-9.48	0.00	-9.48
CONUS16	-110.0	32	15	-11.04	-10.90	-11.04	0.00	-11.04
CONUS16	-110.0	32	16	-12.00	-11.86	-12.00	0.00	-12.00
CONUS16	-110.0	32	17	-11.44	-11.35	-11.44	0.00	-11.44
CONUS16	-110.0	32	18	-16.89	-16.85	-16.89	0.00	-16.89
CONUS16	-110.0	32	19	-10.64	-10.55	-10.64	0.00	-10.64
CONUS16	-110.0	32	20	-8.47	-8.33	-8.47	0.00	-8.47

ANNEX 1 TO APPENDIX 30A FOR USABSS-16

1 Not used.

2 Not used.

3 Limits to the change in the overall equivalent protection margin with respect to frequency assignments in conformity with the Region 2 feeder-link Plan

With respect to the modification to the Region 2 feeder-link Plan and when it is necessary under this Appendix to seek the agreement of any other administration of Region 2, except in cases covered by Resolution 42 (Rev.WRC-03), an administration is considered as being affected if the overall equivalent protection margin[19] corresponding to a test point of its entry in that Plan, including the cumulative effect of any previous modification to that Plan or any previous agreement, falls more than 0.25 dB below 0 dB, or, if already negative, more than 0.25 dB below the value resulting from:

– *the feeder-link Plan as established by the 1983 Conference; or*

– *a modification of the assignment in accordance with this Appendix; or*

– *a new entry in the feeder-link Plan under Article 4; or*

– *any agreement reached in accordance with this Appendix except for Resolution 42 (Rev.WRC-03).*

A detailed interference analysis was performed using MSPACEg and the uplink and downlink shaped beams of USABSS-16. Results show that no administration is affected. The findings file for USABSS-16 is included at the back of the AP30 Annex 1 attachment.

4 Limits to the interference into frequency assignments in conformity with the Regions 1 and 3 feeder-link Plan or with the Regions 1 and 3 feeder-link Lists or proposed new or modified assignments in the Regions 1 and 3 feeder-link Lists

Not applicable to Region 2 modifications

5 Limits applicable to protect a frequency assignment in the bands 17.3-18.1 GHz (Regions 1 and 3) and 17.3-17.8 GHz (Region 2) to a receiving space station in the fixed-satellite service (Earth-to-space)

An administration in Region 1 or 3 is considered as being affected by a proposed modification in Region 2, with respect to § 4.2.2 a) or 4.2.2 b) of Article 4, or an administration in Region 2 is considered as being affected by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List, with respect to § 4.1.1 c) of Article 4, when the power flux-density arriving at the receiving space station of a broadcasting-

[19] For the definition of the overall equivalent protection margin, see § 1.11 of Annex 5 to Appendix **30**.

*satellite feeder-link would cause an increase in the noise temperature of the feeder-link space station which exceeds the threshold value of ΔT/T corresponding to 6%, where ΔT/T is calculated in accordance with the method given in Appendix **8**, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the necessary bandwidth of the feeder-link carriers. (WRC-03)*

*Interim systems of Region 2 in accordance with Resolution **42 (Rev.WRC-03)** shall not be taken into consideration when applying the above paragraph to proposed new or modified assignments in the Regions 1 and 3 feeder-link List. However, the above paragraph shall be applied to Region 2 interim systems with respect to Regions 1 and 3 administrations, referred to in § 5.2 b) of Resolution **42 (Rev.WRC-03)**. (WRC-03)*

The ΔT/T was calculated in accordance with Appendix 8 for several Region 1 and 3 assignments closest to USABSS-16 at 110° W. The ITU's GIMS program was used to determine the victim space station receive antenna gain towards the USABSS-16 feeder-link. The table below provides the results of these calculations, and shows that all ΔT/Ts are extremely small, and meet the Section 5 limit of 6%.

R1/3 Assignment	Orbital Position	Rcv. Noise Temp, °K	USABSS-16 FL EIRP, dBW	Min. USABSS-16 FL off-axis disc. towards victim	Rcv. Ant. Max Gain, dBi	Rcv. Ant. off-axis disc. towards USABSS-16 FL, dB	FS Loss	ΔT/T, %
OCE10100	160° W	600	78	50	32.6	-26.8	209.5	1.35E-03
FJI19300	178° W	600	78	50	44.2	-44.1	209.5	3.61E-04
SMO05700	178° W	600	78	50	48.9	-46.0	209.5	6.92E-04
IRL21100	37.2° W	600	78	50	48.1	-46.7	209.5	4.90E-04
NGR11500	37.2° W	600	78	50	38.5	-39.2	209.5	3.01E-04

Not all Region 1 and 3 assignments visible from the USABSS-16 feeder-links were analyzed. Due to the large orbital separations between USABSS-16 and Region 1 and 3 space stations, there are very large off-axis discriminations in both the transmit and receive antennas, and therefore, very small ΔT/Ts. It is reasonable to assume that the Region 1 and 3 space stations not in the table below will have similar ΔT/T values. Therefore, USABSS-16 is in compliance with Section 5.

6 Limits applicable to protect a frequency assignment in the band 17.8-18.1 GHz (Region 2) to a receiving feeder-link space station in the fixed-satellite service (Earth-to-space)

Not applicable to Region 2 modifications