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March 28, 1997

Thomas S. Tycz, Division Chief
Satellite & Radiocommunication Division
International Bureau
Federal Communications Commission
2000 M Street, N.W., Room 520
Washington, DC 20554

**Re: In the Matter of EchoStar Satellite Corporation Application
for Special Temporary Authority - File No. 155-SAT-STA-96;
In the Matter of Directsat Corporation Application for Special
Temporary Authority - File No. 156-SAT-STA-96**

Dear Tom:

On behalf of EchoStar Satellite Corporation ("EchoStar") and Directsat Corporation ("Directsat"), this letter will respond to your letter dated February 26, 1997 requesting certain technical information in connection with the above-captioned proceedings. EchoStar and Directsat have requested Special Temporary Authorization to operate their two satellites, authorized for 119.2° W.L. and 118.8° W.L., at 119.05° W.L. and 118.95° W.L. respectively. For reasons set forth in EchoStar's and Directsat's requests, the requested temporary clustering of the two satellites closer together will serve the public interest by enhancing efficient and integrated operation of EchoStar's and Directsat's Direct Broadcast Satellite ("DBS") systems.

The Commission exercised its discretion to put the STA requests on public notice and invite public comment (*see* Report No. SPB-60 (rel. Sept. 20, 1996)). No one opposed the requests or filed comments in response to that public notice. In particular, Tempo Satellite, Inc. ("Tempo"), which is assigned channels 22-32 at orbital location 118.8° W.L., did not raise any timely objection to EchoStar's request.

Tempo stands to benefit from the proposed relocation of EchoStar I and Directsat I to 119.05° and 118.95° W.L.. Absent the requested STAs, Tempo would have to collocate its

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satellite with Directsat I at 118.8° W.L. Such close proximity between the two satellites carries inherent risks, especially in light of the relatively wide 0.1° stationkeeping latitude of both satellites. Migration of Directsat I to 118.95° pursuant to the requested STA would avoid these risks.

At the same time, the move of EchoStar I from 119.2° W.L. to 119.05° W.L. will not cause harmful interference for Tempo operations. In the attached Technical Annex, EchoStar's engineering expert Dr. Richard Barnett assesses the interference situation. Dr. Barnett has carefully evaluated the possibility of uplink interference from EchoStar into Tempo uplink transmit earth station antennas. Dr. Barnett concludes that the minor adjustment in EchoStar I's location results in a carrier-to-interference ratio for Tempo that should be well above a reasonable harmful interference threshold. Therefore, under the combined STA requests of EchoStar and Directsat, Tempo will benefit substantially from the migration of Directsat I without suffering any detriment from the relocation of EchoStar I.

EchoStar and Directsat respectfully submit that, for the foregoing reasons and those set forth in EchoStar's and Directsat's applications, the requested STAs are in the public interest. EchoStar and Directsat are also engaging in continuing discussions with Tempo and will soon report to the Commission on the outcome of these discussions.

Respectfully submitted,



Pantelis Michalopoulos
Attorney for EchoStar Satellite Corporation
and Directsat Corporation

cc: Kimberly M. Baum

Technical Annex

This technical annex responds to the Commission's request for a technical showing concerning the possible interference impact on Tempo of the operation of the Echostar and Directsat DBS satellites at 119.05° W and 118.95° W, respectively.

Overview of the Interference Situation

Echostar is authorized to operate odd-numbered channels 1-21 and Directsat is authorized to operate even-numbered channels 2-20, both at the 119° W.L. nominal orbital location¹. The Region 2 Appendix 30 and 30A BSS Plans actually assign the odd-numbered channels to 119.2° W.L. and even numbered channels to 118.8° W.L.. Echostar/Directsat has requested that it be allowed to operate at the slightly different orbital locations of 119.05° W.L. and 118.95° W.L., which are only 0.15° away from the BSS Plan locations. Tempo has been authorized to operate both odd numbered and even numbered channels in the range 22-32 at the 118.8° W.L. orbital location.

Under the requested STA, the Echostar satellite (odd-numbered channels 1-21) would move somewhat closer to the Tempo satellite (all channels in the range 22-32). The BSS Plan nominal spacing of 0.4° is reduced to a nominal spacing of 0.25° in this case. Due to the relatively wide beamwidth of the DBS receive earth station antennas, there is no harmful interference into the Tempo downlinks resulting from this minor adjustment to the Echostar orbital locations. Moreover, a more detailed assessment of interference impact from the uplink

¹ Odd and even-numbered channels operate in opposite senses of circular polarization to each other.

transmit earth station antennas of the EchoStar and Tempo satellites (which have narrower beamwidth) allows a conclusion of no harmful interference as well.

Because of the staggered arrangement of channels between the two polarizations in the Region 2 BSS Plan adjacent channel numbers overlap in part of the channel bandwidth. Therefore, the dominant effect to consider here is the interference from Echostar channel 21 into Tempo channel 22.

Assessment of Uplink Interference from Echostar into Tempo

The interference mechanism from the Echostar uplink in channel 21 into the Tempo channel 22 is dominated by the cross-polar discrimination achievable. The key performance factor here is the ratio of the co-polar boresight gain to the cross-polar off-axis gain (in the direction of the Tempo satellite) of the Echostar transmit antenna. The Appendix 30A Plan² requires that this discrimination factor be at least 30 dB at boresight, or greater at increasing off-axis angles. We refer to this factor below as $XPD(\theta)$.

For digital transmissions in both systems (i.e., flat spectrum), the carrier-to-interference ratio (C/I) for the Tempo uplink can be expressed as:

$$C/I_{\text{Tempo}} = EIRP_{\text{Tempo}} - EIRP_{\text{Echostar}} + XPD(\theta) + F_{\text{Overlap}}$$

where:

² Reference patterns for co-polar and cross-polar gain of the transmit earth station antennas, Figure 6, page 233 of Appendix 30A of the Radio Regulations.

$EIRP_{Tempo}$ is the clear-sky EIRP of the Tempo uplink earth station in the direction of the Tempo satellite;

$EIRP_{Echostar}$ is the clear-sky EIRP of the Echostar uplink earth station in the direction of the Echostar satellite;

$XPD(\theta)$ is the cross-polar performance factor of the Echostar uplink earth station antenna in terms of the difference between its co-polar boresight gain to its cross-polar off-axis gain (in the direction of the Tempo satellite). $XPD(\theta)$ is always greater than 30 dB for the range of off-axis angles considered in this analysis.

$F_{Overlap}$ is the frequency overlap factor, which represents the proportion of the power in the Echostar channel that falls within the bandwidth of the Tempo channel. In the case of the Region 2 BSS Plan this factor is 4.06 dB (ratio of 9.42 MHz to 24 MHz).

Note that this formula always represents the worst-case situation insofar as rain fade situations are concerned. Although the uplink earth stations will operate Uplink Power Control (UPC) to combat uplink rain fades, the Region 2 BSS Plan requires that such UPC only be implemented when there is at least 5 dB of rain fade, and then on a dB for dB basis. This results in the received power at the satellites, and therefore the uplink interference, always being less under rain fade conditions than under clear sky conditions.

Therefore the above formula can be simplified to:

$$C/I_{Tempo} \geq EIRP_{Tempo} - EIRP_{Echostar} + 30 \text{ dB} + 4.06 \text{ dB}$$

Clearly, this formula demonstrates that, provided the uplink EIRP of the two systems is comparable, then the C/I is well in excess of 30 dB.

The Echostar uplink EIRP, under clear sky conditions, will not exceed 87.4 dBW³. We consider that an uplink C/I of 30 dB should be adequate for Tempo. Therefore, provided the Tempo clear sky uplink EIRP is at least 83.34 dBW, then the uplink interference from Echostar into Tempo will be acceptable. Note that this value of EIRP should be well within the capability of the Tempo uplink earth station, which we understand to be a 13 meter antenna (gain of approximately 65 dBi), requiring less than 100 Watts of RF power.

In conclusion, provided that the Echostar uplink complies with certain of the provisions of the Region 2 BSS Plan, as defined in Appendix 30A of the Radio Regulations, and that Tempo similarly operates at reasonable uplink EIRP levels, then there is no risk of unacceptable interference from the Echostar uplink into the Tempo satellite for the adjusted orbit location requested by Echostar.

³ Region 2 BSS Plan value in Appendix 30A of the Radio Regulations.

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 pleading, 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 pleading, and that it is complete and accurate to the best of my knowledge and belief.

Richard Barnett

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Dated: March 27, 1997