

ECHOSTAR-15

Technical Annex

A.1 Scope and Purpose

EchoStar Satellite Operating Corporation (with its affiliates, “EchoStar”) has Commission authorization to operate the ECHOSTAR-15 satellite at 45.1° W.L.¹ ECHOSTAR-15 will provide Broadcasting-Satellite Service (“BSS”) to Brazil pursuant to Brazilian authorization. EchoStar now seeks a minor modification of its existing Commission authorizations in order to permit the satellite to be repointed. Repointing the satellite will further optimize service coverage of Brazil and will result in the following changes:

- 1) Downlink beam contours. The satellite’s two downlink beams will remain pointed towards Brazil, but the downlink beam contours will change, as set forth in the associated Schedule S.
- 2) Feeder uplink spot beams. The satellite’s two feeder uplink spot beams will be centered over Brazil, as described in the associated Schedule S. Thus, feeder link communications with U.S. earth stations will no longer be required.²

¹ See EchoStar, *Stamp Grant*, IBFS File No. SAT-MOD-20130503-00066 (granted June 20, 2013).

² Telemetry, tracking, and command (“TT&C”) operations will continue to be performed from existing authorized U.S. earth stations. To the extent that TT&C operations may be performed from non-U.S. earth stations in the future, control of these operations will remain in the United States through dedicated lines to and from EchoStar’s U.S. control facilities.

Given the proposed repointing, the analyses with respect to Annex 1 of Appendices 30 and 30A of the ITU Radio Regulations have also been updated.

This Attachment provides the technical information relating to the proposed modification. Any Part 25 requirements regarding operation of the EHOSTAR-15 satellite that are not included in this Attachment have been previously provided to the Commission and have not changed. A completed Schedule S accompanies this application.

A.2 TT&C Characteristics

The EHOSTAR-15 TT&C sub-system provides for communications during transfer orbit and on-station operations, as well as during spacecraft emergencies. The TT&C sub-system operates at the edges of the communications uplink and downlink frequency ranges during all phases of the mission. A summary of the TT&C subsystem characteristics is given in Table A2-1.

Table A2-1: TT&C Performance Characteristics.

Command/Ranging Frequencies	17,791.5 MHz 17,793.5 MHz
Uplink Flux Density (Minimum)	Omni Rx antenna: -83 dBW/m ² (Command) -78 dBW/m ² (Ranging) Comms Rx antenna: -93 dBW/m ² (Command) -87 dBW/m ² (Ranging)
Satellite Receive Antenna Types	Omni antenna and communications antennas.
Polarization of Satellite Rx/Tx Antennas	RHCP for omni antenna RHCP for communications antennas
Telemetry/Ranging Frequencies	12,692.0 MHz 12,693.0 MHz 12,694.5 MHz 12,698.5 MHz
Satellite Transmit Antenna Types	Omni antenna and communications antennas.
Maximum Downlink EIRP	15.2 dBW (Omni antenna) 18 dBW (Communications antennas)

A.3 Interference Analyses - Annex 1 to Appendices 30 and 30A

The EHOSTAR-15 satellite will operate at 45.1° W.L. under the International Telecommunication Union filing submitted by the Administration of Brazil for the B-SAT-3A-3 network. The Brazilian administration will be responsible for coordinating the operation of the EHOSTAR-15 satellite following the Appendix 30 and 30A ITU procedures.

Annex 1 to Appendices 30 and 30A provide criteria to determine if another administration is affected by a proposed modification to the Region 2 BSS Plan. The attached Appendix 1 provides the results of the analyses required by Annex 1 to Appendices 30 and 30A using the transmission parameters of the EHOSTAR-15 satellite network as opposed to those of the B-SAT-3A-3

network. The transmission parameters of the ECHOSTAR-15 satellite network are less interference-producing than those of the B-SAT-3A-3 ITU network.

As demonstrated in the attached Appendix 1, the ECHOSTAR-15 satellite network can be operated at 45.1° W.L., as proposed herein, without causing unacceptable interference to any Region 2 Plan network or to any operational BSS network.

**CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING
ENGINEERING INFORMATION**

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this application, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this application and that it is complete and accurate to the best of my knowledge and belief.

_____/s/_____

Stephen D. McNeil
Telecomm Strategies Canada, Inc.
Ottawa, Ontario, Canada
(613) 270-1177

Appendix 1 to Technical Annex

Analysis of Annex 1 of Appendix 30

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.

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. (WRC-03)*

The ECHOSTAR-15 satellite will operate under Brazil's B-SAT-3A-3 network. Using the transmission parameters of the ECHOSTAR-15 satellite network, an MSPACE analysis was performed utilizing the Region 2 BSS Plan as contained in IFIC 2754. The results of the analysis are contained in Annex 1 to this Appendix. As shown, there are two affected networks that were filed on behalf of Holland and Russia. These networks are modifications to the Region 2 BSS Plan. The results are discussed below for each of these networks:

- Holland's NSS-BSS 47.5W network at 47.5°W.L. is deemed to be affected. We can find no evidence that this network is under construction or scheduled for launch. Further, Holland's network is required to be coordinated with Brazil's Plan networks at the nominal 45° W.L. location.
- Russia's INTERSPUTNIK-47.5W-B network at 47.5°W.L. is deemed to be affected. We can find no evidence that this network is under construction or scheduled for launch. Further, the Russian network is required to be coordinated with Brazil's Plan networks at the nominal 45° W.L. location.

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-density values, at any test point in the service area of its overlapping frequency assignments:

$-147 \text{ dB}(W/(m^2 \cdot 27 \text{ MHz}))$	<i>for</i> $0^\circ \leq \theta < 0.23^\circ$
$-135.7 + 17.74 \log \theta \text{ dB}(W/(m^2 \cdot 27 \text{ MHz}))$	<i>for</i> $0.23^\circ \leq \theta < 2.0^\circ$
$-136.7 + 1.66 \theta^2 \text{ dB}(W/(m^2 \cdot 27 \text{ MHz}))$	<i>for</i> $2.0^\circ \leq \theta < 3.59^\circ$
$-129.2 + 25 \log \theta \text{ dB}(W/(m^2 \cdot 27 \text{ MHz}))$	<i>for</i> $3.59^\circ \leq \theta < 10.57^\circ$
$-103.6 \text{ dB}(W/(m^2 \cdot 27 \text{ MHz}))$	<i>for</i> $10.57^\circ \leq \theta$

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. (WRC-03)

The analysis shows that there are no affected adjacent networks.

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

With respect to § 4.1.1 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the consequence of the proposed modified assignment in the Regions 1 and 3 List 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 Plan or List for Regions 1 and 3 as established by WRC-2000. 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 § 4.2.3 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:

$$\begin{array}{ll} -148 \text{ dB}(W/(m^2 \cdot 4 \text{ kHz})) & \text{for } \theta \leq 5^\circ \\ -148 + 0.5 (\theta - 5) \text{ dB}(W/(m^2 \cdot 4 \text{ kHz})) & \text{for } 5^\circ < \theta \leq 25^\circ \\ -138 \text{ dB}(W/(m^2 \cdot 4 \text{ kHz})) & \text{for } 25^\circ < \theta \leq 90^\circ \end{array}$$

where θ represents the angle of arrival. (WRC-03)

The analysis shows that there are no affected adjacent networks.

5 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 assignments in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference.

The analysis shows that the PFD levels produced by the ECHOSTAR-15 satellite are less than those resulting from the frequency assignments in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference.

6 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 $\Delta T / T$ resulting from the proposed modification is greater than the value of $\Delta T / T$ 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 $\Delta T / T$ resulting from the proposed modification exceeds 6%, using the method of Appendix 8 (Case II). (WRC-03)*

The analysis shows that there are no affected adjacent networks.

Annex 1 to Appendix 1 to Attachment A

ECHOSTAR-15 MSPACE Results

Admin	Orbital Position (°W)	Network	Max. OEPM Degradation (dB)
HOL	47.5	NSS-BSS 47.5W	9.318
RUS	47.5	INTERSPUTNIK-47.5W-B	4.991

Appendix 2 to
Attachment A (Technical Information to Supplement Schedule S)

Analysis of ANNEX 1 of Appendix 30A

1 Limits to the change in the overall equivalent protection margin with respect to frequency assignments in conformity with the Region 2 feeder-link Plan (WRC-2000)

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 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). (WRC-03)*

See the results described under Section 2 of the Appendix 30 Annex 1 Analysis.

2 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 List or proposed new or modified assignments in the Regions 1 and 3 feeder-link List (WRC-03)

Not Applicable to Region 2.

3 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-satellite feeder-link would cause an increase in the noise temperature of the feeder-link space station which exceeds the threshold value of $\Delta T/T$ corresponding to 6%, where $\Delta T/T$ 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)

The analysis shows that there are no affected adjacent networks.

4 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) (WRC-03)

With respect to § 4.1.1 d) of Article 4, an administration is considered affected by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List when the power flux-density arriving at the receiving space station of a broadcasting-satellite feeder-link in Region 2 of that administration would cause an increase in the noise temperature of the receiving feeder-link space station which exceeds the threshold value of $\Delta T/T$ corresponding to 6%, where $\Delta T/T$ 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)

Not Applicable to Region 2.