EXHIBIT C

FCC Form 312: Response to Question 35
Waiver Requests

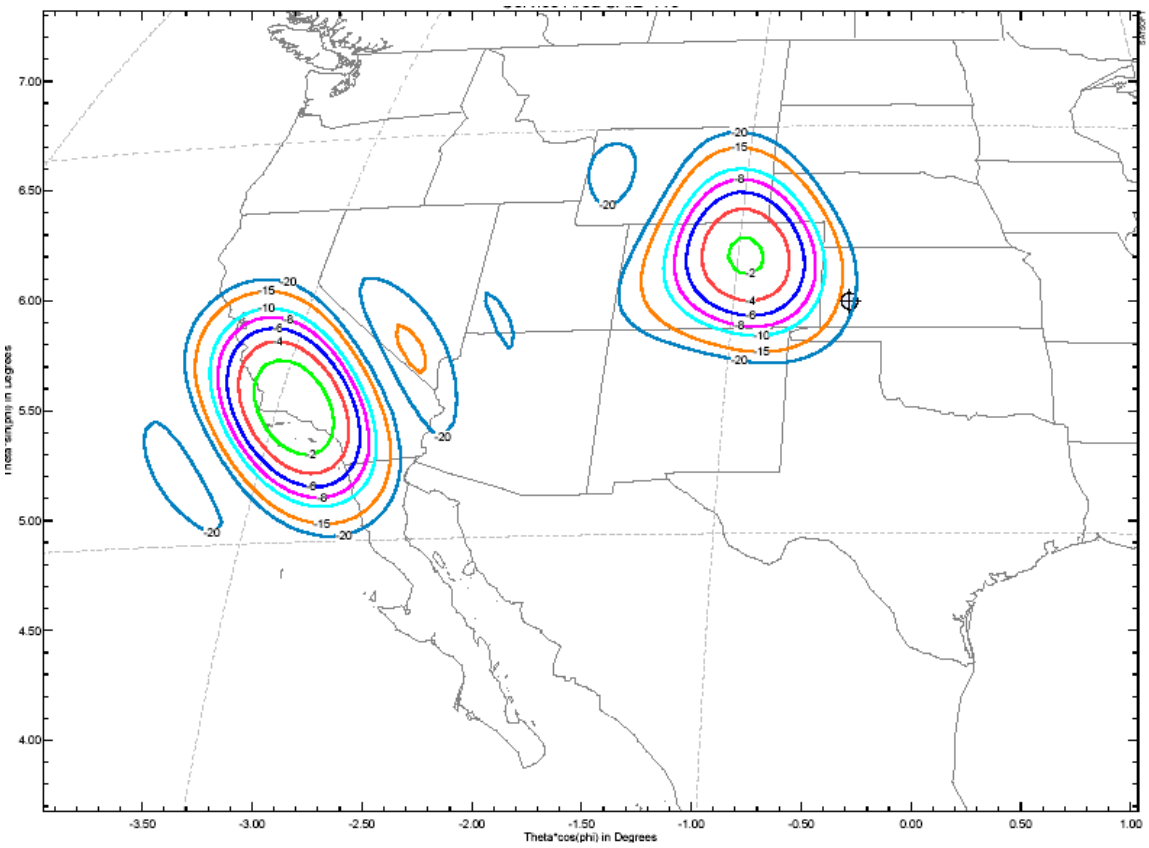
Section 25.210(c): DIRECTV requests a partial waiver of the requirement in Section 25.210(c) of the FCC's rules that satellites in the FSS must have the capability to change the transponder saturation flux density by ground command in 4 dB increments over a range of 12 dB. The SPACEWAY satellites comply with this requirement in the 29.5-30.0 GHz band. However, in the 28.35-28.6 GHz and 29.25-29.5 GHz band, they employ automatic level control circuitry ("ALC") that maintains a constant input to the final spacecraft amplifier over a range of receive signal levels. This range for the 28.35-28.6 GHz band is 8 dB, and for the 29.25-29.5 GHz band is 6 dB.

This gain step requirement was adopted to allow the sensitivity of FSS satellites to be varied in order to ensure that an FSS satellite can be made electromagnetically compatible with a neighboring satellite. However, in the Ka-band the FCC has adopted rules for blanket licensing of earth stations (*see* Section 25.138) which effectively serve to ensure that Ka-band satellites spaced as close as 2^{o} can in fact be operated in an electromagnetically compatible fashion. This is done by specifying the allowable off-axis EIRP density from earth stations. Therefore, the requirement specified in Section 25.210(c) is unnecessary for Ka-band systems like SPACEWAY that comply with the coordination triggers established in the blanket licensing rules.

Accordingly, DIRECTV requests that the Commission accept the proffered information and grant a partial waiver of Section 25.210(c) for the frequency bands 28.35-28.6 GHz and 29.25-29.5 GHz.

Section 25.210(d): DIRECTV requests a partial waiver of the requirement for full frequency reuse set forth in Section 25.210(d) of the Commission's rules with respect to a single uplink beam. The rule requires the use of orthogonal polarizations within the same beam and/or through the use of spatially independent beams. The proposed SPACEWAY-2 satellite will comply with this requirement in all 133 uplink beams except one: the uplink beam in the 28.35-28.6 GHz band operates using only left hand circular polarization. The satellite will receive this particular frequency band through a combination of antenna horns with an aggregate pattern as shown in Figure W1. As can be seen from this Figure, this configuration of receive antennas does, in fact, cover geographically separated areas; however it provides this coverage using a single polarization.

Figure W1. Receive Antenna Pattern for LHCP Antennas for 28.35-28.6 GHz



SPACEWAY-2 is a Boeing 702 model spacecraft, one of the largest satellites ever built for commercial use and the largest Ka-band-only satellite ever launched. Given that the payload components that will support the use of the 28.35-28.6 GHz band were added to a satellite that was nearing completion of construction, changing the design of the overall receive system for this particular frequency band was simply not practicable. DIRECTV essentially would have had to choose between not using both polarizations for this particular receive frequency band and changing the overall design of the receive system for this particular frequency band, which would have had innumerable consequential effects on design changes for the rest of the already completed portions of the spacecraft. In similar circumstances involving a limited amount of bandwidth, the Commission has in the past waived the full frequency reuse requirements set forth in Section 25.210 of the Commission's rules.[1] DIRECTV requests such a waiver with respect to its operations in the 28.35-28.6 GHz band.

Section 25.210(i): DIRECTV requests a waiver of the requirement in Section 25.210 (i) of the FCC's rules that space station antennas in the Fixed-Satellite Service be designed to meet a cross-polarization isolation of 30 dB within the primary coverage area

[1] *See, e.g., PanAmSat Licensee Corp.*, 17 FCC Rcd. 10483, 10491-92 (Int'l Bur. 2002).

of the antenna. The SPACEWAY multi-spot beam receive antenna that operates in the 29.25-30.0 GHz range has been designed to meet a cross-polarization requirement of 18.8 dB, and the wide area beam transmit antenna that operates in the 18.3-18.8 GHz band has been designed to meet a cross-polarization requirement of 19 dB.

Cross-polarization interference can result from either ground terminal or spacecraft polarization imperfections, or from atmospheric effects such as rain. The SPACEWAY 29.25-30.0 GHz receive antenna design achieves the required performance while using relatively inexpensive user terminals with axial ratios of up to 1 dB (1:1.26). While the design requirement for the 29.35-30.0 GHz receive antenna only specifies 18.8 dB, measurement data shows a worst case value of 23 dB in one of the 112 receive beams in this frequency band and an average value for the remaining beams that is 2-3 dB better than this worst case. Verified measurement data for the 18.3-18.8 GHz transmit antenna is not yet available.

The satellite design does not technically provide 30 dB cross-polarization over the entire coverage area as required by Section 25.210(i) of the Commissions rules. However, cross-polarization interference is an intra-system design issue and does not affect inter-system coordination, and thus will not affect other Ka-band satellite systems. Moreover, with respect to intra-system interference, SPACEWAY-2 employs digital modulation with forward error correction coding on both polarization senses to reduce the system sensitivity to cross-polarization interference. Specifically, polarization isolation, directivity and antenna implementation losses have been jointly optimized to yield the best overall performance. Even with the stated level of cross-polarization isolation, cross-polarization interference accounts for a small fraction of the overall total link noise. Accordingly, DIRECTV requests a waiver of the 30 dB cross-polarization isolation requirement of Section 25.210(i).

Section S6 of Schedule S: Section S6 of Schedule S calls for information on the Service Areas of the satellite system. These Service Areas are then tied to specific satellite antenna beams in the next section of Schedule S, and so this request for Service Area information has been interpreted as the "service area for each non-overlapping beam of the satellite system."

The SPACEWAY-2 satellite generates, in part, 112 specific non-overlapping receive spot beams. Because they are non-overlapping, these receive spot beams each serve a unique "service area" (labeled service area ID 1 to 112 , or SAID-1 to SAID-112). A complete listing of each and every one of these 112 service area IDs has not been included in Section 6. Instead, the highest and lowest numbered of these SAIDs (i.e. SAID-1 and SAID-112) have been listed, along with some intermediate service area IDs.

Even though each and every one of these 112 service area IDs has not been specifically listed, the details of the specific geographical area served by each and every service area from SAID-1 to SAID-112 has been included in the attached Excel spreadsheet labeled "BeamID&ZipCode.xls." This spread sheet lists the combination of US zip codes served by SAID-1 to SAID-107 (except for SAID-106). For those

numbered SAIDs not listed in this spread sheet, PDF files that graphically illustrate the service area have been attached. DIRECTV requests that the Commission accept the proffered information as sufficient and grant a partial waiver of any requirement for further information on service areas.

Section S7 of Schedule S: Section S7 of Schedule S calls for information on the Space Station Antenna Beam Characteristics of each beam of the satellite. Much of the information called for in this Section of Schedule S has been provided. However, there are certain characteristics for which it is not possible, or practicable, for DIRECTV to respond directly to Schedule S. These characteristics are discussed below. In addition, given the large number of beams that are part of the SPACEWAY-2 satellite (*see also* discussion of Section S6 above), not all beams have been listed in this Section. However, those numbered beams not listed have identical technical characteristics to those numbered beams that are listed.

Item S7(p) calls for minimum saturation power flux density for space station receive beams. This characteristic is typically specified for a "conventional" satellite payload, with a frequency translating receiver, a traveling wave tube or solid state power amplifier, and a passive transmit antenna. The SPACEWAY-2 satellite, however, employs a non-conventional payload design to support beams 1 to 112. In the SPACEWAY design the output from each beam of the receive antenna is down-converted to a common IF frequency and routed through a 256x256 microwave switch matrix. The outputs from this switch matrix are then routed to additional payload hardware that performs, among other things, commandable gain and power level control. This payload function adjusts the received signal power to a fixed level, and thereby effectively separates the received signal level from the transmit signal level. This is done in order that the RF input level to the 1500 elements of the active phased array transmit antenna is carefully controlled. Hence, there is no particular value that can be specified for item S7(p) for rows containing uplink beams 1 to 112.

Likewise, items S7(k) and S7(l) call for input losses and effective output power for space station transmit antennas. Again, these values are typically specified for conventional satellite payloads and refer to the output power from a conventional transmitter and losses between the conventional transmitter output and the transmit antenna input. However, in the case of the SPACEWAY-2 satellite, the DL-A space station transmit antenna is an active phased array with 1500 elements. It is the phase and amplitude interaction, in space, of the emissions from each of these 1500 elements (*i.e.*, constructive and destructive interference) that forms the actual downlink beam shape and generates the final EIRP in each downlink beam. As such, the characteristics called for in these items of Schedule S simply cannot be applied to the SPACEWAY-2 satellite transmit antenna. The resultant maximum downlink EIRP (item S7(m)), which is the truly significant entry in columns k to m, can be specified, and a value is provided for this item. DIRECTV requests that the Commission accept the proffered information and waive any further information requirement under Section S7 of Schedule S.

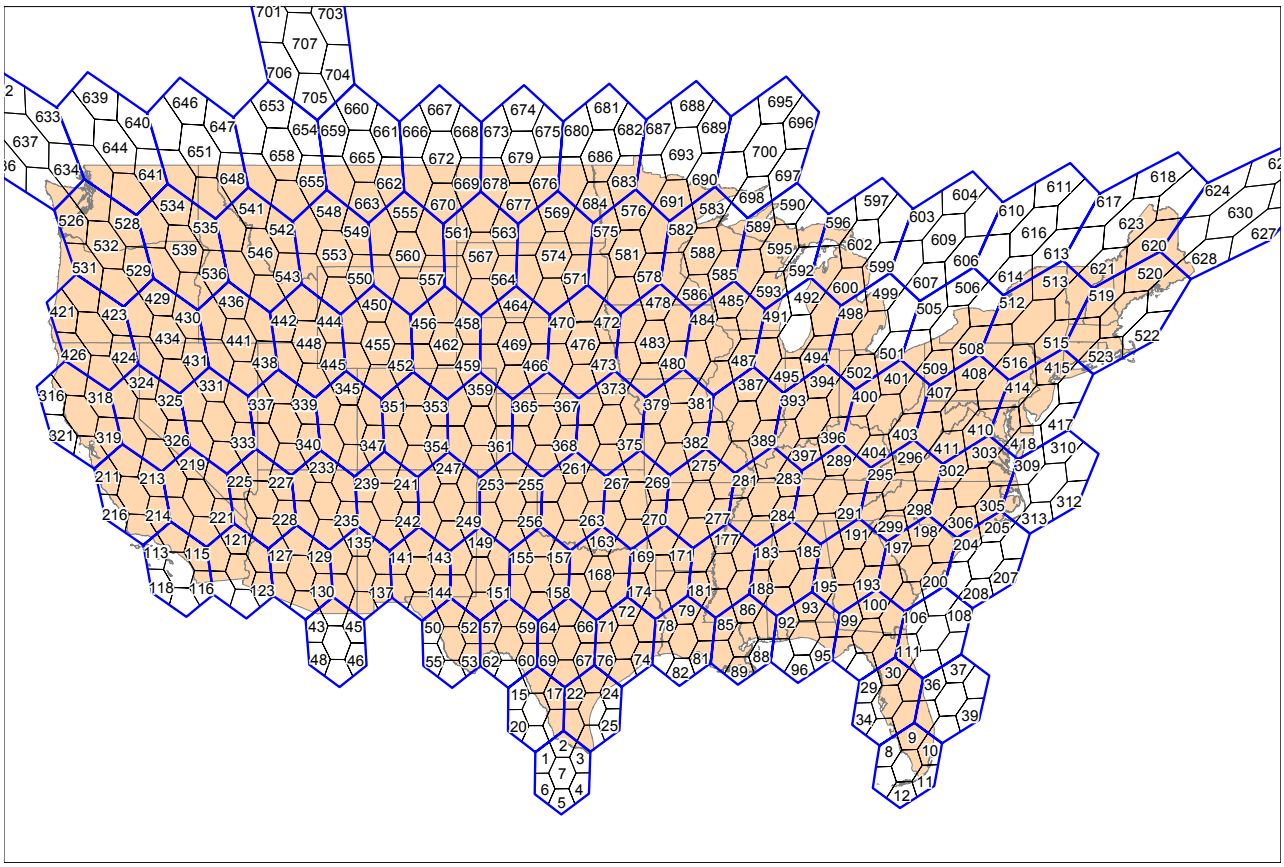
Section S8 of Schedule S: Section S8 of Schedule S calls for information on Antenna Beam Diagrams. A representative sample of the information called for in the Schedule S has been provided. However, given the flexibility and complexity of the SPACEWAY-2 spacecraft, and the sheer volume of data that full compliance with this section would represent, DIRECTV asks for a partial waiver of this Section as discussed below.

Item S8 calls for a GXT file containing antenna gain contour data for each beam on the spacecraft. The SPACEWAY-2 satellite has 113 receive communications beams, over 785 transmit communications beams, and various telemetry, tracking and control beams. In addition, given the active phased array design of the SPACEWAY-2 transmit antenna, it could be argued that the number of transmit beam configurations is effectively infinite. This clearly renders compliance with this Section of Schedule S impractical.

In order to address the requirements of this section, a set of GXT files for a representative collection of the 112 SPACEWAY-2 receive beams has been included in Schedule S. In addition, a full set of the command receive beams and the limited number of other communications receive beams have all been included.

For transmit beams, the downlink phased array antenna can be operated such that it produces 24 downlink hopping beams that move among 784 downlink locations. The net effect of this operation, over time, is that the entire CONUS can be viewed as being within the 0 dB contour of the downlink beam (*i.e.*, beam DL-A). This is the worst case operation from the perspective of possible interference to other systems, which will provide the essential baseline that this section of Schedule S is designed to elicit. As such, what has been provided as a GXT file for beam DL-A is a "composite" contour of the downlink phased array operation, over time. This is essentially the summation of the downlink contours from all of the contiguous perimeter beams (See Figure W2 for representation of contiguous downlink beams), as well as the contours of all of the non-contiguous beams. In addition, a full set of the telemetry transmit beams and the limited number of other communications transmit beams have all been included. Accordingly, DIRECTV requests that the Commission accept the proffered information and grant a partial waiver from any further requirement for information under Section S8.

Figure W2. Arrangement of Contiguous Downlink Cells for Beam DL-A



Section S10 of Schedule S: Section S10 of Schedule S calls for information on each Space Station Transponder. In this Section, a "transponder" is defined as a connection between a receive channel (*i.e.,* center frequency, bandwidth and polarization in a given beam) and a transmit channel. Considering the flexibility and complexity of the SPACEWAY-2 spacecraft, and the sheer volume of "transponders" that compliance with this section would represent, DIRECTV asks for a partial waiver of this section as discussed below.

Item S10 calls for a complete listing of all "transponders" supported by the spacecraft. The SPACEWAY-2 satellite receives the 28.35-28.6 GHz band in uplink beam 113, and can receive the 29.25-29.5 GHz band in any of the uplink beams numbered 1 to 112. These received bands are retransmitted in the lower and upper halves of the 18.3-18.8 GHz band, respectively, in downlink beam DL-B, in either RHCP or LHCP. In this case there are two possible "transponders" for the 28.35-28.6 GHz/18.3-

18.55 GHz bands, and both of these have been listed. There are also 224 possible "transponders" for the 29.25-29.5 GHz/18.55-18.8 GHz bands (*i.e.*, this band being received in any of the 112 uplink beams and being re-transmitted in RHCP or LHCP). Not all of these possible combinations have been listed. What has been listed is a representative set of "transponders" in which this band is received in the lowest and highest numbered receive beams and is retransmitted either RHCP or LHCP. These combinations are listed with transponder IDs beginning with the nomenclature "B00xx."

In non-processor mode, the satellite can support any combination of eight 62.5 MHz channels in the 19.7-20.2 GHz band, in any of the 112 receive beams (1 to 112), and can connect those channels to any of eight transmit channels in the 29.5-30.0 GHz band in beam DL-A, in either RHCP or LHCP. Considering just one uplink channel, this channel can be received in any of the 112 receive beams, and transmitted in any of eight possible transmit channels, in either RHCP or LHCP. Therefore, for this one received channel there are 1792 (*i.e.*, 112x2x8) possible "transponders" that can be defined. Given that there are 8 uplink channels, there are 14,336 possible single channel "transponders" that can be defined by the SPACEWAY-2 uplink beams 1 to 112 and downlink beam DL-A. Not all of these possible combinations have been listed. What has been listed is a representative set of "transponders" in which the lowest numbered uplink channel, being received in RHCP and LHCP uplink beams, is connected with the lowest and highest numbered downlink channels, in either RHCP or LHCP, and likewise for the highest numbered uplink channel. These combinations are listed with transponder IDs beginning with the nomenclature "A00xx."

For satellites with on-board processing, this section of Schedule S calls for the specification of half-links. When operated in this mode, the SPACEWAY-2 satellite can support multiple 62.5 MHz sub-bands, of which there are eight, in any of the 112 uplink beams. Considering just one channel, this channel can be received in any of 112 uplink beams. Therefore, there would be 896 (*i.e.*, 8x112) possible single channel half links required to make a full set of entries into Section S10 for this mode of operation. Not all of these possible entries have been listed. What has been listed is a representative set, showing each of the individual sub-bands being received by the satellite in either RHCP or LHCP. These combinations are listed with transponder IDs beginning with the nomenclature "A01xx" and "A02xx."

DIRECTV requests that the Commission accept these representative samples as adequate under the circumstances to satisfy the intent of Section S, and grant a partial waiver to relieve DIRECTV from the burden of providing information for literally thousands more "transponders" on its SPACEWAY-2 satellite.

Section S13 of Schedule S: Section S13 of Schedule S calls for information on typical emissions. The first item called for is the listing of all transponders in which a given emission can be transmitted. As explained in connection with Section S10, not all of the over 15,000 possible transponders associated with the SPACEWAY-2 satellite have been listed in Section S10. As such, a complete listing of all possible transponders in which a given emission could be transmitted cannot be listed in Section S13. Thus, a

representative sampling of typical emissions has been included. For the non-processor "transponders" each emission is listed with the lowest and highest number transponder included in the transponder tab of the Schedule. For the processor mode of operation each emission designator is listed twice. The first listing is for the case of this emission being transmitted or received, as appropriate, from the smallest earth station that will operate with this emission. The second listing is the equivalent for the largest earth station that will operate with this emission.

Given the thousands of "transponders" available on SPACEWAY-2, DIRECTV requests that the Commission accept the representative data supplied herein and grant a partial waiver to relieve it from the burden of providing any further information on typical emissions.