



1200 EIGHTEENTH STREET, NW
WASHINGTON, DC 20036

TEL 202.730.1300 FAX 202.730.1301
WWW.HARRISWILTSHIRE.COM

ATTORNEYS AT LAW

December 19, 2005

**REDACTED
FOR PUBLIC INSPECTION**

BY ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: PUBLIC Reply in MB Docket No. 05-181

Dear Ms. Dortch:

Attached please find a redacted version of DIRECTV's Reply, submitted for public inspection in the above-captioned proceeding. I have filed under separate cover and by hand a non-public, confidential version of the Reply. Should you have any questions, please do not hesitate to contact me.

Respectfully submitted,

/s/ _____
Michael Nilsson
Counsel to DIRECTV, Inc.

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

In the Matter of:

Implementation of Section 210 of the
Satellite Home Viewer Extension
and Reauthorization Act of 2004 to Amend
Section 338 of the Communications Act

MB Docket No. 05-181

REPLY

DIRECTV, Inc. (“DIRECTV”) has invested many years and over a billion dollars in designing, constructing, and launching two Ka-band satellites (SPACEWAY 1 and 2) to deliver local broadcast signals in high definition (“HD”) format in markets across the country. Based on the knowledge it has gained in this process, DIRECTV has argued that requiring the retransmission of HD and multicast local broadcast programming in Alaska and Hawaii is an unreasonable and unconstitutional interpretation of SHVERA¹ because of the enormous capacity burdens it creates and the resulting necessity of reallocating capacity away from other markets DIRECTV otherwise intends to serve.

The National Association of Broadcasters (“NAB”), appearing for the first time in this proceeding, now asserts that requiring such carriage is a reasonable and constitutional² interpretation of the statute because, in its view, requiring such carriage

¹ *Implementation of Section 210 of the Satellite Home Viewer Extension and Reauthorization Act of 2004 to Amend Section 338 of the Communications Act*, 20 FCC Rcd. 14242 (2005) (“Order”). 47 U.S.C. § 338(a)(4); *Satellite Home Viewer Extension and Reauthorization Act of 2004 (“SHVERA”)*, Pub. L. No. 108-447 § 210, 118 Stat. 2809, 3428-29 (2004).

² NAB did not dispute that the Commission has a duty to interpret statutes to avoid constitutional issues. *See Telephone Company – Cable Television Cross-Ownership Rule*, 10 FCC Rcd. 7887, 7888 (1995).

imposes no serious capacity burdens on DBS operators.³ This dispute largely boils down to a factual question: does mandatory HD and multicast carriage in Alaska and Hawaii substantially burden the capacity allocations made by DBS operators, or does it not?⁴

NAB's attempt to answer this question demonstrates a profound misunderstanding of how DIRECTV's satellites retransmit local signals. The technical "analysis" upon which NAB relies is based on assumptions and calculations that simply do not correlate with the real world. Unlike NAB, however, DIRECTV can supply the Commission with the actual satellite performance characteristics of its SPACEWAY satellites and give a true measure of the carriage requirement's impact. As discussed more fully below and in the attached technical declaration,⁵ DIRECTV now uses two SPACEWAY transponders to retransmit local signals in Alaska and Hawaii in standard definition ("SD") format. Requiring carriage of those stations in HD format, or carriage of HD plus multicast signals from each station, would dramatically increase the capacity required to serve those states.

Table 1: Transponders Required for Alaska-Hawaii Carriage

Alaska-Hawaii Carriage Requirement	Number of SPACEWAY transponders needed for Alaska and Hawaii carriage
SD Only	2
HD Only	10
HD Plus Multicast	15

³ Opposition of National Association of Broadcasters to Petitions for Reconsideration (filed Dec. 9, 2005) ("NAB Opposition") at 10 (arguing that, "[i]n the absence of a substantial capacity burden and consequent 'actual effects' on DIRECTV's programming choices, DIRECTV has not shown a constitutionally significant burden on its speech"); *id.* at 16 (arguing that, "[i]n the context of a satellite operator's entire system, the economic burden imposed by a very limited carriage obligation would not be significant, especially in light of the rapid past and continuing expansion in satellite capacity").

⁴ For purposes of this Reply only, DIRECTV disregards the substantial operating costs and technical difficulties associated with multicast carriage, such as purchasing, integrating, and deploying technology capable of simultaneously decoding and multiplexing multicast signals. It also disregards the substantial imposition on DIRECTV's editorial control and property rights of mandatory carriage requirements.

⁵ See Declaration of James R. Butterworth, attached hereto as Exhibit A ("Butterworth Dec.").

In order to meet these increased capacity demands, DIRECTV would have to reallocate transponders to Alaska and Hawaii that otherwise would likely have been allocated for use in providing HD local service in other markets. As in illustrative matter, the scenarios summarized above would require reallocation of transponders sufficient to serve the markets listed below, which reflect the smallest markets SPACEWAY is scheduled to serve. Such an outcome, DIRECTV submits, is both unwise and unlawful.⁶

Table 2: Illustrative Markets Denied HD Local

Alaska-Hawaii Carriage Requirement	Illustrative Markets Denied HD Local
SD Only	Baseline case
HD Only	Buffalo, NY; Providence, RI; Austin, TX; Fresno, CA; Green Bay, WI; Portland, ME; Madison, WI; Reno, NV
HD Plus Multicast	All of the above, plus Memphis, TN; Oklahoma City, OK; Albuquerque, NM; Greensboro, NC; Las Vegas, NV

I. Compared to Current SD Carriage, Mandatory HD or HD Plus Multicast Carriage Would Impose Substantial Capacity Burdens.

NAB begins its discussion of satellite capacity with a claim that simply defies logic – that the number of programming streams within a broadcast signal that a DBS

⁶ Again, DIRECTV believes that the key issue raised by NAB’s Opposition is capacity. In the interest of completeness, however, DIRECTV must note several areas where it disagrees with NAB’s legal analysis. First, NAB’s claim that the Commission’s statutory interpretation merits *Chevron* deference is simply incorrect. NAB Opposition at 3 (citing *Chevron USA, Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837, 843-44 (1984)). By its terms, *Chevron* deference is limited to situations “[w]hen a court reviews an agency’s construction of the statute.” *Chevron*, 467 U.S. at 842. The Commission is entitled to reach a different result on reconsideration so long as it provides a reasoned basis for doing so. See, e.g., *Motor Vehicle Manuf’s. Assoc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 41-42 (1983). Second, NAB’s assertion that “a broadcast signal delivered in HDTV must be carried by the cable operator in HDTV,” NAB Opposition at 13, cannot go un rebutted. While cable operators must retransmit digital-only broadcast stations in the digital format broadcast, they need not carry the HD signal (or any other digital signal) of the vast majority of stations that have yet to cease analog transmissions. See *Carriage of Digital Television Broadcast Signals: Amendments to Part 76 of the Commission’s Rules*, 20 FCC Rcd. 4516, 4532 (2005). Given the efforts NAB has exerted on the cable carriage rules, it is difficult to conclude that NAB’s erroneous description of those rules in this proceeding is anything but deliberately misleading.

operator must carry does not matter because the operator never has to carry more than is broadcast. NAB thus asserts that, if DBS operators are prepared to carry digital television stations in Alaska and Hawaii, “then logically they must be prepared to carry an HD signal for each, which means by extension that they are capable of carrying broadcasters’ multiplexed signals as well.”⁷

This is nonsense. NAB recognizes that the amount of data transmitted in any broadcaster’s digital television signal can be as much as 19.4 Megabits per second (“Mbps”).⁸ When the ATSC standard was first developed in the mid-1990’s, the assumption was that this bitrate could be used to support a single HD signal *or* multiple SD signals.⁹ However, as NAB acknowledges, technology has advanced to the point where broadcasters today use on average only 12-15 Mbps to transmit an over-the-air HD signal¹⁰ – leaving 4.4-7.4 Mbps of capacity that can be filled with *additional* SD multicast programming.

In any event, the very question in this proceeding is whether DBS operators should be required to carry Alaska-Hawaii broadcast signals under any of the following scenarios:

- An “***SD Only***” scenario, in which DIRECTV is required to carry a single feed from each Alaska and Hawaii station in SD format.

⁷ NAB Opposition at 5.

⁸ *Id.* at 4.

⁹ *See, e.g., Carriage of Digital Television Broadcast Signals; Amendments to Part 76 of the Commission’s Rules*, First Report and Order, 16 FCC Rcd. 2598, 2615 n. 111 (2001) (“For example, an HDTV channel encoded in 8 VSB, would occupy a digital bandwidth of about 19.4 megabits per second (‘mbps’) which, in turn, would require a 6 MHz bandwidth.”).

¹⁰ Because satellite operators statistically multiplex the digital signals within a given market, the key figure here is the average data rate required to retransmit signals – not the rate of any one signal at any given time. This is why it does not matter if a station may “require most of [its allotted bandwidth] if, for example, sporting events are being transmitted.” NAB Opposition at 4 n.7.

accommodate all 17 Alaska stations on a single transponder, and all 12 Hawaii stations using another transponder.¹⁴

In an HD-only scenario, far more capacity would be required. Specifically, DIRECTV uses approximately [REDACTED] for retransmission of an HD signal by a [REDACTED] SPACEWAY satellite.¹⁵ Given a maximum bit rate of 29 Mbps per transponder, DIRECTV can thus carry up to three HD signals per SPACEWAY transponder. Accordingly, carriage of a single HD feed from each of 17 stations in Alaska would require six transponders, not one. And carriage of a single HD feed from each of 12 stations in Hawaii would require four transponders, not one. In other words, *HD carriage would require five times as much SPACEWAY capacity* as DIRECTV is currently using for SD service to Alaska and Hawaii (*i.e.*, a total of ten transponders, rather than just two).

An HD plus multicast scenario compounds these difficulties. Making the (conservative) assumption that each station in Alaska and Hawaii can simultaneously broadcast one HD signal and two multicast signals in SD format, DIRECTV could retransmit this package of signals using approximately [REDACTED] (*i.e.*, [REDACTED] for the [REDACTED] HD signal and [REDACTED] for each SD signal) using existing technology. It would therefore be able to carry the signals of two stations on each SPACEWAY transponder. Accordingly, such carriage of 17 stations in Alaska would require nine transponders and of 12 stations in Hawaii would require six transponders. In other words, HD plus multicast carriage would require *more than seven times as much SPACEWAY capacity* as

¹⁴ See Butterworth Dec. at 6-7.

¹⁵ As NAB points out, even the original terrestrial transmission of an HD signal typically requires only 12-15 Mbps, rather than the maximum bit rate of 19.4 Mbps. See NAB Opposition at 4 n.7.

DIRECTV is currently using for SD service to Alaska and Hawaii (*i.e.*, a total of 15 transponders, rather than just two).

Finally, as NAB has raised the issue, DIRECTV is compelled to add a word about credibility. NAB urges the Commission to view DIRECTV's claims of capacity constraints "skeptically" because, NAB asserts, DIRECTV has "in the past made a number of claims about capacity constraints that proved inaccurate."¹⁶ Nothing could be further from the truth.¹⁷ And it is indisputable that DIRECTV did not have sufficient capacity to introduce HD local service outside of New York and Los Angeles until it redesigned and repurposed the SPACEWAY satellites from their original mission of providing broadband services. Indeed, even after writing off an investment of hundreds of millions of dollars and abandoning a satellite-based broadband service, DIRECTV *still* had to invest tens of millions of dollars into development of MPEG-4 encoding technology and set-top boxes in order to roll out HD local services. These efforts – which will significantly expand the digital reach of the broadcasters that now belatedly see fit to participate in this proceeding – give DIRECTV more, not less, credibility on capacity issues.¹⁸

¹⁶ NAB Opposition at 8.

¹⁷ The one example cited by NAB – the introduction of local-into-local service in more markets than DIRECTV had anticipated – required DIRECTV to enter into an arrangement for the use of a Canadian DBS slot to serve U.S. households.

¹⁸ By contrast, NAB's credibility should be measured against the broadcast industry's continuing efforts not to complete the digital transition and return their analog spectrum.

II. Capacity Demands for Mandatory Services in Alaska and Hawaii Would Have Real World Consequences, Precluding DIRECTV From Launching HD Local Service in Many Other Markets Across the Country.

As a constitutional matter, it is sufficient to show that the HD carriage obligation proposed for Alaska and Hawaii would require five times as much capacity as is now used for local service in the two states, and that multicast carriage adds significantly to that burden. However, the impact of these carriage requirements becomes even more tangible when placed in a real-world context: in order to fulfill carriage requirements in Alaska and Hawaii, DIRECTV would have to repurpose SPACEWAY transponders that would otherwise be used to provide local HD service in other markets.¹⁹

Were such a radical reallocation of capacity required, DIRECTV would be forced to analyze the competing technical and business considerations to determine exactly which markets would be denied local HD service. DIRECTV hopes never to have to undertake such an analysis.²⁰ For illustrative purposes, however, one could see the effect if that capacity were allocated away from the smallest markets DIRECTV currently intends to serve from its SPACEWAY satellites. Table 2, above, matches the capacity currently allocated for local HD service in such markets (starting with the smallest one and moving upward) with the incremental additional capacity needs for service in Alaska and Hawaii under a variety of carriage rules. As described therein, it is not unreasonable

¹⁹ DIRECTV could also use CONUS capacity to make up for the shortfall. But this, of course, would deprive subscribers throughout the country of valuable programming.

²⁰ Indicative of NAB's fundamental misunderstanding of the issues in this proceeding, its expert faults DIRECTV for "fail[ing] to explain why it is unwilling or unable to reassign to Alaska and Hawaii any of its planned Ka spot beam capacity." Skjei Statement, ¶ 10. It is precisely because such a massive reassignment of capacity would deprive DIRECTV subscribers in many other markets of HD local service they otherwise would receive that the Alaska-Hawaii carriage requirement imposed by the Commission is both unwise and unlawful.

to assume that markets ranging from as small as Reno to as large as Salt Lake City would risk losing local HD service, depending upon the outcome of this proceeding.

III. NAB's References to "Future Capacity" Are Unavailing.

Lastly, DIRECTV would briefly address NAB's references to the D10 and D11 satellites, two next-generation Ka-band satellites currently under construction at the cost of hundreds of millions of dollars.²¹ Even if both satellites launch successfully and on time – by no means a certainty – neither will be in operation prior to SHVERA's deadline for digital service in Alaska and Hawaii. Accordingly, as a legal matter, neither can be counted on to remedy the capacity burdens caused by the Commission's *Order*.

Moreover, the two satellites will not have sufficient capacity on the Alaska and Hawaii spot beams to carry all 29 of the Alaska-Hawaii stations in HD, much less comply with an HD plus multicast requirement.²² DIRECTV could, of course, use capacity on the SPACEWAY satellites to make up the shortfall. But this in turn would prevent DIRECTV from using that capacity for other purposes such as extending HD local service to additional markets or extending SD signals to markets that do not yet have any local-into-local service. And the more burdensome the Alaska-Hawaii carriage requirement, the more capacity from SPACEWAY would be required, and the fewer other markets would receive local-into-local service. Accordingly, the anticipated launch of D10 and D11 does not diminish the grave constitutional questions raised by the *Order*.

²¹ NAB Opposition at 6. NAB also revives its laundry list of other techniques with which it supposes DIRECTV might find additional capacity. Many of these techniques are already being used with the SPACEWAY system, and it is entirely speculative to suppose that such technology will make the quantum leap forward that would be required to prevent an HD or HD plus multicast carriage requirement from requiring a substantial reallocation of DIRECTV's capacity. The Commission simply cannot make decisions based on the "hope" that technology will solve problems it has created, especially when those problems are of a constitutional dimension.

²² Unlike the SPACEWAY satellites, D10 and D11 have fixed beams. There is thus no way to reallocate capacity they would otherwise use to serve different markets.

* * *

At its heart, the question in this proceeding is whether it is appropriate or constitutional for the Commission to decide that subscribers in other places should be deprived of services in order to maximize the bitrate consumed by Alaska and Hawaii broadcasters. This is no theoretical concern. By mandating the parameters for local retransmissions in Alaska and Hawaii, the Commission will determine the service available to – or not available to – millions of DIRECTV subscribers. This is neither good law nor wise policy, and the Commission should therefore grant DIRECTV’s Petition.

Respectfully Submitted,

William M. Wiltshire
Michael Nilsson
HARRIS, WILTSHIRE & GRANNIS LLP
1200 Eighteenth Street, NW
Washington, DC 20036
(202) 730-1300

Counsel for DIRECTV, Inc.

December 19, 2005

/s/ _____
Susan Eid
Vice President, Government Affairs
Stacy R. Fuller
Vice President, Regulatory Affairs
DIRECTV, INC.
444 North Capitol Street, NW, Suite 728
Washington, DC 20001
(202) 715-2330

CERTIFICATE OF SERVICE

I, Jennifer Anselmo, do hereby certify that on this nineteenth day of December, 2005, I have caused a copy of this Reply to be delivered by first class mail, postage prepaid, to:

Marsha J. MacBride
Jane E. Mago
Benjamin F.P. Ivins
National Association of Broadcasters
1771 N Street, NW
Washington, DC 20036

/s/ _____
Jennifer Anselmo

EXHIBIT A

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

In the Matter of:

Implementation of Section 210 of the
Satellite Home Viewer Extension
and Reauthorization Act of 2004 to Amend
Section 338 of the Communications Act

MB Docket No. 05-181

DECLARATION OF JAMES R. BUTTERWORTH

My name is James R. Butterworth. I am Senior Vice President, Technology and Operations, at DIRECTV Enterprises, LLC (“DIRECTV”). As such, I am the person at DIRECTV primarily responsible for core engineering operations for the company.

DIRECTV has invested many years and over a billion dollars in designing, constructing, and launching two Ka-band satellites (SPACEWAY 1 and 2). DIRECTV currently uses all SPACEWAY capacity (and, apart from New York and Los Angeles, *only* SPACEWAY capacity) to retransmit local broadcast signals in high definition (“HD”) format, as well as standard definition (“SD”) format to Alaska and Hawaii.¹

Indeed, DIRECTV is the only entity that (1) provides direct-to-home video services using Ka-band satellites, (2) uses advanced MPEG-4 compression to deliver a consumer video service, and (3) offers local HD signals via satellite in any market other than New York and Los Angeles.

¹ DIRECTV launched HD local service in Detroit in October; in Chicago, Philadelphia, Atlanta, and San Francisco in November; and in Boston, Dallas, Houston, Tampa, and Washington, D.C. this month. DIRECTV currently expects to expand HD local service from the SPACEWAY satellites to a total of 36 markets.

In order to make HD local service a reality, DIRECTV had to retrofit satellites originally designed to provide broadband service, and, in doing so, had to essentially strand hundreds of millions of dollars that it had invested in the SPACEWAY broadband business, while investing tens of millions more to develop MPEG-4 technology for improved video delivery. As part of the HD rollout, DIRECTV will incur the significant costs in replacing the set top boxes of millions of customers. The rollout of local HD channels thus represents an extraordinary expense and effort on DIRECTV's part – an effort that, in large part, will benefit the very broadcasters that have seen fit to oppose DIRECTV here.

DIRECTV, in short, has put its money where its mouth is with respect to the digital transition. As one of the principal architects of this strategy, I must admit that I take personal exception to the National Association of Broadcaster's ("NAB") insinuation that DIRECTV has somehow been less than forthcoming about its capacity constraints, or that its claims in this regard "should not be accepted at face value." NAB Opposition at 8. I cannot help but observe here that, had broadcasters made investments in the digital transition commensurate to those made by DIRECTV, the transition would have been successfully completed years ago.

In any event, based on its experience with the SPACEWAY satellites over the last few months, DIRECTV has gained unique insights and practical knowledge concerning the retransmission of local digital signals from this platform. In this regard, I have reviewed the Engineering Statement of Sidney M. Skjei ("Skjei Statement"), which was attached to NAB's Opposition to DIRECTV's Petition for Reconsideration in this proceeding. Based on Mr. Skjei's analysis, NAB asserts that requiring Direct Broadcast

Satellite (“DBS”) operators to carry both HD and multicast programming is a reasonable interpretation of the Satellite Home Viewer Extension and Reauthorization Act of 2004 (“SHVERA”).

NAB’s analysis demonstrates a profound misunderstanding of how DIRECTV’s SPACEWAY satellites retransmit local signals. Rather than taking issue with each of Mr. Skjei’s erroneous statements and unfounded assumptions, however, I thought it would be more useful to analyze these issues myself using actual satellite performance characteristics of the SPACEWAY satellites. Please note that, for reasons of space, I have *not* addressed other costs and burdens associated with HD and multicast carriage, such as the expense of new set top boxes described above, and technical/administrative difficulties in retransmitting a mix of multicast programming “on the fly.”

Accordingly, Part I of this declaration discusses the operational parameters of the SPACEWAY satellites as they retransmit local broadcast signals in HD and SD formats. Taking these real-world characteristics, Part II discusses the capacity required to serve Alaska and Hawaii under varying assumptions about the carriage requirements imposed. Next, Part III provides an illustrative list of markets that could lose local HD service in each of these scenarios. Finally, Part IV briefly addresses DIRECTV’s future satellite capacity.

I. Technical Characteristics of SPACEWAY Satellites

A. Capacity Per Transponder

The SPACEWAY satellites have unprecedented flexibility as compared to all other satellites used to deliver direct-to-home video services. For example, the phased

array antennas on the spacecraft give DIRECTV the ability to redirect their beams as needed to meet evolving service requirements. However, this flexibility comes at a price.

As the SPACEWAY satellites were originally designed to operate as broadband satellites, the Ka-band was subdivided into “sub-bands” with a nominal bandwidth of 62.5 MHz. When used to provide broadband services, a SPACEWAY satellite can use almost all of the spectrum in each of these sub-bands due to the regenerative nature of the processing payload. However, when configured in a “bent-pipe” broadcast mode, a SPACEWAY satellite simply passes the entire “sub-band” from the uplink to the downlink. DIRECTV originally anticipated that it would use two 24 MHz carriers within each sub-band for video services, but it determined after extensive testing that using a single 36 MHz carrier per 62.5 MHz sub-band was required to avoid satellite-induced degradation of the signals. Thus, at least with respect to video services, each 62.5 MHz sub-band must be thought of as analogous to a single 36 MHz “transponder” on a more traditional satellite.

Each SPACEWAY satellite can generate up to 12 beams in each of two polarizations (LHCP and RHCP), for a maximum of 24 beams. Each beam, in turn, can carry up to three transponders, for a maximum utilization of 24 beams x 3 transponders, or 72 transponders, per satellite. However, because each beam re-uses the same three transponder frequencies, not all of this capacity can be used to serve a single market at the same time. At most, each SPACEWAY satellite can provide a single beam in each sense of polarity to a given area, setting an upper limit of 12 transponders per market (1 beam x 3 transponders x 2 polarities x 2 satellites = 12).

Satellite power also imposes certain constraints on operations. The downlink array on each SPACEWAY satellite has a total output power available of less than 450 W per polarization. A typical SPACEWAY spot beam requires approximately 10 W per transponder. Due to the antenna boresite position near the center of the United States, the scan loss of an Alaska spot beam requires half again as much power per transponder (15 W), while the Hawaii spot beam requires double the power per transponder (20 W). Clearly, if additional transponders must be allocated to provide service in these two states, they would consume a significantly greater portion of the power available to the satellites. In fact, if enough transponders are reallocated to these states, there might not be sufficient power to operate all remaining transponders for service to other markets.

Providing service specifically to Alaska and Hawaii also imposes certain communications link constraints on SPACEWAY service. In Mr. Skjei's analysis, it was assumed that DIRECTV could utilize 8PSK modulation with a convolutional coding rate of $\frac{3}{4}$ + Reed Solomon. While DIRECTV uses these high-order modulation and coding schemes for service in some parts of the country, they cannot be employed for service to Alaska and Hawaii due to the specific link degradations associated with those states, combined with the ITU-mandated power flux density limitations. In Alaska, the poor elevation angle to the 102.8° W.L. and 99.2° W.L. orbital slots limit our use to

REDACTED

REDACTED

. While Hawaii presents an improved elevation angle, the rain rates are significantly worse – a serious consideration for delivery of a Ka-band signal – which necessitates the use of the same robust mode as used in Alaska. This transmission mode applied

REDACTED

to a 36 MHz bandwidth yields a usable data bit rate of 28.9 Mbps per transponder, as opposed to the 83 Mbps per transponder assumed by Mr. Skjei.

B. Capacity Required For Each Video Feed

Even using the latest technology, the compression possible with MPEG-4 encoding is not nearly as robust as Mr. Skjei assumes it is. For example, Mr. Skjei assumes that MPEG-4 AVC encoding will provide a 50% data reduction over MPEG 2 capabilities. Skjei Statement, ¶ 7. This broad-stroke assertion is simply not accurate. While it is true that MPEG-4 AVC can provide a comparable-quality HD picture using approximately 50% of the bit rate of an existing MPEG-2 stream, this assumes a “clean” source of the signal. For an MPEG-2 source to be encoded well using MPEG-4 techniques, the source’s bit rate is of paramount importance. When the source provides a lesser-quality MPEG-2 HD broadcast stream, the compression artifacts are magnified by the “recompression” of that stream into MPEG-4. After substantial experimentation with MPEG-4 encoding, DIRECTV determined that a data rate would faithfully **REDACTED** reproduce a variety of HD input sources with no perceptible degradation. This represents a more than 30% improvement over MPEG-2 encoding, but far less than the 50% assumed by Mr. Skjei. **REDACTED**

Accordingly, DIRECTV encodes HD signals to a data rate of roughly on average for retransmission on the SPACEWAY satellites, regardless of the rate in which those signals are broadcast (compared to the 6 Mbps assumed by Mr. Skjei).² DIRECTV

² Of course, because DIRECTV statistically multiplexes the digital signals within a given market, the key figure here is the *average* data rate required to retransmit signals – not the rate of any one signal at any given time. This is why it does not matter if a station may at a given instant “require most of [its allotted bandwidth] if, for example, sporting events are being transmitted.” NAB Opposition at 4 n.7. Averaged over time and over a number of channels, these variations are “smoothed out” by multiplexing technology.

also compresses SD signals to a data rate of roughly [REDACTED] for retransmission using [REDACTED] MPEG-4 encoding. With these operational parameters in mind, we can now proceed to evaluate the impact of various requirements for carriage of stations in Alaska and Hawaii.

II. Capacity Burdens of Various Alaska-Hawaii Carriage Scenarios

Again, each SPACEWAY satellite has 72 transponders, for a total of 144 transponders for the entire system, which DIRECTV intends to use to provide local HD service throughout the country. These transponders, however, can be redirected (if necessary) from “covering” one market to “covering” Alaska or Hawaii. Thus, as more transponders are required to fulfill Alaska-Hawaii carriage burdens, DIRECTV would have to direct more transponders that otherwise would have been used to provide service in other markets.³

Using the operational parameters discussed above for each SPACEWAY transponder, and knowing how much capacity is required to retransmit SD and HD signals, it is relatively straightforward to calculate the capacity burden associated with a variety of carriage requirements. I do so below based on each of three possible carriage scenarios for Alaska and Hawaii:

- An “**SD Only**” scenario, in which DIRECTV is required to carry a single feed from each Alaska and Hawaii station in SD format.
- An “**HD Only**” scenario, in which DIRECTV is required to carry a single feed from each Alaska and Hawaii station in HD format.
- An “**HD Plus Multicast**” scenario, in which DIRECTV is required to carry all feeds, HD as well as SD, in the format broadcast, for each Alaska and Hawaii station, but can compress those feeds.

³ As discussed above, although power limitations could exacerbate such reallocation of transponders, I have not attempted to capture the impact this might have on DIRECTV service in this analysis. Thus, it is likely that the true effect would be greater than presented here.

A. SD Only

DIRECTV can retransmit the signal of a station in SD format using approximately

of capacity, and each of the SPACEWAY transponders serving Alaska and

Hawaii has a maximum bit rate of approximately 29 Mbps.. Thus, DIRECTV can

accommodate all of the 17 stations in Alaska on a single transponder ($17 \times$ =

).

It can also accommodate all of the 12 stations in Hawaii using another

transponder ($12 \times$ =). Thus, "SD only" carriage requires the use of

two SPACEWAY transponders, and that is what DIRECTV currently uses for its local service to these states.

B. HD Only

As discussed above, the SPACEWAY satellites use approximately to

retransmit an HD signal. Unfortunately, there is no technology available that would

enable a satellite operator to "split" a single HD signal over two transponders. Thus,

given a maximum bit rate of 29 Mbps per transponder, DIRECTV can carry up to three

HD signals in each transponder. Accordingly, carriage of a single HD feed from each of

17 stations in Alaska would require six transponders, not one ($17/3 = 5.67$ transponders).

And carriage of a single HD feed from each of 12 stations in Hawaii would require four

transponders, not one ($12/3 = 4$ transponders). In other words, *HD carriage would*

require five times as much capacity as DIRECTV is currently using for SD service to

Alaska and Hawaii (*i.e.*, a total of 10 transponders, rather than just two).

C. HD Plus Multicast

This scenario requires a bit more explanation. When the ATSC standard was first

developed in the mid-1990's, the assumption was that maximum bitrate of 19.4 Mbps

could be used to support a single HD signal *or* multiple SD signals. However, as NAB acknowledges, technology has advanced to the point where today a broadcaster uses on average only 12-15 Mbps to transmit an over-the-air HD signal⁴ – leaving 4.4-7.4 Mbps of capacity that can be filled with *additional* SD multicast programming. Indeed, many broadcasters now offer multicast programming at the same time that they offer HD programming.

The additional 4.4-7.4 Mbps available for multicast programming would be sufficient to accommodate from two to three SD signals at a data rate achievable by current broadcast technology. For purposes of illustration, I will assume that on average each station in Alaska and Hawaii broadcasts one HD signal and two multicast signals in SD format – a reasonable and conservative assumption based on existing and expected broadcasting patterns.⁵

Using the figures set forth above, DIRECTV could retransmit this package of signals on the SPACEWAY satellites using approximately (i.e., for **REDACTED** **REDACTED** the HD signal and for each of two SD signals). DIRECTV would then be able to carry the signals of only two stations on each SPACEWAY transponder (29 Mbps per transponder divided by per station =).⁶ Accordingly, such carriage of 17 **REDACTED**

⁴ Because satellite operators statistically multiplex the digital signals within a given market, the key figure here is the *average* data rate required to retransmit signals – not the rate of any one signal at any given time. This is why it does not matter if a station may “require most of [its allotted bandwidth] if, for example, sporting events are being transmitted.” NAB Opposition at 4 n.7.

⁵ It is possible that some broadcasters might choose not to broadcast any HD programming, or that some might broadcast simultaneously in HD and multicast only during prime time. However, because broadcasters are not constrained in how they operate and could change the nature of their transmissions over time, DIRECTV must make conservative assumptions about capacity requirements.

⁶ For purposes of this analysis, I assume that all of the signals from a single station must be retransmitted as a block in a transponder. In theory, it might be possible to split the individual signals broadcast from one station over two transponders if DIRECTV had sufficient information about the broadcaster’s operations – and those operations were not allowed to change thereafter. As a practical

stations in Alaska would require nine transponders and of 12 stations in Hawaii would require six transponders. In other words, HD plus multicast carriage would require *more than seven times* as much capacity as DIRECTV is currently using for SD service to Alaska and Hawaii (*i.e.*, a total of 15 transponders, rather than just two).

III. Illustration of Potential HD Local Markets Lost

As described above, SPACEWAY's beams can be redirected. Thus, if carriage requirements in Alaska and Hawaii are increased, it is possible to "rob Peter to pay Paul" by redirecting capacity that could be used to provide local HD service in other markets. And, by definition, the more burdensome the carriage requirement in Alaska and Hawaii, the more markets in the rest of the country would be denied local HD service.

Of course, determining exactly which markets should be denied local HD service in light of competing technical and business considerations would require a very complex and time-consuming analysis. For example, some markets are served by more than one transponder, some transponders are used to serve more than one market, and some markets have more existing DIRECTV subscribers (or subscribers taking HD service) than others. DIRECTV has not undertaken such an analysis, and hopes that it will never be forced to do so. But for purposes of illustrating the impact of various carriage mandates, one simplistic methodology would be to assume that capacity for local HD service is redirected away from those markets with the fewest potential subscribers first. Generally speaking, each of these relatively smaller markets is served by a single SPACEWAY transponder, so that each additional transponder required for service in

matter, however, DIRECTV has no such information and broadcasters are under no such constraint going forward. Accordingly, the only prudent course is to maintain each station's signals as a unit, even if that does not optimize spectrum use.

Alaska or Hawaii is an additional market that DIRECTV would have to deny local HD service.

Simply as an illustrative matter, I have attempted to match the capacity currently allocated for local HD service in the smallest markets DIRECTV intends to serve using SPACEWAY with the incremental additional capacity needs for service in Alaska and Hawaii under a variety of carriage rules. Of course, DIRECTV might in its business judgment choose other markets. But a rough cut can at least illustrate the scope of the problem. It is worth noting that all of these markets are larger than any of the three markets in Alaska that would receive HD plus multicast programming under the *Order's* mandate, and all but three of these markets (Portland, ME; Madison, WI; and Reno, NV) are larger than the Hawaii market.

A. HD Only

As discussed above, DIRECTV would have to allocate ten SPACEWAY transponders to Alaska-Hawaii carriage (rather than one for SD only carriage). Those eight incremental transponders would require the capacity that could otherwise be allocated to provide HD local service in Buffalo, NY; Providence, RI; Austin, TX; Fresno, CA; Green Bay, WI; Portland-Auburn, ME; Madison, WI; and Reno, NV.

B. HD Plus Multicast

As discussed above, an HD plus multicast requirement would require fifteen SPACEWAY transponders. In this scenario, the incremental capacity required to serve Alaska and Hawaii would be equal to the amount that could otherwise be allocated to provide HD local service in all of the markets listed above, along with Memphis, TN; Oklahoma City, OK; Albuquerque, NM; Greensboro, NC; and Las Vegas, NV.

IV. Future Capacity

Like NAB's analysis, this discussion has not included capacity that would become available with the launch of DIRECTV 10 and DIRECTV 11, two next-generation Ka-band satellites currently under construction at a cost of hundreds of millions of dollars. Even assuming that these satellites complete construction on their current schedule and are launched successfully, neither of them will be operational until well after the HD plus multicast carriage obligation adopted by the Commission becomes effective in June 2007. Like SPACEWAY, these satellites will be used for carriage of HD local signals, and are intended to replace the service to Alaska and Hawaii provided from the SPACEWAY satellites. Unlike SPACEWAY, these new satellites have been optimized for video service only, and thus each transponder will have greater spectral efficiency. Even with this increase in capacity, the capacity assigned to each of these markets would be insufficient to meet the requirements of HD plus multicast carriage. Accordingly, even assuming these satellites were available, DIRECTV would have to allocate additional capacity from other markets to meet the carriage requirements recently imposed by the Commission.

NAB also asserts that future improvements in technology will ease the burden on DIRECTV.⁷ Most of the improvements cited – including use of Ka-band satellites, higher-order modulation and coding, satellite dishes pointed at multiple orbital slots, and improved signal compression techniques – are already in use with the SPACEWAY system. Given that “HD only” and “HD plus multicast” carriage increases the number of transponders required to serve Alaska and Hawaii from the two currently used to 10 and

⁷ See NAB Opposition at 8.

