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July 31, 2000

BY HAND DELIVERY

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Federal Communications Commission
The Portals, 445 Twelfth Street, S.W.
Room 8-B201H
Washington, D.C. 20554

Commissioner Susan Ness
Federal Communications Commission
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Commissioner Gloria Tristani
Federal Communications Commission
The Portals, 445 Twelfth Street, S.W.
Room 8-C302C
Washington, D.C. 20554

Re: File No. 0418-EX-ST-1999; File No. 094-EX-ST-1999;
Ex Parte ET Docket No. 98-206; DA 99-494

Dear Chairman Kennard and Commissioners:

Northpoint Technology hereby submits the attached "Evaluation and Analysis of DBS-Terrestrial Compatibility Testing at Oxon Hill, Maryland" for the Commission's consideration in the above-captioned proceedings.

We would be happy to address any questions or concerns you may have regarding this submission. Please do not hesitate to contact me. Thank you for your consideration.

Respectfully submitted,

Antoinette Cook Bush

Enclosure

cc: See Attached Service List

CERTIFICATE OF SERVICE

I, Linda Rickman, hereby certify that on this 31st Day of July, 2000 a true and correct copy of the foregoing Evaluation and Analysis of DBS-Terrestrial Compatibility Testing at Oxon Hill, Maryland have been delivered by hand to the following individuals at the Federal Communications Commission, 445 12th Street, S.W., Washington, D.C.:

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Linda L. Rickman

Northpoint's Evaluation and Analysis

of

DBS-Terrestrial Compatibility Testing

at

Oxon Hill, Maryland

Northpoint Technology, Ltd.
July 31, 2000

Northpoint Response to DBS Testing Report

Executive Summary

DBS Fails to Document Any Consumer Harm from Northpoint

In its experimental report, the DBS industry has once again created a hypothetical scenario of worst-case interference and then claim it is the general case for all Northpoint operations.

> *For all of its effort, DBS did not demonstrate that there was a single actual DBS customer who was, or even could have been, adversely impacted by the interference DBS claims to have created in Oxon Hill, Maryland.*

In their recent report, DBS claims to have replicated Northpoint planned deployment for a site in Oxon Hill, Maryland and it presents signal readings for several sites immediately surrounding the DBS terrestrial transmitter. Without any substantiation, DBS incorrectly claims these readings are representative of the average DBS customer experience and then completes the false picture by extrapolating from the hypothetical customer impact in Oxon Hill to customer impact throughout the United States.

Later in this report, Northpoint will demonstrate that DBS did not replicate the Northpoint system as it claimed and did not use the parameters specified by Northpoint in its "Conceptual Deployment," a Northpoint filing made to the FCC which DBS claims to have used as the basis for its effort to replicate Northpoint. However, regardless of actual differences between a correctly engineered Northpoint deployment and the DBS terrestrial operations at Oxon Hill, the most important finding of the DBS report is that it did not document any actual consumer impact. In fact, DBS admits that if an Echostar dish were installed by the road side immediately under a Northpoint tower that was operating at higher than normal transmit power, that Echostar customer would still receive perfect reception for greater than 99.87% of the time.

Customer impact, not hypothetical signal levels must be the standard used to judge harmful interference and availability. While DBS presents readings taken immediately in the vicinity of its terrestrial transmitter in parking lots and road sides, it does not show that operation of a Northpoint system at the Oxon Hill location would have had any impact whatsoever on any actual DBS subscribers in the larger Oxon Hill community.

As Northpoint has presented to the FCC on many occasions, the Northpoint signal is highest in the first 500 – 1500 feet surrounding its transmitter and rapidly falls off in power as the signal moves out into the service area. It is only in this tiny area near the transmitter, representing less that 0.25% of its service area, where there is any potential at all for any impact on DBS customers. Northpoint has developed a wide range of mitigation technique to prevent harmful interference within this tiny area the most basic of which is to make sure that it locates its transmitters in such a manner where this tiny mitigation zone will be contained in regions where there are few if any DBS customers. Like other Northpoint cells, the Oxon Hill site was designed using this principle.

In the DBS report, much is made of the potential for impairment to Echostar's satellite at 61.5 degrees West by DBS' terrestrial operations. DBS states if an Echostar customer had been located at the exact spot where it took its reading that customer would have an availability of 99.87% instead of 99.94%, as a result of the Northpoint system, a reduction it calls harmful. However, we need not debate whether this tiny reduction of availability is in fact harmful because that spot is a parking lot. Northpoint designed its proposed Oxon Hill deployment so that there were no households and therefore no DBS subscribers, at this worst-case location identified by DBS. Northpoint chose the Oxon Hill location and specified the deployment details for exactly this reason, just as each Northpoint transmitter site will be individually chosen and engineered to eliminate the possibility of interference to DBS from Northpoint.

However, not only did DBS fail to show harmful interference, there are serious questions regarding the validity of the DBS test. Importantly, in no case do the DBS measurements of the signal strength of their own satellites match their predicted values. They differ by 2 dB, some higher and some lower. The magnitude of this error is far greater than interference degradation that could be caused by Northpoint. DBS does not explain this discrepancy. Further, the interference power DBS claims to have measured differs by wide amounts, over seven dB, when no difference should exist. DBS acknowledges this error, but provides no adequate explanation. These errors seriously call into question the validity of the DBS test.

In summary, the DBS report is nothing new. It reiterates, rather than supplements previously filed, and fully refuted, DBS material opposing Northpoint. Most importantly, DBS did not document any risk of actual consumer harm from the operation of the Northpoint system.

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1.0 Introduction

Representatives of DirecTV and Echostar recently released an announcement of a series of field experiments conducted in Oxon Hill, Maryland on the compatibility of direct broadcast satellite services ("DBS") and co-channel terrestrial operations (the "DBS Experiment").[1] In their announcement, these DBS operators claim that the DBS Experiment was a "balanced" test at a "Northpoint-selected test site."[2] They further claimed that harmful interference resulted from this terrestrial operation, and makes claim as to the reduced availability in various parts of the country that will result from Northpoint's operation. In conclusion, DBS state that the data and analysis demonstrate that the FCC should not permit licensing of Northpoint terrestrial transmissions in the 12.2 – 12.7 GHz band.

As is shown in the following report, the data contained in the DBS report is extremely limited and contains serious discrepancies. DBS took measurements in only four locations immediately under its terrestrial transmitter, in each case operating its transmitter for only a few minutes at a time. In total it appears that DBS only operated its transmitter for less than 90 minutes. The physical area where the DBS readings were taken represent conditions in only about 0.05% of the service area of its terrestrial transmitter. DBS reports no readings at any actual DBS customer's premises or of the other 99.95% of the service area of its terrestrial transmitter. As will be shown in Section 5.0, DBS also set up its transmitter in a manner unrepresentative of an actual Northpoint deployment to assure readings were as unfavorable to Northpoint as possible.

It would have been valid for DBS to highlight the worst case, label it such and ask what solutions there might be for this worst case, if it ever actually occurred. However, DBS does not do this, instead, without any substantiation, DBS incorrectly suggests to the FCC their readings are representative of the average DBS customer experience and then provides a completely false picture by extrapolating from the hypothetical customer impact in Oxon Hill to customer impact throughout the United States.

Even so, DBS also fails to make a compelling case that its worst case is actually harmful. Peeling away all of the hyperbole from the DBS report and translating the DBS worst case into plain terms, the most substantial claim of potential harm made is this: If an Echostar dish were installed by the road side immediately under a Northpoint tower that was operating at higher than normal transmit power, that Echostar customer would still receive perfect reception for greater than 99.87% of the time.[3] Yes, according to DBS, without Northpoint that customer would have had an availability of 99.94%, but it is important to remember that DBS is a consumer television service with a stated 99.7% availability.

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1 Letter to Federal Communications Commission ("DBS Cover Letter") with attached report, ("DBS Report"), July 25, 2000.

2 Page 3 of DBS Cover Letter.

3 See section 3 of this report.

2.0 Overview of Northpoint Technology and Washington D.C. Conceptual Deployment

Northpoint technology is a patented system that is designed to accomplish satellite/terrestrial sharing. The Northpoint system uses a network of terrestrial repeaters whose transmissions are oriented in the opposite direction of DBS transmissions. Northpoint has the same directional reception antennas as DBS; however, in the case of Northpoint the dish is oriented to the North in contrast to the DBS services, which are typically received from the South. When the principles of Northpoint technology are used, the result is compatibility between satellite and terrestrial systems.

The fact that compatibility between Northpoint technology and DBS operations can be achieved was demonstrated through a series of experimental tests conducted since 1997. The most recent was in a two-month trial in Washington, D.C.[5] In that demonstration, two Northpoint emitters (transmitter and repeater) operated successfully during a two-month period. During that test of the actual Northpoint technology, not a single case of harmful interference was recorded. The DBS parties monitoring this test claimed to have found harmful interference, however, this claim was directly contradicted by a thorough FCC field office investigation.[6] No harmful interference was found.

The Washington D.C. trial also resulted in a conceptual deployment of Northpoint in the Washington D.C. area.[7] This conceptual deployment allows for twenty-four Northpoint transmitters providing service to over 1.3 million households. One such conceptualized location for a repeater was in Oxon Hill, at 6009 Oxon Hill Drive. This location would serve over 31,000 households, as depicted in Figure 1.[8] This location was also used by DBS in the DBS Experiment and thus it is instructive to compare the DBS installation to that which was recommended by Northpoint in its conceptual design, (which was further refined with a specific Northpoint EPFD limit proposal)[9] as will be done later in this report. It will be shown that DBS operated at far higher power levels than recommended.

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5 Progress Report WA2XMY, Northpoint – DBS Compatibility Tests, Washington D.C, October 1999.

6 Federal Communications Commission, Compliance and Information Bureau report on DBS claim of harmful interference during Northpoint testing in Washington D.C., stating that no harmful interference was found, dated October 6, 1999.

7 Methodology for Predicting Terrestrial Interaction with DBS in the 12.2-12.7 GHz Band ("Methodology Report"), filed in ET Docked No. 98-206 February 10, 2000.

8 Methodology Report, Table 8.

9 The Northpoint EPFD Mask, March 28, 2000

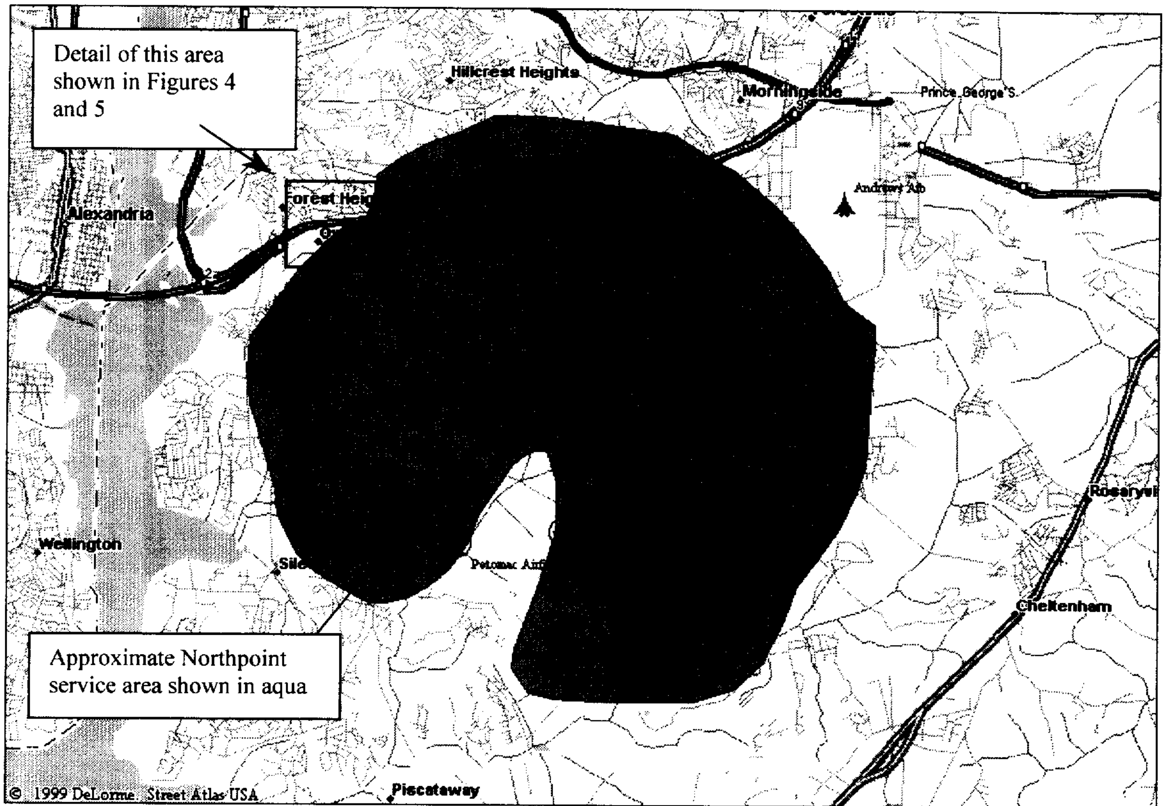

Figure 1 Oxon Hill region with approximate range of Northpoint signal.

3.0 Analysis of DBS Worst Case – Far from Harmful

As will be shown later, DBS operated at far higher power levels than specified by Northpoint. Even so, the DBS claim for harmful interference is without merit. The DBS worst case is a claim for potential impairment from terrestrial operations to Echostar's satellite operations at 61.5 degrees West. DBS implies that a single data point for Echostar 61.5 is the smoking gun that proves harmful interference. DBS also claims to have variously found 11.9%, 81.2% or 122.4% increase in unavailability at its 'Test Site 5.'[10]

DBS is unable to show that any DBS customer, current or potential, would have experienced this level of outage. According to the Northpoint Washington Conceptual Deployment, there would have been approximately <u>four</u> households within the 20 dB C/I contour for 61.5 West at Oxon Hill.[11] No customers would have been inside of a 15 dB C/I contour. Natural shielding would probably protect these four households, but if necessary, other mitigation techniques are available. Northpoint chose the Oxon Hill location for exactly this reason -- just as each Northpoint transmitter site will be

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[10] DBS Report, Table 1 page 10.

[11] The Washington Conceptual Deployment shows that four households in the 20 dB C/I contour, zero in the 15 dB C/I contour for Satellite 61.5W, Table 8 page 14.

individually chosen and engineered to eliminate the possibility of interference to DBS from Northpoint.

On average, 86% of DBS customers would be naturally shielded from terrestrial transmissions.[12] Additionally, the satellite at 61.5 W is operated by Echostar, and the DBS national penetration rate for Echostar is less than 4%. Even assuming a 10% DBS penetration rate, the odds that one of these four homes would be an Echostar customer and would not have natural shielding are less than 1 in 50. Thus, it is 98% certain that none of the households in this 20 dB contour would have a C/I less than 20 dB. In the 2% case of a possible DBS customer existing within a mitigation zone, various low-cost methods for mitigation are available, including dish relocation, shielding or upgrade of the DBS dish.

DBS presents some measurements of the ExpressVu satellite at 91 W. This satellite serves Canada, and service is not authorized in the United States, as DBS states in its report.[13] If a service is not authorized, then there is no system availability, it is already zero percent and it cannot be reduced any further. Therefore, there can be no interference.

DBS not only fails to show that any customers would have experienced this level of outage; it fails to show that any particular level of outage would be harmful. According to DBS' own calculations, the availability of Echostar 61.5 W is 99.94%.[14] The claimed worst-case availability with Northpoint is variously 99.87 to 99.93%. These levels of availability are far higher than the stated DBS performance objective of 99.7%, and it is unlikely that any consumer would be able to discern such a difference. If such a customer existed at Oxon Hill, DBS would surely have brought them forward. The DBS assertion that increasing the unavailability by 10%, regardless of the beginning unavailability, constitutes harmful interference is simply erroneous and false.

4.0 Serious Questions As To the Validity of the DBS Measurements

Not only did DBS not show harm, the DBS test results are suspect at best. First, there are large variations in the C/I ratios, which should be constant, a discrepancy that DBS acknowledges but provides no adequate explanation. Although laboratory grade demodulators were certainly available to DBS, they chose to rely on the set top box for their measurements, claiming it can deliver very accurate C/N estimates. However, the DBS C/N estimates from set top boxes do not agree with their own predicted C/N from the link budgets for these satellites.

DBS acknowledges that the C/I ratios they estimated varied greatly, when they should have been constant. Although these tests were ostensibly performed at the same

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12 Methodology Report, page 9.

13 DBS Report page 5.

14 Methodology Report, page 9.

locations, with the same terrestrial transmit power, the C/I ratio varies by over 7 dB among transponders. DBS acknowledges this enormous error, but provides an inadequate explanation. They state that "this may be the result of increased sensitivity of the receive antenna backlobes at lower frequency."[15]

For example, referring to Table 1 of the DBS report, at the test location 5, DBS claims to have found a C/I ratio that ranges between 11.3 and 18.8 dB, a 7.5 dB variation. Similar results were obtained for other satellites at the other test sites. For Echostar 110, the variation is 5.5 dB, for DirecTV 101 the variation is also 5.5 dB. For ExpressVu, the difference is 7.1 dB. This information is graphically represented in the following figure, which shows the C/I ratio that DBS measured for each satellite.

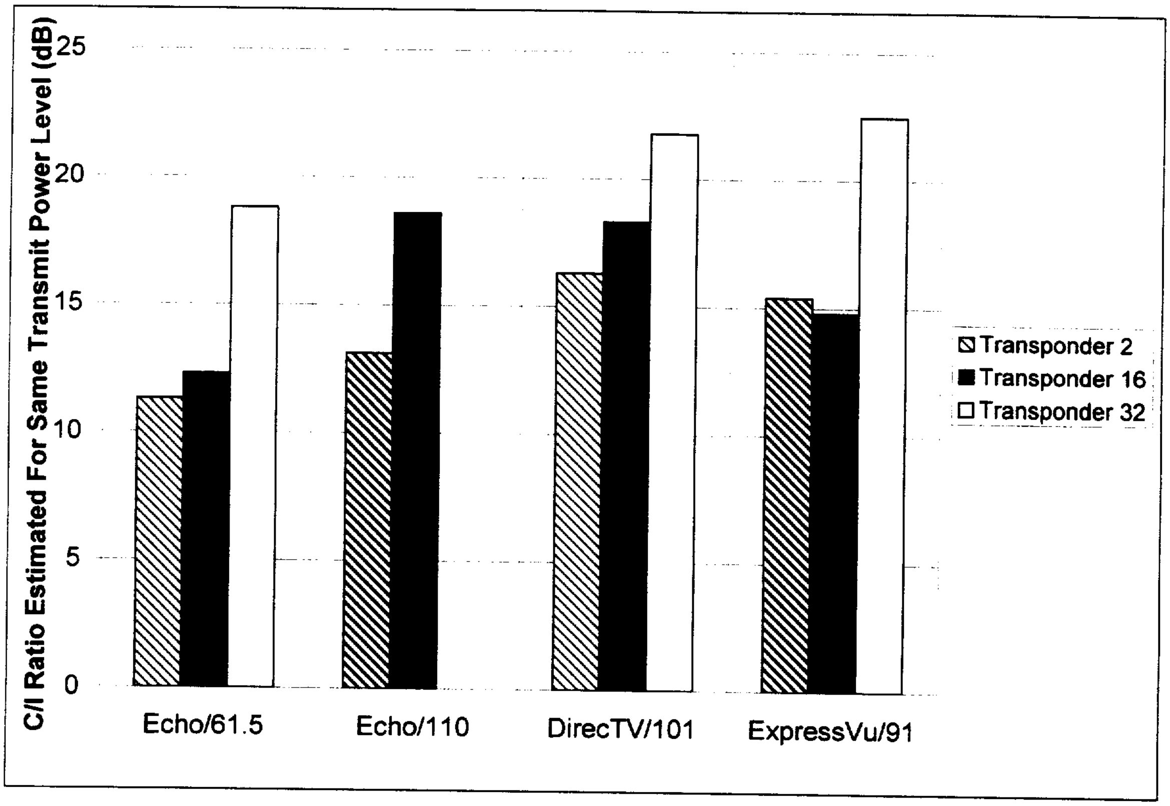

Figure 2 C/I Ratio as measured by DBS for constant power level.[16]

The DBS explanation that the antenna is more sensitive at lower frequencies *cannot* be true. There is a direct ray trace into the LNB from the interfering source. The LNB would have to be non-linear in frequency. If the LNB were non-linear in frequency, then the SSP readings would differ significantly, which they do not. The signal strength readings were constant across the transponders, and thus received C/N was constant, according to Table 1 of the DBS report. Therefore, the interference power is either changing or the method for estimating the interference power is flawed, or both are in

15 Page 3 of DBS Report.

16 Table 1 of DBS Report.

error. The discrepancy is probably an error in transmitter operation.

DBS uses the set top box signal strength meter, saying that any meter can be calibrated to provide "very accurate" C/N values.[17] Northpoint used precision test instruments in its Washington test and deployment, including laboratory grade demodulators and spectrum analyzers. Professional laboratory grade demodulators are available to DBS, and one wonders why they did not use them in place of a low-fidelity set top box. Our experience with the set top boxes is that they have a large margin for error (2-4 counts), and are prone to hysteresis. In other words, a calibration is only useful if performed before and after each measurement.

As proof of the lack of merit of the DBS measurements, the DBS "estimates" for C/N values from the set top boxes *do not agree* with their own link budget "predictions" for C/N provided in the very same report. For example, the composite C/N claimed for Echostar 61.5 in Table 1 of the DBS Report "C/N, dB TX OFF" of 14.4 dB is much higher than the predicted composite C/N of 13.3 dB DBS provides in the link budgets on pages 21-23. No explanation is offered for this discrepancy, either. Comparison of the other "estimates" with "predictions" also reveals similar discrepancies. For example, the C/N for DTV @ 101 is estimated from the set top box at 12.2 – 13.1 dB, but the link budgets in Appendix B predict 14.5 total C/(N+I). The comparisons are listed in the following table. Interestingly, some measurements are higher than predicted, and some are lower than predicted. Either the DBS predictions or measurements are in error, or both are in error, but both cannot be correct.

Table 1. Comparison of DBS predicted and estimated C/N values

Satellite	Predicted C/N from DBS Link Budget in Annex B (dB)	Estimated/Measured C/N from Table 1 of DBS Report (dB)	Difference between DBS Predicted and DBS Measured
Echo/110	13.1	14.4	1.3 dB
Echo/61.5	13.3	14.8	1.5 dB
DirecTV/101	14.5	12.2	- 2.3 dB
ExpressVu/91	9.3	11.4	2.1 dB

As an idea of the magnitude of this error, a 2 dB change in clear sky C/N causes a change in unavailability much higher than that which DBS claims to be harmful. DBS does not explain this serious discrepancy. In any case, the lack of attention to this important detail casts serious doubts about the DBS predictions and measurements, as well as the derived "estimates of increase in unavailability". Apparently unaware of its errors, DBS used these flawed C/N and C/I estimated levels to predict variously 11.9%, 81.2% or 122.4% increase in unavailability.

Additionally, while Northpoint was observing DBS operations, DBS operated the terrestrial transmitter "on" for only very brief periods during the course of the test,

[17] DBS Report, page 17.

approximately 60 – 180 seconds, with changes in frequency between transmissions. This exact method of operation was soundly criticized by DBS during Northpoint's Washington Test and Demonstration. It stated the results of such a test would be "meaningless and self-serving".[18] Moreover, there is a serious problem with operations in this manner. Turning the transmitter on for only a brief period does not allow the transmit amplifier to reach a steady state temperature, and hence the output power will vary during these natural temperature transitions. During these brief operating windows, DBS also changed the power level, which also affects the operating temperature. The use of a 20 dB coupler would lower the already low power levels possibly into the non-linear range of a power sensor meter, which also has its own temperature dependent measurement qualities. Therefore, it is questionable if DBS actually could determine terrestrial transmit power at all, and under these conditions, it is doubtful that the DBS experiment is repeatable.

5.0 DBS Operation – Not a Bona Fide Test of Northpoint Technology

Northpoint proposes to use the Oxon Hill location for its operations in Washington D.C., but not in the manner stated by DBS. DBS did not perform a bona fide test of Northpoint technology, due to numerous differences between the DBS operation, and the proposed Northpoint operation at that site.[19] DBS operated at a lower height, higher power, and used an antenna that Northpoint would not have used at that location.

As an initial comment on DBS operations, it is noted that DBS does not state the transmit height of their antenna. In fact, the DBS transmitter was operated two stories below the top of the Constellation Center building, at a height of approximately 130 feet, over 20 feet below the top of the building. This is 15% below the height proposed by Northpoint. The Northpoint Conceptual deployment recommended a height above average terrain of 152 feet. The impact from this height differential is to increase the peak C/I value by about 1-3 dB (depending on the transmit antenna) and to increase the size of any C/I contour.

DBS also states that it used an antenna "manufactured to the characteristics provided by Northpoint's October 1999 Progress Report: 10 dBi gain; 110 degree horizontal beamwidth; 17 degree vertical beamwidth; and horizontal polarization."[20] However, as provided in the Northpoint EPFD FCC presentation made to the Commission before the commencement of the DBS experiment, this particular antenna is to be used where the height is 250 feet over the average terrain. Northpoint in fact uses a range of antennas depending on the installation. For the Oxon Hill installation, an antenna with a vertical beam width of 10 degrees would be more appropriate. This antenna would reduce power flux density levels near the transmitter by a further 1-3 dB.

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18 Letter to Sophia Collier, page 2, dated August 10, 1999, from Pantelis Michalopoulos, attorney for Echostar.

19 Site WA15_152, Methodology Report.

20 Page 2 of DBS Report.

The combined effect of the wrong antenna, with the incorrect transmit height is shown in Figure 3, which identifies the isotropic signal strength of each deployment.

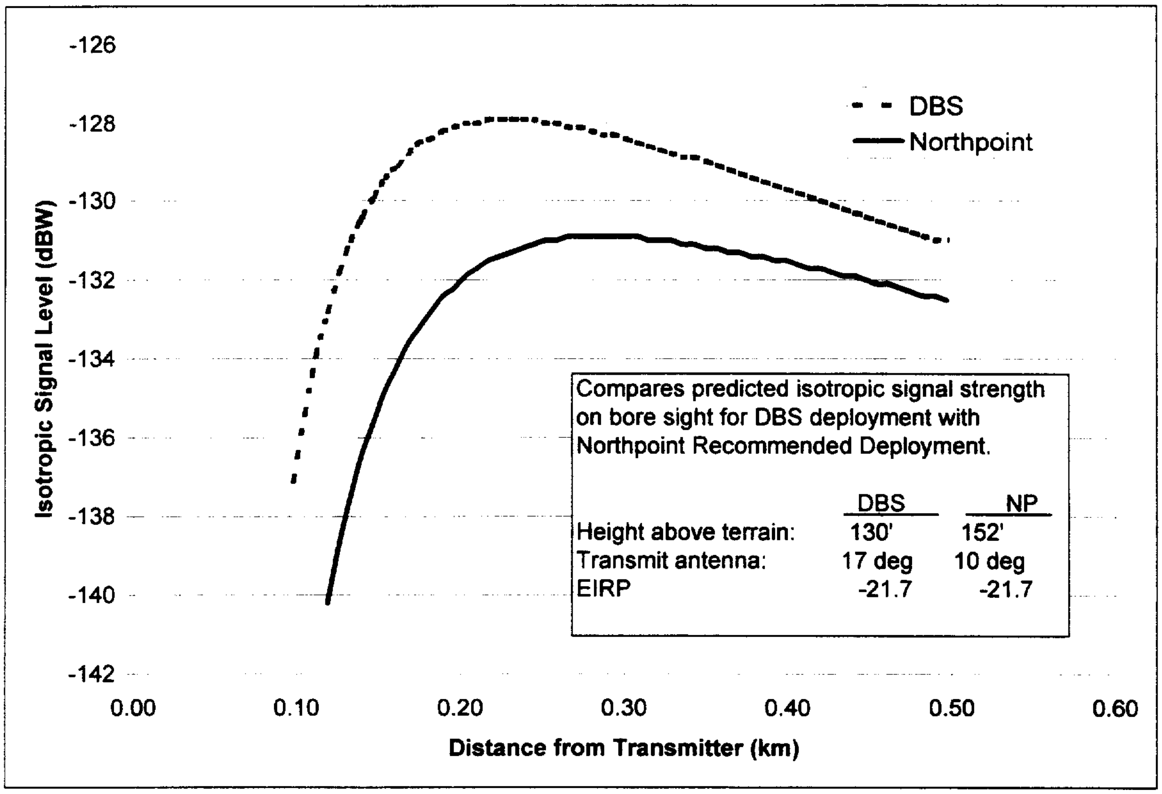

Figure 3 Comparison of DBS and Northpoint Power Levels

The inflated power levels of the DBS test are also illustrated in Figure 4 and Figure 5. These figures, produced by MSITE software, show the composite line-of-sight C/I contours for DBS satellites at 61.5, 101, 110 and 119 W, (all of the locations providing actual service to Washington D.C.). In actual operation, natural shielding will protect 86% of the DBS customers. Note the differences between the two deployments. In the Northpoint deployment, the blue 16 dB C/I contour is almost non-existent. However, in the DBS operation, the blue 16 dB C/I contour is much larger, and also contains red 10 dB C/I contours that do not exist in the Northpoint deployment. Note that all DBS test points would have been outside of the blue 16 dB C/I contour in Northpoint's deployment, while they are all inside the blue 16 dB C/I contour in the DBS operation.

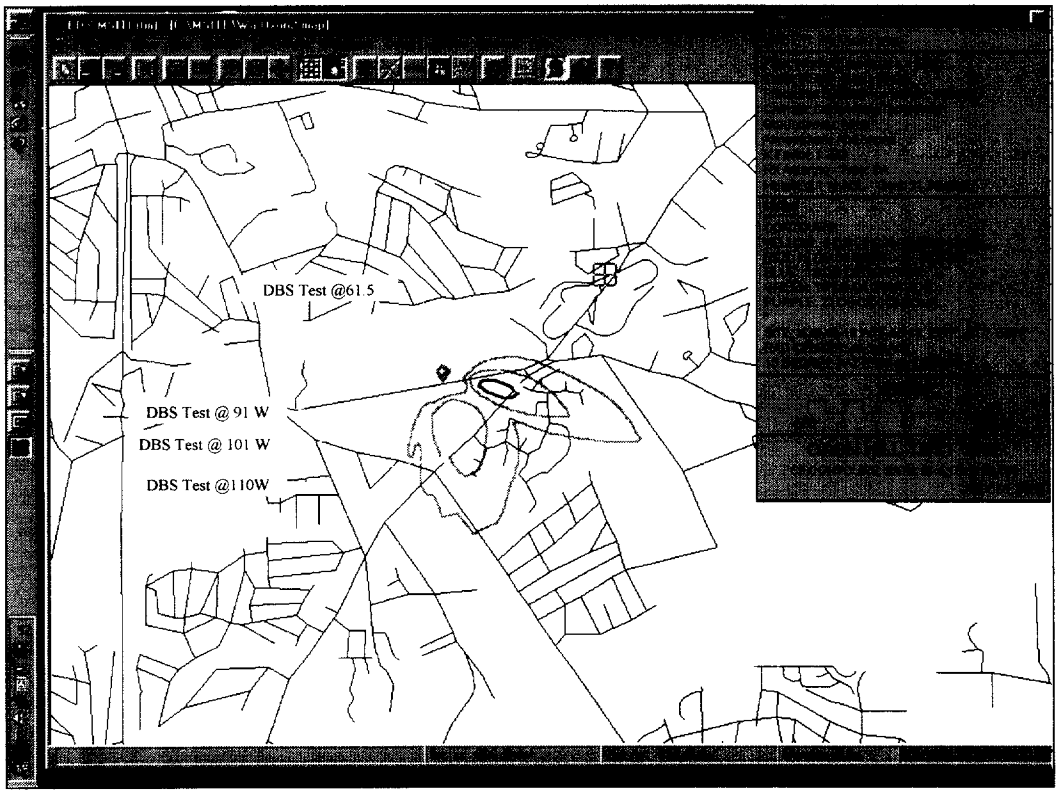

Figure 4 Oxon Hill deployment as specified by Northpoint

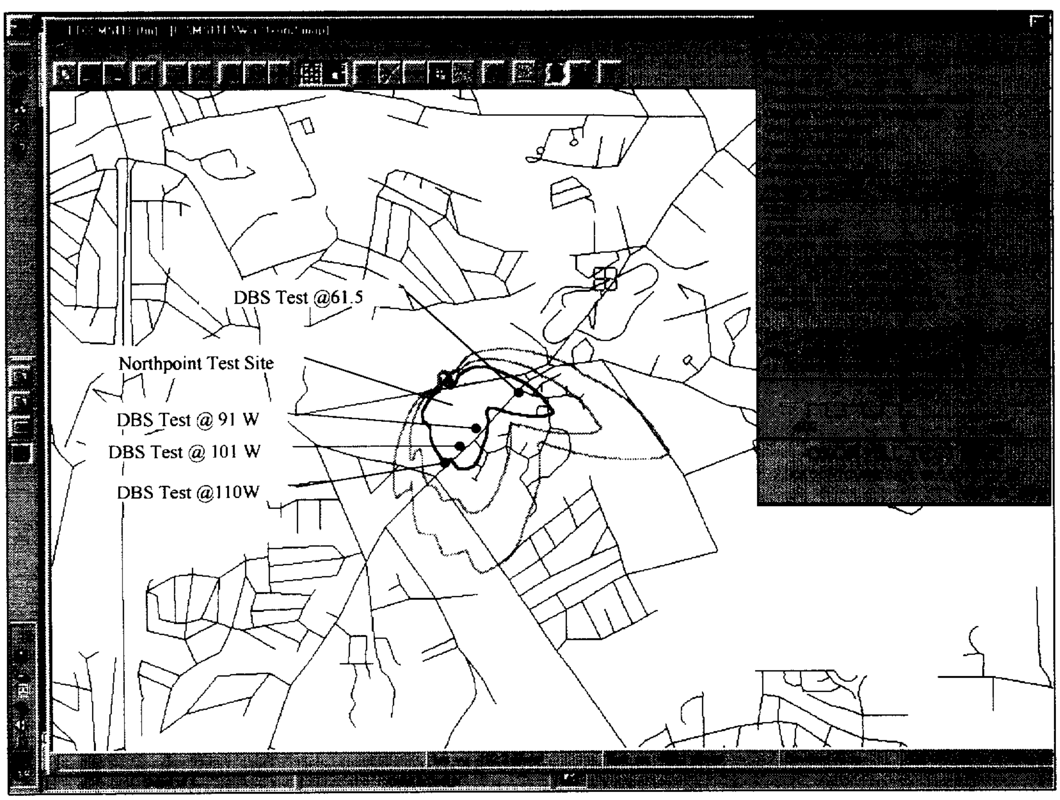

Figure 5 Oxon Hill deployment as operated by DBS.

The locations of the DBS test points are also identified in Figure 4 and Figure 5. Note that the purple contour is the predicted C/I of 22 dB. Everywhere outside of the purple contour, the increase in unavailability is less than 10%, and falls off rapidly. DBS chose test locations to demonstrate the worst-case signal interaction even though none of those test points reflect a typical or actual consumer reception site. However, even with DBS operating at its higher power and at a lower transmit height than what Northpoint intended for this location, a DBS customer located on the roadside would still have had DBS service operating in the quasi-error free mode when employing a planar array antenna.

Even though the DBS test was not a bona fide test of Northpoint technology, Northpoint took the opportunity to test a mitigation technique during the tests. Northpoint has always acknowledged and anticipates that in some rare cases, interference mitigation may be appropriate. There are varieties of mitigation techniques available to Northpoint that can be employed, such as shielding of the dish, moving the dish, or replacing the DBS dish with an antenna less susceptible to interference. The latter method was tested during the DBS operations, as described in the next section.

6.0 The DBS Planar Array Receive Antenna

The planar array antenna manufactured by Fortel Technologies, has a retail price about the same as that of the offset feed antenna ($70), and provides the same DBS signal as the offset feed antenna, yet without the spill over lobes. The planar array is not to be confused with a phased array antenna, or so-called in-line flat array type of antenna. The planar array antenna is widely used in Europe, and it meets the international standards for DBS operation in Region 2. According to the manufacturer, it has a gain towards the horizon of less than -50 dB relative to peak, or better than -16 dB relative to isotropic. The peak gain is 34 dBi, the G/T is better than 13 dB. Thus, the purpose of this experiment was to test the performance of this antenna as compared to the offset feed antenna, the antenna most commonly used by DBS customers in the U.S.

In contrast, while serviceable, the offset feed antenna has certain known deficiencies, including low-noise block (LNB) amplifier spill over lobes. The LNB is exposed to signals entering the side or back of the dish, at an angle of approximately 135 degrees off bore sight. The peak level of this side lobe is -2 dBi, 14 dB higher than the planar array antenna.[21] Northpoint's anticipated deployment is perfectly compatible with the vast majority of DBS customers who use the offset dish, however, in the extremely unlikely case that the offset dish was inadequate, the planar array antenna could be provided.

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21 The comparison between the planar array and offset feed antenna gains is presented in Figure 6.

7.0 The Northpoint Planar Array Validation Measurements

During the DBS operation, representatives of Northpoint field-tested the planar array antenna. The test was conducted at 6140 Oxon Hill Blvd., in the parking lot of a fast food restaurant, (Kentucky Fried Chicken). This location was chosen because it was in direct line of sight of the terrestrial transmitter being operated by DBS, and in an area where the predicted carrier to interference ("C/I") ratio would be near a minimum for one of the DBS satellites. The predicted C/I value for the DBS terrestrial deployment and the offset feed antenna at this location was 10 dB, as shown in Figure 5.

The Northpoint test team deployed the standard 45 cm offset feed DBS receive antenna and the 47 cm planar array antenna to receive signals from the DBS satellite at 110° west longitude. A separate offset feed antenna was used to observe the transmitter being operated by the DirecTV/Echostar group.[22] Integrated receiver-decoder (IRD) units, television monitors, a spectrum analyzer, and associated splitters and cables completed the equipment set up, as depicted in Figure 7 and Figure 8. Particular attention was paid to find the worst-case configuration for the offset feed antenna. As shown in Figure 8 and Figure 9, there was a direct ray trace from the transmitter to the LNB of the offset feed antenna. The off bore sight angle to the transmitter was approximately 135 degrees, indicating a gain towards the transmitter of -2 dBi, as shown in Figure 6.

<u>Signal Strength Pointer Data For Extreme DBS Operations</u>

As DBS affirms in its report, the interfering transmit power levels were increased up to 15 dB above the nominal EIRP of -21.7 dBW during its testing.[23] During this 'test-to-failure' phase, Northpoint tested the reception of the planar array antenna under the extreme condition of loss of signal of the offset feed antenna.

<u>Test procedure and results</u>–During each transmit "on" time, each IRD unit was tuned to the transponder that DBS was transmitting on, and SSP readings were noted. After the transmitter was turned off, the SSP readings were again recorded.[24] Four complete tests were made on this day; the standard deviation over each data set was about one count on the SSP; see Table 5 in the appendix. During one of these tests, (data set 2) DBS increased the power so much, at least 15 dB, that the signal of the offset feed antenna was lost completely, while the planar array continued to receive a normal quasi-error free signal at all times. The results are shown in the following table.

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[22] Constellation Center Bldg., 6009 Oxon Hill Rd, Oxon Hill Maryland, call sign WA9HXY, File No. 0173-EX-ST-2000.

[23] DBS Report pages 4 and 10.

[24] The IRD units were calibrated so that these SSP readings can be used to estimate the carrier to noise (C/N) ratio, within a margin of error as explained elsewhere in this section.

Table 2. Signal Strength Readings, June 20, 2000

			Offset Feed			*Planar Array*	
Data Set	Time	Transponder	*Off*	*On*		*Off*	*On*
1	11:55 AM	2	84.6	55.5		84.6	84.1
2	12:20 PM	2	84.4	0.0		84.2	71.0
3	12:27 PM	2	83.9	46.8		84.6	81.6
4	12:58 PM	16	91.4	42.8		92.6	88.8

In data set one, DBS increased the transmit power so much that a 30-point decline in the SSP of the offset feed antenna, while there was only an SSP depression of 0.4 in the planar array. This 0.4 count depression indicates that a C/I of greater than about 28 exists for the planar array antenna. For data set 2, the transmit power was increased until the offset feed antenna completely lost sync, over an 84-point decline, while the signal received through the planar array antenna maintained at 71, well in the quasi-error free zone. In the remaining data sets, significant depression is seen for the offset feed antenna when DBS was testing to failure, while the planar array antenna maintains very high SSP readings. For instance in data set 3, over a 40-point decline was seen in the offset feed antenna when DBS was increasing the power, while only a 3 point drop for the planar array antenna was seen. This shows that even the extreme power levels present in DBS 'test to failure' methodology could be completely mitigated such that the DBS signal could be received in a quasi-error free manner with the planar array antenna.

Relation of Signal Strength Pointer to C/I levels

The calibration curves for the two IRD units tuned to Echostar 110 are shown in Figure 10. Over this measurement range (40 – 90 points on the SSP scale) the relationship between the SSP and the C/N can be approximated by a straight line. This approximation adds little to the measurement error inherent in the IRD unit. This unit is expected to provide repeatable measurements at best within 2-3 points on the SSP scale. The equations for each IRD are given in the following table.

IRD unit and associated antenna	Straight-line approximation
IRD with planar array:	C/N = 0.180* (SSP) - 0.954
IRD with offset feed:	C/N = 0.183* (SSP) - 1.360

Using these straight-line approximations, the C/N for each data set can be identified, as shown in the following table. Note the superior performance of the planar array in either the ON or OFF conditions.

Table 3. Indicated clear sky C/N values for each data set.

			Offset Feed		*Planar Array*	
Data Set	Time	Transponder	*Off*	*On*	*Off*	*On*
1	11:55 AM	2	14.1	8.8	14.3	14.2
2	12:20 PM	2	14.1	-	14.2	11.8
3	12:27 PM	2	14.0	7.2	14.3	13.7
4	12:58 PM	16	15.4	6.5	15.7	15.0

These C/N values can then be used to derive the carrier to interference (C/I) ratio that must have existed in order to cause a change in the C/N. These are identified in the following table. Some estimate of the margin of error is in order. The SSP is not a high fidelity instrument, and repeatability within only 2-4 counts is expected. This leads to a margin of error of around 0.5 dB for C/N values, and 1-3 dB for the derived C/I values.

Table 4. Indicated C/I ratios

Data Set	Offset Feed	Planar Array	Indicated Isolation Advantage
1	10.3	>28	>17.7
2	<4.8	15.6	>10.8
3	8.2	23.0	14.8
4	7.1	23.4	16.3

Referring to Figure 5, a C/I of 10 dB is expected for the offset feed antenna, for the conditions used by DBS. However, except for Data Set 1, the data show that the C/I values recorded for the offset feed antenna are far lower than the C/I of 10 db predicted for this location. This indicates the operating power of the terrestrial transmitter is far higher than -21.7 dBW, as stated by DBS for their "test to failure" methodology. At the same time, note the planar array antenna maintained C/I levels greater than 15.5 dB at all times. At all times the planar array antenna maintained quasi-error free operation. Finally, Table 4 shows that the isolation advantage of the planar array antenna is probably 15 dB more than the offset feed antenna at this off bore sight angle.

Clearly the EIRP exceeded the Northpoint specified -21.7 dBW during these tests. In fact, the Northpoint test revealed that DBS increased its power by over 15 dB in its 'test to failure' process. Nevertheless, the planar array effectively mitigated interference, even at the highest power levels operated by DBS.

Summary of Planar Array Test

The indicated C/I values, derived EIRP values, and the complete loss of signal recorded, both reveal the transmitter was operated at levels higher than predicted by an EIRP of -21.7 dBW. Despite this fact, this test showed that the planar array antenna performed in a quasi-error free state at all times. The isolation advantage of this antenna over the offset feed antenna is at least 15 dB, which agrees with data provided by the manufacturer. Therefore, the planar array antenna was successfully used to mitigate interference caused by the sensitivity of the offset feed antenna with spill over lobes, despite the extreme power levels used by DBS.

8.0 Summary and Conclusions

The DBS test was not a *bona fide* test of Northpoint technology. Instead, DBS created inflated power levels in its quest to portray Northpoint technology as harmful. However, even under these extreme conditions, Northpoint was able to successfully field test a low-cost mitigation technique. For all its effort, DBS was unable to demonstrate that any current or future consumer could have been harmed by Northpoint operations. Additionally, the DBS testing methodology is suspect, due to the many discrepancies in the data and predictions.

There are serious discrepancies between the DBS predictions, and the DBS measurement data, which do not agree. The DBS estimated C/I values at the same location differ by huge amounts, when they should in fact all be the same C/I value. DBS cannot explain these discrepancies; they cast serious doubt on the merits of the DBS experiment.

This test of planar array technology during DBS operations of terrestrial transmissions proved that a standard low cost planar array antenna could mitigate interference in the peak of a terrestrial mitigation zone, even under extreme conditions of the DBS operations. Specifically, the test showed that the planar array antenna provides over 15 dB of additional isolation over that of the offset feed antenna, concurring with the information provided by the manufacturer. The impact is that when a C/I of 14 dB would be received by an offset feed antenna, the planar array antenna would have a C/I of 29 dB. Thus, this planar array antenna could be successfully used in mitigating unacceptable interference in a wide variety of circumstances.

With regard to DBS operations, it was not in accordance with Northpoint technology operations. The transmit equipment was operated at higher power levels, and at a lower transmit height than as specified in the Northpoint conceptual deployment plan. The transmit height was 15 % lower than specified in the conceptual deployment, leading to extremes in power levels that would not be seen in a Northpoint deployment. Moreover, the transmit power level was clearly at least 5-15 dB higher than would be allowed under the proposed EPFD levels. Both of these factors combined to present an environment that was extreme, and would not be seen under Northpoint deployment.

Thus, the DBS Experiment does not demonstrate that Northpoint services are incompatible with DBS operations. To the contrary, the DBS Experiment provides further empirical data to support Northpoint's introduction in the 12.2 – 12.7 GHz band by demonstrating that low cost, practical mitigation techniques exist for even the artificial and extreme conditions created by the DBS operators.

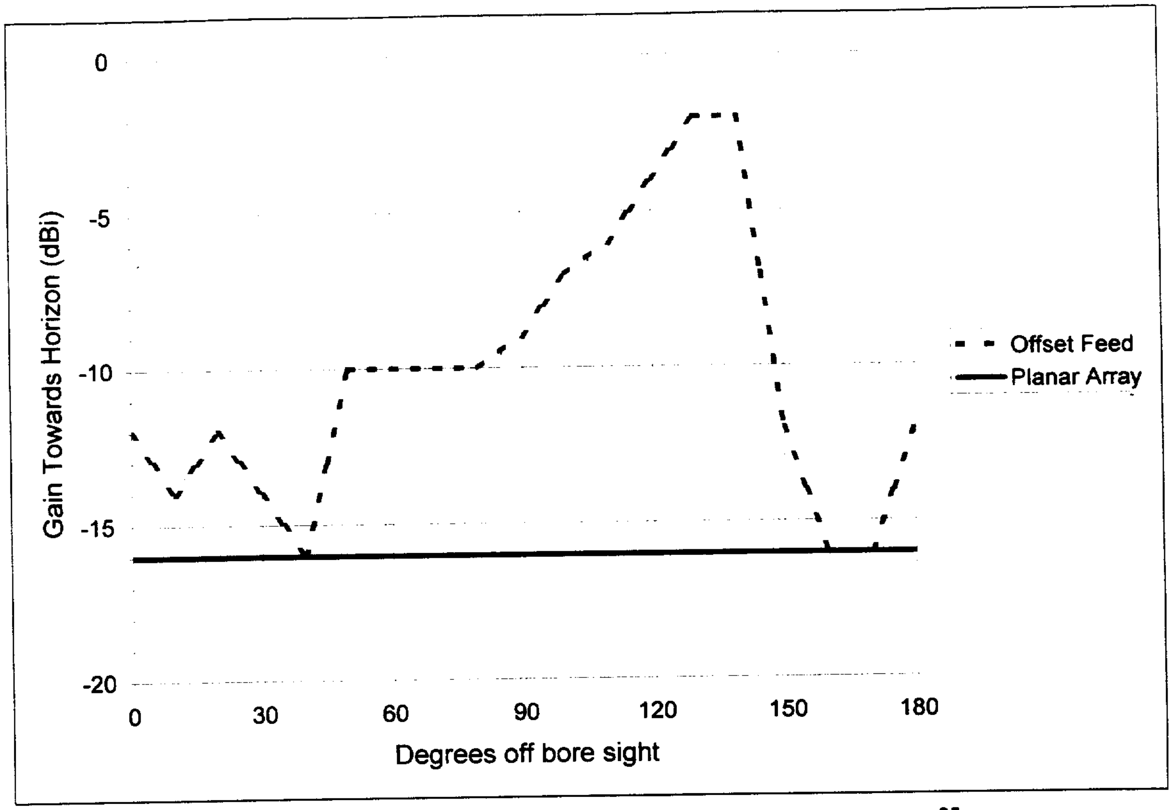

Figure 6 DBS receive antenna patterns towards horizon[25]

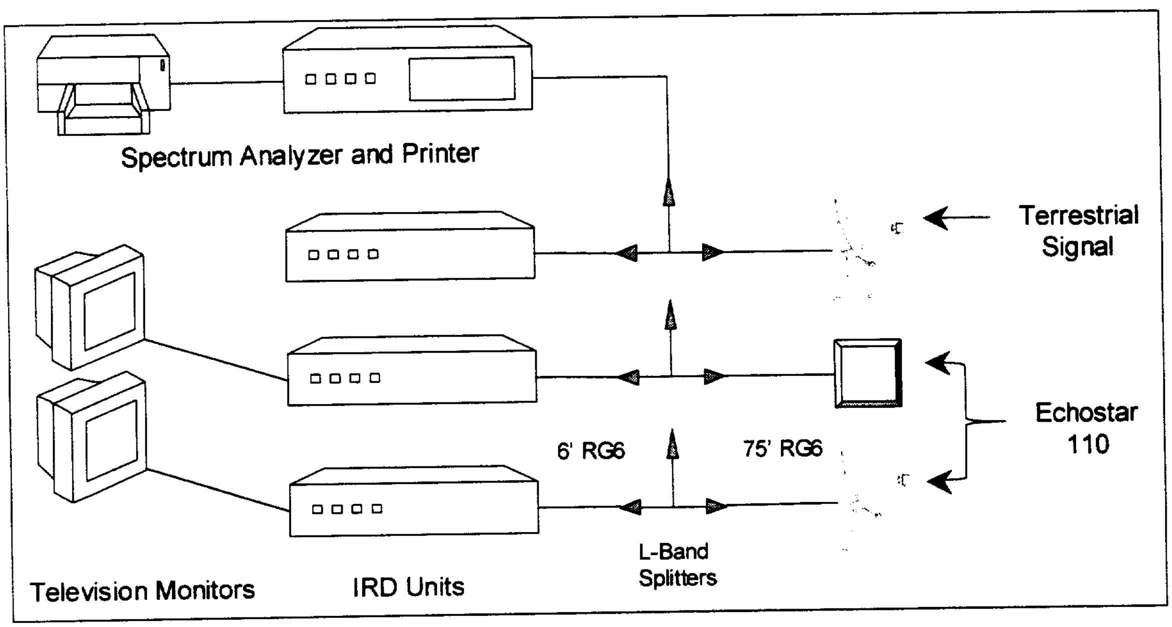

Figure 7 Northpoint test equipment block diagram

[25] Offset feed data according to Technical Annex to Reply Comments of DirecTV, April 14, 1999, page 10, planar array data provided by the manufacturer, Fortel Technologies Inc.

Figure 8 Northpoint equipment configuration, June 2, 2000

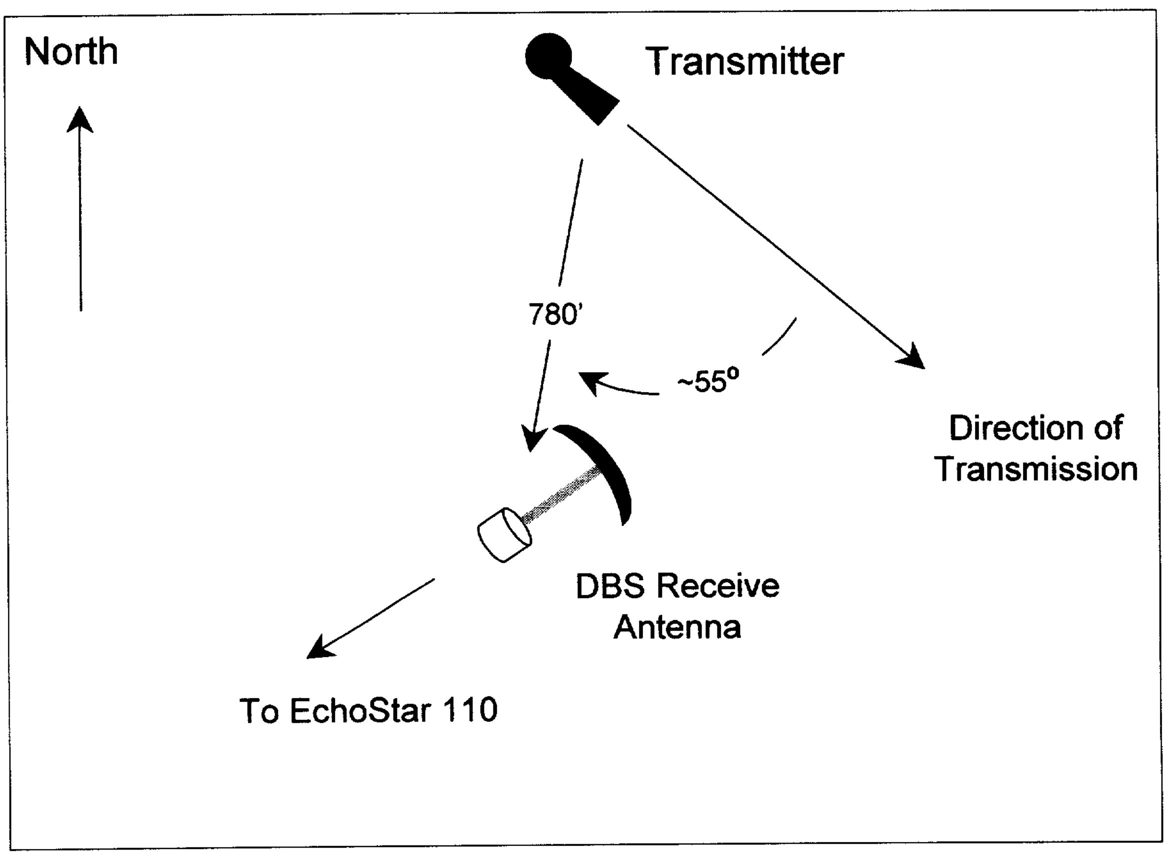

Figure 9 Northpoint offset feed antenna test geometry

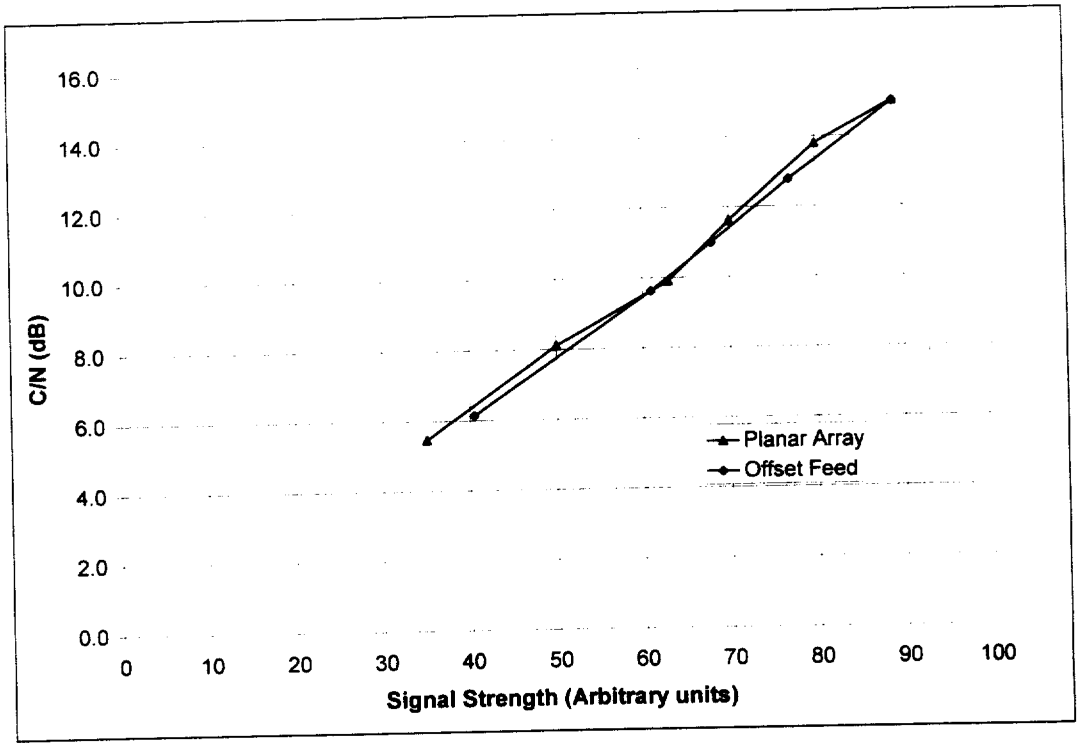

Figure 10 IRD calibration curves

Table 5. Signal Strength readings (average and standard deviation)

Data Set	Receive Antenna	Transmitter Condition	Average	Std Dev
1	Offset Feed	ON	55.5	2.1
1	Planar Array	ON	84.1	0.3
1	Offset Feed	OFF	84.6	0.5
1	Planar Array	OFF	84.6	0.5
2	Offset Feed	ON	0.0	0.0
2	Planar Array	ON	71.0	2.0
2	Offset Feed	OFF	84.4	0.5
2	Planar Array	OFF	84.2	0.4
3	Offset Feed	ON	46.8	2.0
3	Planar Array	ON	81.6	0.5
3	Offset Feed	OFF	83.9	0.7
3	Planar Array	OFF	84.6	0.5
4	Offset Feed	ON	42.8	2.6
4	Planar Array	ON	88.8	1.5
4	Offset Feed	OFF	91.4	1.3
4	Planar Array	OFF	92.6	1.1