ORIGINAL EX PARTE OR LATE FILED

ORIGINAL

SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP

1440 NEW YORK AVENUE, N.W.
WASHINGTON, D.C. 20005-2111

TEL: (202) 371-7000
FAX: (202) 393-5760

FIRM/AFFILIATE OFFICES

BOSTON
CHICAGO
HOUSTON
LOS ANGELES
NEWARK
NEW YORK
PALO ALTO
SAN FRANCISCO
WILMINGTON

BEIJING
BRUSSELS
FRANKFURT
HONG KONG
LONDON
MOSCOW
PARIS
SINGAPORE
SYDNEY
TOKYO
TORONTO

DIRECT DIAL
202-371-7230
DIRECT FAX
202-371-7996
EMAIL ADDRESS
ABUSH@SKADDEN.COM

March 22, 2000

RECEIVED
MAR 23 2000
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

VIA HAND DELIVERY

Magalie Roman Salas, Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: ***Ex Parte* Submission of Northpoint Technology, Ltd.**
ET Docket No. 98-206, RM-9147, RM-9245

Dear Ms. Salas:

Enclosed on behalf of Northpoint Technology, Ltd. is an ex parte letter to the Honorable Chairman with the attached Response to The Boeing Company dated March 22, 2000.

In accordance with Section 1.1206 of the Commission's rules (47 CFR § 1.1206), an original and six copies of this letter are submitted for inclusion in the public record for the above-captioned proceedings. Please direct any questions concerning this submission to the undersigned.

Sincerely,

Antoinette Cook Bush
Counsel for Northpoint Technology, Ltd.

No. of Copies rec'd 0+6
List ABCDE

COPY

SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP

1440 NEW YORK AVENUE, N.W.

WASHINGTON, D.C. 20005-2111

TEL: (202) 371-7000

FAX: (202) 393-5760

DIRECT DIAL
(202) 371-7230
DIRECT FAX
(202) 371-7996

FIRM/AFFILIATE OFFICES

BOSTON
CHICAGO
HOUSTON
LOS ANGELES
NEWARK
NEW YORK
PALO ALTO
SAN FRANCISCO
WILMINGTON

BEIJING
BRUSSELS
FRANKFURT
HONG KONG
LONDON
MOSCOW
PARIS
SINGAPORE
SYDNEY
TOKYO
TORONTO

March 22, 2000

VIA HAND DELIVERY

William E. Kennard
Chairman
Federal Communications Commission
The Portals, 445 12th Street, S.W.
Washington, D.C. 20554

Re: ***Ex Parte* Submission of Northpoint Technology, Ltd.**
ET Docket No. 98-206, RM-9147, RM-9245

Dear Chairman Kennard:

Northpoint Technology Ltd. ("Northpoint") responds to the *ex parte* filing of February 16, 2000 of The Boeing Company ("Boeing").[1] The most striking aspect of the Boeing filing is the great lengths to which Boeing goes to reject all of Northpoint's good-faith sharing proposals without offering a single positive sharing proposal of its own.

The Boeing Analysis contains significant flaws, not the least of which is that it is based on the assumption that Boeing will be the only NGSO-FSS system to be deployed in the band. As the Commission is well aware, there are a number of NGSO applicants and any sharing solution must include all applicants and not just the Boeing system. In contrast, Northpoint's proposals address spectrum sharing among all applicants and do not rest on Boeing's unrealistic assumption that only Boeing will be deployed. In fact, some of Northpoint's proposals will also facilitate sharing amongst the NGSOs themselves.

---

1 Ex Parte Presentation of The Boeing Company ("Boeing Letter") dated February 16, 1999, received by the Commission February 16, 2000. This letter is accompanied by an "Analysis of Interference Characteristics of Northpoint Technology, Ltd." ("Boeing Analysis").

The basic claim in Boeing's filing is that deployment of the Northpoint system will create a "mitigation zone" in the 12.2 – 12.7 GHz band around each Northpoint transmitter equal to approximately 3.5% of the Northpoint service area and that the lack of service in this area will prevent the deployment of Boeing's system. As is demonstrated in the attached technical analysis, Boeing's calculations of this mitigation zone are in error. However, it is important to note that even if Boeing were correct in its estimate, Boeing would still be able to use 96.5% of the Northpoint service area in the 12.2 – 12.7 GHz band and 100% of the service area in the 11.7 – 12.2 band. Since Boeing's application seeks an unprecedented total of 3,650 MHz of bandwidth and Northpoint only seeks 500 MHz, it is obvious that Boeing would get almost everything it has asked for, even in the worst-case scenario that it has presented to the Commission.

In the attached technical response, Northpoint demonstrates that the mitigation zone for Boeing is actually approximately 200 meters in size, an area comprising less than 0.1% of the Northpoint service area. The size of any mitigation zone is driven by the level of protection claimed. In the attached technical analysis, Northpoint demonstrates that there is no support for Boeing's desired protection level. First, Boeing claims that its system needs *much more* protection from terrestrial services than that afforded to existing geostationary systems.[2] For justification of this criterion, Boeing relies upon an ITU-R Recommendation that explicitly states it is to be used only for sharing with other co-directional satellite systems, not terrestrial systems as Boeing claims.[3]

Second, the method by which Boeing arrives at its criterion has serious errors and omissions. Among these errors:

- Boeing assumes that it is the only NGSO FSS system operating in the band, leading to unrealistic elevation angle assumptions and a gross exaggeration of the rain statistics used in its calculations.
- Boeing improperly calculates the required I/N through fundamental errors in link budget analysis, leading to a gross exaggeration of the required I/N.
- Boeing uses a *desirable* system availability, to calculate its I/N criterion, instead of an *achievable* system availability.

---

2 Boeing claims that it should be protected to an interference-to-noise ("I/N") ratio of –19.4 dB, equivalent to 1% of system noise. According to draft New ITU-R Recommendation ITU-R S. Doc. 4/67, the allowable level of interference from co-primary services should be 6% of total system noise, equivalent to an I/N of at least –12.2 dB.

3 Recommends 3 of ITU-R F.1323 (Document ITU-R 4/69).

In fact, as demonstrated in the attached documents, applying the Boeing technical analysis to the specifications in Boeing's application, the Boeing system cannot meet its basic system availability objectives. However, assuming that Boeing can correct this problem, the attached analysis explains that a peak I/N value of 0 dB would not cause harmful interference to the Boeing system and would result in a steady-state I/N of –12.2 dB, which is acceptable by any standard.

Even if there were agreement upon the I/N criterion, the methodology applied by Boeing to determine the potential mitigation zone is fraught with serious errors. Boeing has greatly exaggerated the size of any possible mitigation zone by assuming that Northpoint interferes with Boeing's antenna back lobes. As shown in the attached analysis, Northpoint does not interfere at all with Boeing's back lobes; instead, the Boeing analysis rests on a combination of mistaken assumptions and omitted Northpoint system parameters. *The attached analysis demonstrates that Northpoint will actually be below the I/N criterion of –12.2 dB in 100% of its service area.* Northpoint demonstrates through a detailed analysis that any mitigation zone for the Boeing system must be less than 0.1% of the Northpoint service area, which comports with the previous analysis submitted by Northpoint on March 2, 1999. It should be noted that VIRGO, another NGSO FSS system, finds this mitigation zone acceptable.[4]

In summary, the Boeing protection criteria and analysis should be disregarded. They conflict with ITU-R Recommendations which state how much noise Boeing should allocate for sharing with co-primary services such as the FS. Boeing cannot claim more protection than is afforded to existing geostationary systems. Boeing cannot support its claim of a Northpoint mitigation zone size of 3.5%; the actual mitigation zone is less than 0.1%. Finally, the Boeing criticism of frequency diversity is without merit, and Boeing offers no mitigation plan of its own, other than that it should be given exclusive use of the spectrum. Such an inefficient system should not be given priority over other, more efficient users of the spectrum, such as Northpoint and VIRGO.

---

4 *See* letter from David Castiel, President of Virtual Geosatellite, LLC and Sophia Collier, President of Northpoint, to the FCC Chairman, dated March 8, 2000.

Should you have any questions, please do not hesitate to call.

Sincerely,

Antoinette Cook Bush
Counsel for Northpoint Technology, Ltd.

cc: Secretary, FCC
David A. Nall and Bruce A. Olcott,
counsel for Boeing

Response to The Boeing Company

March 2000

Northpoint Technology, Ltd.

Outline

1 **INTRODUCTION** 3

2 **INTERFERENCE CRITERION** 5

2.1 ITU-R RECOMMENDATIONS CONTRADICT BOEING'S PROPOSED CRITERIA 5

2.2 DEVELOPMENT OF INTERFERENCE CRITERIA IS WITHOUT PURPOSE IF A SYSTEM CANNOT MEET STATED AVAILABILITY OBJECTIVES 7

2.3 PEAK INTERFERENCE FROM GSO SYSTEMS IS COMPLEMENTARY, NOT ADDITIVE .. 8

2.4 OTHER ERRORS IN THE BOEING PROPOSED INTERFERENCE CRITERION 8

3 **AREA FOR POTENTIAL INTERFERENCE** 12

3.1 BACK-LOBE ANALYSIS 12

3.2 INTERFERENCE CONTOURS 14

4 **INTERFERENCE MITIGATION** 18

4.1 FREQUENCY DIVERSITY ALLOWS FOR MUTUAL COEXISTENCE – WITHOUT AFFECTING SYSTEM DESIGN 18

4.2 OTHER MITIGATION TECHNIQUES ARE APPROPRIATE 21

5 **REFUTATION OF OTHER BOEING TECHNICAL ERRORS** 21

5.1 NORTHPOINT'S SYSTEM DESIGN PROPERLY ACCOUNTS FOR RAIN MARGIN 21

5.2 NORTHPOINT DID PARTICIPATE IN INTERNATIONAL SPECTRUM SHARING STUDIES 22

5.3 FIXED SERVICES ARE STILL OPERATING IN THE 12.2 – 12.7 GHZ BAND 22

5.4 NORTHPOINT PFD IS NOT A BURDEN ON BOEING 23

6 **SUMMARY AND CONCLUSIONS** 25

1 Introduction

On February 16, 2000, The Boeing Company ("Boeing") filed with the Commission an "Analysis of Interference Characteristics" in order to provide an assessment of Boeing's NGSO FSS system's ability to share with Northpoint's terrestrial system.[1] In this analysis, Boeing claimed that it needs protection for its system to an interference-to-noise ("I/N") level of -19.4 dB, or 1% of system noise. Using this criterion, Boeing claims that in the band 12.2 – 12.7 GHz, there would be unacceptable interference in a circular area with a diameter of 3 km near a Northpoint transmitter, an area equal to 3.5% of the total Northpoint service area. Outside of this area, Boeing admitted that it and Northpoint could operate co-channel without interference. In the 11.7 – 12.2 GHz band there would be no interference into the Boeing system. Boeing then stated that lack of access to this portion of the Northpoint service area in the 12.2 – 12.7 GHz band would jeopardize the deployment of Boeing system.[2]

Northpoint disagrees with both Boeing's choice of I/N criterion and its analysis, as there are serious flaws in each of these. This paper will demonstrate that Boeing's proposed criterion of -19.4 dB was developed through gross misapplication of, and is fully contradicted by, the ITU-R Recommendations. A steady-state I/N of -12.2 dB will provide the necessary protection to the Boeing system. This 7.2 dB difference in I/N criterion would be sufficient to dramatically reduce the size of predicted mitigation zones. In addition, in performing its "back-lobe analysis," Boeing omits from consideration key Northpoint system parameters. A more comprehensive back-lobe analysis that includes Northpoint's system parameters shows that there are no back-lobe issues anywhere in the Northpoint service area. This paper demonstrates that the size of the Boeing mitigation zone is at least an order of magnitude smaller, and occupies less than 0.1% of the Northpoint service area. The differences between the Boeing filing and this filing are summarized in the following table.

Item	**Northpoint**	**Boeing**
Interference criterion for protection of NGSO FSS		
I/N, maximum allowed	0 dB	-19.4 dB
I/N, steady-state equivalent	-12.2 dB	Not stated
Percent of system noise	6%	1%
Percent increase in Unavailability	~10%	10%
Size of mitigation zone		
Diameter of mitigation zone	200-300 meters	2-3 kilometers
Percent of affected Northpoint service area	< 0.1%	3.5%

[1] Ex Parte Presentation of the Boeing Company ("Boeing Letter") dated February 16, 1999, received by the Commission February 16, 2000. This letter is accompanied by an "Analysis of Interference Characteristics of Northpoint Technology, Ltd." ("Boeing Analysis").

[2] Boeing Letter, page 2.

As demonstrated below, effective techniques to mitigate this interference are available that do not require any changes in NGSO system design, and do not affect throughput or efficiency.[3] Therefore, there is no undue burden on either the Boeing NGSO FSS system, or on the Northpoint system. The Commission should disregard the Boeing analysis.

[3] For example, frequency diversity can be used to mitigate interference if even up to 50% of the NGSO FSS service area were affected, see Comments of Northpoint Technology, Ltd. In RM-9147 and RM-9245, March 2, 1999 ("Northpoint Comments"), page 30.

2 Interference Criterion

Boeing proposes that its system should be protected from the fixed service ("FS") to an I/N criterion of -19.4 and claims that this criterion is equal to a 10% increase in unavailability or a 1% increase in total noise. The acceptable level of interference between services provided in ITU-R Recommendations is a 6% increase in total system noise, equivalent to a steady-state I/N of -12.2 dB. Therefore, it is inappropriate for Boeing to claim more protection than an I/N of -12.2 dB. This is discussed in further detail in section 2.1.

Moreover, as will be shown in section 2.2, if Boeing actually operated according to the parameters claimed in its interference analysis, the Boeing system would not meet its stated availability objective. In section 2.3, the subject of how time-varying sources of noise could be combined is discussed. Finally, in section 2.4, it is shown that Boeings application of S.1323 and other ITU Recommendations is fundamentally flawed. If Boeing used an actual link budget to develop its criterion, it would have determined that an I/N of -12.2 dB is sufficient.

2.1 ITU-R Recommendations Contradict Boeing's Proposed Criteria

ITU-R Recommendations provide guidance on how the FSS and Boeing should allocate a noise budget in its system. The existing recommendations are directed primarily at geostationary FSS systems. However, it is inappropriate for an NGSO FSS system, as a new entrant to the band, to demand more protection than is afforded services that have already been allocated within the band.

A Draft New ITU Recommendation provides guidance to Boeing and NGSO FSS designers. This recommendation specifies that an I/N of -12.2 dB would be more appropriate as a steady-state criterion. One of the basic tenets of the recommendation is that FSS systems should allocate at least 6% of their total noise budget for co-primary services[4] such as Northpoint.[5] Moreover, the Recommendation cited by Boeing, (ITU-R

---

[4] Northpoint is a fixed service and the FS is designated a PRIMARY service within 12.2 – 12.7 GHz band, both domestically and internationally. See 47 CFR §2.106, and the ITU Radio Regulations, designating fixed service a primary service, with the condition that existing and future terrestrial services not cause harmful interference "to the space services operating in conformity with the Broadcasting-Satellite Plan."

[5] Recommends 4 from draft new Recommendation ITU-R S.[DOC. 4/67]:

4 that error performance degradation due to interference at frequencies below 15 GHz should be allotted portions of the aggregate interference budget of 32% or 27% of the clear-sky satellite system noise in the following way:

– 25% for other fixed-satellite service systems for victim systems not practising frequency reuse;

– 20% for other fixed-satellite service systems for victim systems practising frequency reuse;

– 6% for other systems having co-primary status;

– 1% for all other sources of interference,

S.1323 (Doc 4/69) explicitly states it is to be used for interference from co-frequency, co-directional satellite systems only, and not for sharing with other services as claimed by Boeing. Boeing, in contrast, proposes that the Commission only allocate 1%, which is the criterion for "all other services" combined, as described below.

Translation from steady-state to time-varying sources of noise

As discussed above, co-primary services such as Northpoint should be allocated at least a steady-state 6% of total system noise. This is a steady-state equivalent of what may be a time-varying source of interference.[6] Recommendation ITU-R 558-2 deals with interference from fixed service systems into FSS systems and allows an interference level equivalent to 10% of the clear-sky satellite system noise for not more than 20% of any month. Recommendation ITU-R 558-2 goes on to indicate that interference from fixed service systems should not cause the Bit Error Ratio ("BER") to exceed 1×10^{-4} for more than 0.03% of any month nor cause the BER to exceed 1×10^{-3} for more than 0.005% of any month. These interference allowances, in terms of percentage of system noise, can be converted into corresponding values of I/N. Ten percent of the system noise is equal to an I/N of -10 dB. Quoting from draft new ITU-R Recommendation S.[4/67]:

> If a conservative Bit Error Ratio (BER) characteristic of 1 dB increase in noise yielding a tenfold increase in BER is assumed, I/N values for the other BERs are found to be I/N of -2.4 dB for 0.03% of any month and I/N of 0 dB for 0.005% of any month. This I/N corresponds to 6% of the satellite system noise. Thus, the interference from the fixed service, which shares frequencies on a primary basis, is equivalent to a single interference entry from another satellite system, according to Recommendations ITU-R S.735 and ITU-R S.1323.

Therefore, based upon ITU-R Recommendations, Boeing should allocate 6% of its total system noise to sharing on a co-frequency basis with the fixed service, in this case Northpoint. This is equivalent to an I/N of -12.2 dB. As a time-varying source of noise, this interference can be translated to an I/N mask, which may range to 0 dB or higher. This is a comparable situation to "epfd" values, where the steady state equivalent may be 10-15 dB below the maximum allowable value for some percentage of time.

While it is beyond the scope of this paper to develop an epfd mask, nor is it necessary, it is clear that a time-dependent criterion for Boeing would allow for higher I/N values, up to 0 dB, or possibly even higher. This is true because the clear air margin of Boeing is sufficient to tolerate an I/N of 0 to 3 dB without a loss of sync.[7] Therefore, the Boeing assertion that an I/N = 0 dB as unacceptable is demonstrated to be false. A time-allowable percentage of I/N = 0 dB could be tolerated for some percentage of time, and still allow the system to meet the basic performance objectives.

---

6 Even though Northpoint's transmissions are steady-state, they may appear as time-varying to NGSO FSS systems as these system orbit the globe and pass over a Northpoint transmitter.

7 An I/N of 0 dB causes a 3 dB loss of link margin. By inspection of the Boeing link budgets in the Boeing Application (pages C-2, C-3 and C-11), each link has at least 3 dB of margin. Therefore, an I/N of 0 dB would not cause an outage in clear air.

2.2 Development of Interference Criteria is Without Purpose if a System Cannot Meet Stated Availability Objectives

Boeing provides a stated system availability objective of 99.7% in its application to the FCC,[8] and 99.9% in the present filing,[9] both for a rain region K. These are significantly different amounts of availability. An availability of 99.9% means the system is unavailable only 8.76 hours per year. By contrast, a system with 99.7% availability is unavailable 26 hours per year. If a criterion of "10% increase in unavailability" is to be used it is clearly very important to identify the true achievable availability of the system before making any calculations.[10] The Boeing system cannot meet the now claimed 99.9% objective in region K as it claims. Indeed it cannot meet this availability in much of the country, as shown in the following figure.[11] Unlike terrestrial systems, Boeing cannot locally engineer its transmission system to overcome these deficiencies. Nor does it seem likely that increasing user antenna gain would compensate, as up to 6 dB is required in rain regions K, M and N, which cover approximately 50% of the continental U.S. Calculation of these actual availability numbers is instructive, it shows the Boeing claim of -19.4 dB I/N (equal to 10% increase in unavailability) is based on a desired availability of 99.9% for region K, not the actual availability in Region K as shown in Figure 1 below. While Region K has been used by as a reference example by Boeing, and is showed to be inaccurately portrayed, it is important to note that the accompanying link budgets demonstrate that Northpoint's analysis is extensible to all rain regions, including those where Boeing's availability is higher.

---

8 See "Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed Satellite Service" ("Boeing Application"), January 8, 2000, page 45.

9 Boeing Filing page 3.

10 An increase of 10% in unavailability for a system with 99.9% availability is equal to 0.876 hours per year; for a system with 99.7% availability the number would be 2.628 hours per year, a difference of 300%.

11 See the supporting link budgets attached in Appendix I.

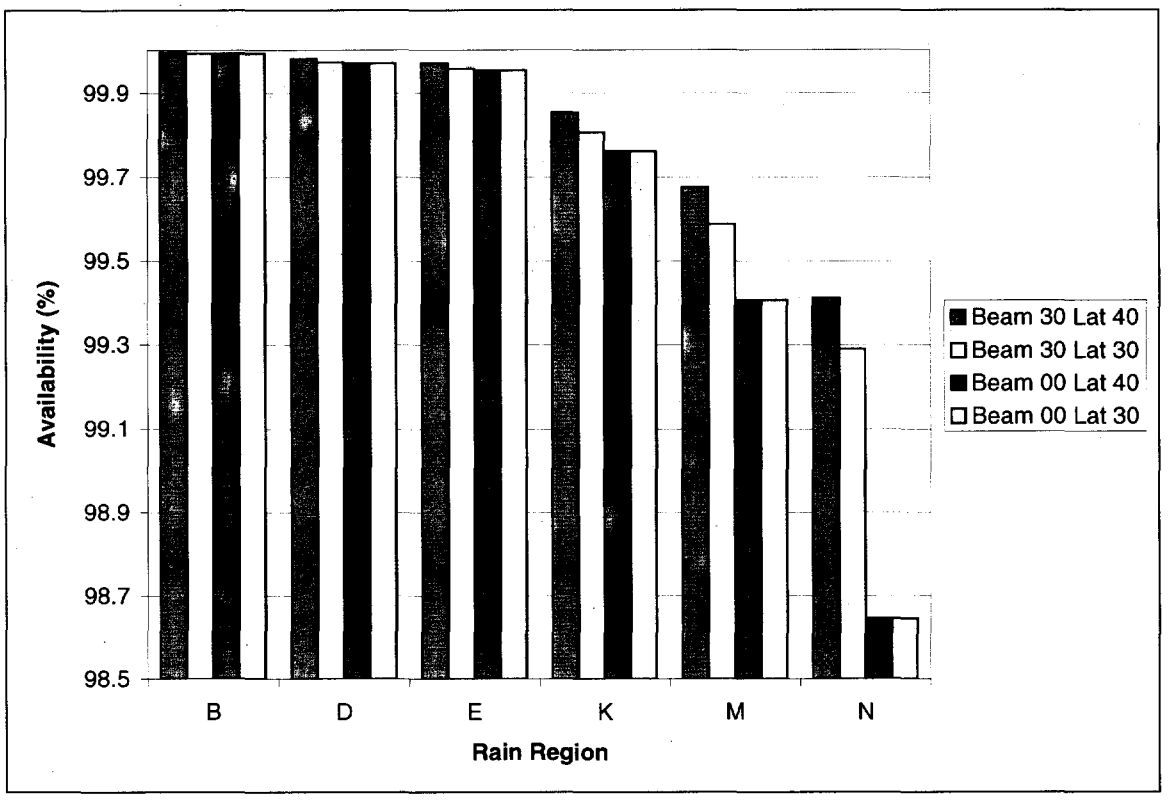

Figure 1. Boeing system availability throughout the U.S.

2.3 Peak Interference from GSO Systems is Complementary, Not Additive

The geometric relationship between the GSO arc and Northpoint transmissions provides that radio energy from the GSO arc and from Northpoint arrive at a point on the ground from opposite directions. Therefore, the peak levels of interference do not occur at the same time. Although it is clear that any time-varying interference margin allocated for the GSO can also be used to mitigate interference from Northpoint, this concept requires further exploration to quantify the extent.

2.4 Other errors in the Boeing proposed interference criterion

In Section 2.1 of this report, it was shown that Boeing's proposed I/N criterion of -19.4 would not be appropriate under any circumstances. Even so, Boeing's derivation of its criterion has several fundamental errors. First, the Boeing application of ITU-R Recommendations is erroneous. Boeing wrongly equates a change in rain margin with C/N reduction, which is in error, as clearly shown in ITU-R S.1323. Second, Boeing's selection of an ITU antenna pattern intended for offset-feed parabolic GSO earth stations is non-representative of the proposed planar array Boeing plans to use for its NGSO system, and inconsistent with the Boeing Application. Third, Boeing provides elevation angles that are not characteristic of how its system would operate. Finally, based upon its

erroneous elevation angle assumptions, Boeing develops a rain margin PDF that is also non-representative of its system.

- *Boeing Improperly Estimates Availability Degradation*

Boeing states that its design availability is 99.9% in rain region K. As was demonstrated in Section 2.2 of this report, Boeing has not shown that its system can meet this availability. Availability degradation must be calculated on the basis of actual achieved availability, not a desired availability, so use of the Boeing's desired 99.9% availability as a baseline for calculation is incorrect. Boeing should have used the actual availability, which would have led to an allowable link degradation of 0.16 dB in Region K at 40 degrees latitude, as shown in the attached link budgets.

- *Boeing Erroneously Equates Change in Rain Margin with C/N Degradation*

Boeing equates a change of rain margin with C/N degradation, which is in error, and is an improper application of ITU-R 1323. Because thermal noise is a function of rain rate, a change of rain margin is not equivalent to a change in C/N degradation. As the rain rate changes so does the thermal noise, in amounts that are approximately equal. The noise increase can be viewed as a G/T degradation, the loss of rain margin as a reduction in carrier power. A 0.1 dB change in rain rate will be accompanied by a G/T degradation of equal magnitude. The various methods in ITU-R 1323 clearly specify how the degradation can be computed. For example, see Table 1 of Annex 4 to the Draft Revision of Recommendation ITU-R S 1323 (Doc. 4/69), "Example calculations of $epfd_{down}$ for various earth station antennas." In this example, an I/N of -12.2 dB causes a 0.11 dB change in allowable rain fade, and a 0.14 dB change in G/T degradation, for a total allowable degradation of 0.25 dB.

Therefore, by only accounting for the change in allowable rain fade, Boeing has improperly computed the allowable I/N. Had Boeing properly calculated the allowable I/N, based on both the G/T degradation, as well as the change in rain margin, the result would be much lower than the -19.4 dB proposed by Boeing. Northpoint used this procedure to determine that an I/N of –12.2 dB produced increases in unavailability of about 10%, a figure that Boeing finds acceptable.

- *Boeing Selection of Antenna Pattern Is Erroneous and Inconsistent with Boeing Application*

In its filing, Boeing presents an antenna pattern and refers to draft new Recommendation ITU-R S.[Doc. 4/57] as the source.[12] However, the antenna pattern used by Boeing in this recommendation clearly states that it is "*for GSO earth stations only*." As specified in Note 2, "This Recommendation is based on studies of a range of paraboloid antennas." Finally, Note 1 refers to the "spillover" region of the offset feed, which would not exist on Boeing Integrated Digital Service ("IDS") receive antennas, as

[12] Page 7 of the Boeing Analysis.

Boeing proposes to use planar array antennas. Boeing also provides an antenna pattern in its Application on page 52, which is different from the ITU-R Recommendation now being quoted by Boeing. The back-lobe is given as -10 dBi, the sidelobes follow a gain pattern of 29-25*log (θ) for θ less than 48°, there is no "spillover region".

- *Boeing's Elevation Angle Distribution Assumes it is the Only NGSO FSS System Operating*

Boeing presents on pages 3 and 4, graphs of elevation angles for various latitudes. These representations are given the *explicit assumption* that the user is assigned the highest elevation satellite at all times. However, Boeing admits that in practice, this will not be possible, with the caveat that this "assumption is only valid for the Boeing NGSO system operating independently of other NGSO systems."[13] Figure F of Appendix II hereto shows the elevation angle density for the Boeing system to representative parts of the U.S. using the appropriate assumption.

The cumulative density function in Figure G of Appendix II hereto shows that the average elevation angle is about 50 degrees in all cases. By comparison, the graphs on pages 3-4 of the Boeing Analysis indicate that the average elevation angle of the Boeing system would be between 60 and 80 degrees. The net result is that Boeing has overestimated the average elevation angle for its system, which leads to a lower required rain margin to meet a specific availability target, as explained in the following section.

- *Boeing's Faulty Rain Margin Analysis*

Given that the elevation angle assumptions are unrealistic, the application of equation (1) on page 2 of the Boeing material is also wrong. Figure H of Appendix II hereto provides the resultant rain margins according to ITU-R Recommendation 618-5, based upon the elevation angle density functions presented in Figures F and G of Appendix II. Comparing Figure H with the Boeing graphs on page 5 of its report, it appears that Boeing has cherry-picked a rain margin from a favorable set of elevation angles (as discussed in the previous section), as well as a favorable rain region and latitude for its analysis. While only a small section of the equation, these Boeing errors are compound the flaws in the overall analysis.

Summary of Boeing's Application of ITU-R 1323.

From the analysis in this section, it is clear that Boeing's application of the ITU-R recommendations is improper. First, Boeing uses a *desirable* system availability, as opposed to an *achievable* system availability. Second, in applying ITU-R 1323, Boeing has disregarded fundamental radio frequency link principles, which greatly exaggerates the allowable I/N value. Third, the antenna pattern suggested by Boeing is inconsistent with the intended use of the antenna pattern, and is contradicted by its own application. Finally, based upon its erroneous elevation angle assumptions, Boeing develops a rain

[13] Page 2 of the Boeing Analysis.

margin PDF that is also non-representative of its system. The methods in the ITU-R Recommendations when properly applied lead to an I/N of –12.2 dB, and associated increases in unavailability of 10%, a figure that Boeing finds acceptable.

3 Area for Potential Interference

In its filing, Boeing asserts that (based upon a criterion of -19.4 dB) interference will be unacceptable in a roughly circular area in front of the Northpoint transmitter with a diameter of 3 km. As the Northpoint service area has a diameter of 16 km, the Boeing 3 km area would be 3.5% of the Northpoint service area.[14] Northpoint disagrees with the Boeing result, yet even if accurate, 3.5% is not a significant portion of the Northpoint service area. Boeing used a flawed back-lobe analysis to make this conclusion.

Using the proper criterion of -12.2 dB, the same back-lobe analysis can be undertaken, using the method provided in Table 2 of the Boeing report. In performing this analysis, one finds that the back-lobe methodology performed by Boeing is unsuitable because back-lobe interference is not possible, as shown in Section 3.1. In order to calculate areas for potential interference, one must take into account the pointing characteristics of the Boeing antenna. This calculation is done in Section 3.2.

3.1 Back-lobe Analysis

The interference claims in the Boeing Analysis filing are completely based on the erroneous conclusion that Northpoint interferes with Boeing's antenna back lobes.[15] As will be shown below, Northpoint does not interfere at all with Boeing's back lobes, instead the Boeing analysis rests on a combination of mistaken assumptions and omitted Northpoint system parameters. In order to examine Boeing's claims, the back lobe analysis is reproduced below with corrected parameters and results. However, the Boeing back lobe analysis does not account for necessary Northpoint system parameters. Only when this second step is completed does an accurate picture of the interference environment emerge.

Replicating Boeing's Back-lobe Analysis with Corrected Parameters

First, Boeing ignores 3 dB of isolation between Northpoint's linear and Boeing's circular polarizations. This is a 3 dB source of error in the Boeing back-lobe analysis. Simply applying this 3 dB error to Boeing's overstated -19.4 I/N criterion would change the separation distance between a Boeing receiver and a Northpoint transmitter from 3 to 2.1 kilometers reducing the area of potential interference from 3.5% to 1.5% of the Northpoint service area. Second, with respect to the Northpoint transmit noise density, Boeing uses a value of 24 MHz, but this ignores 3 MHz of guard band. The proper band to make noise density calculations would be 27 MHz. Third, as discussed in section 4 of this report, Boeing uses an antenna pattern different that the one in its application. Using the antenna pattern provided in the Boeing Application provides an additional 1-5 dB of error. Finally, the Boeing system temperature is given as 237 °K, as opposed to the

---

14 The percentage of two similar areas can be found by taking the square of the ratios, in this case $(3/16)^2 = 3.5\%$.

15 Table 2, Boeing Analysis.

figure of 230 °K.[16] Making all the required corrections leads to an allowable interference power of –204.1 dBW/Hz, as illustrated in the following table that replicates Boeing's analysis.

Table 1. Calculation of allowable isotropic signal level.

	Boeing	Northpoint	Delta	Units
Receiver Noise Temp.	230	237		°K
Receiver Noise Density	-205.0	-204.9	0.1	dBW/Hz
Allowable I/N	-19.4	-12.2	7.2	dB
Allowable Interference Density	-224.4	-217.1		dBW/Hz
Transmit EIRP	-17.5	-17.5		dBW
Transmit BW	24	27		MHz
Transmit EIRP Density	-91.3	-91.8	0.5	dBW/Hz
Attenuation Required	133.1	125.2		dB
Antenna Rejection	-9	-10	1.0	dBi
Polarization Isolation	0	-3	3.0	dB
Allowable Isotropic Signal Level	-215.4	-204.1	11.3	dBWi/Hz
Required "Straight Line" Attenuation Distance*	3.01	0.77		km
Percent of Northpoint 16 km Service Area	3.5%	0.25%		

* Does not account for transmit antenna discrimination in the vertical plane.

Additional Information is Required to Finish the Analysis

The Boeing analysis ends with the information provided above, which Boeing uses to calculate the separation distance required between a Boeing receiver and Northpoint transmitter. Using the above figures, Boeing calculated a 3.5% loss of service area from Northpoint deployment. Using the proper assumptions, a value of 0.25% would result. However, this approach does not even take into account Northpoint's antenna height or discrimination of the transmit antenna. The Northpoint antenna has a 17° vertical beamwidth, and power levels close to the transmitter can not accurately be calculated without considering these antenna characteristics. In order to demonstrate the impact of the Northpoint antenna height and pattern on the Boeing system, the Northpoint isotropic signal level is plotted in the following figure for two cases: (1) Northpoint transmit antenna at 150 meters with 0° of beam tilt, and (2) with 3° of beam tilt. These are the typical Northpoint transmit parameters to be used for interference analysis.[17] This figure shows that Northpoint is below the accepted ITU criterion of -12.2 I/N everywhere in its service area.

[16] Page C-3 of the Boeing Application.

[17] As provided in the Technical Annex to the Northpoint Comments.

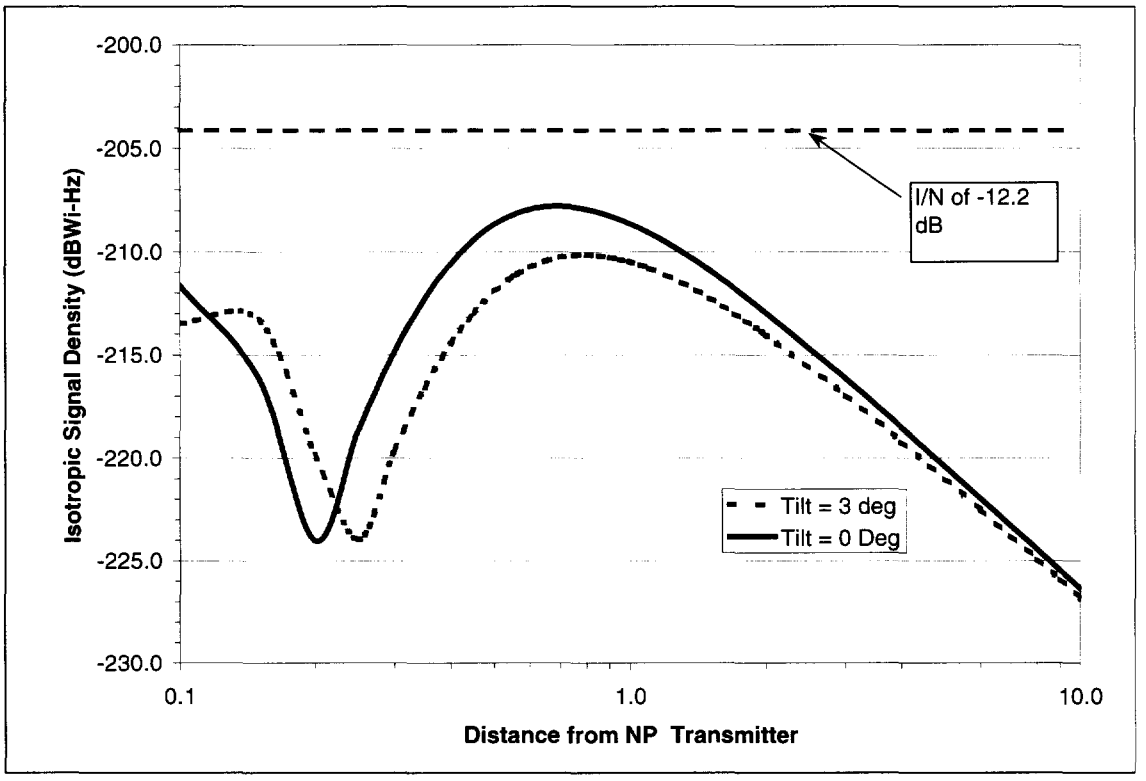

Figure 2. Received Northpoint power levels below criterion throughout the service area.

This method is useful for defining parts of the Northpoint service area where the steady-state interference into the Boeing back-lobe would exceed a constant 6% ΔT/T level. As Figure 2 shows, there is no point in the Northpoint service area where this could occur. Clearly, Northpoint does not have the "back-lobe" problem that Boeing claims. Therefore, only cases where the Boeing receive antenna points at the Northpoint transmitter, "in-line events," would need to be considered for further analysis and this is discussed in detail in the next section.

3.2 Interference Contours

The back-lobe analysis in the previous section shows that interference can exist from Northpoint only if the Boeing receiver points at the Northpoint transmitter. Given that the minimum elevation angle of the Boeing system is 30 degrees, a Boeing receiver would need to be within 300 meters of the Northpoint antenna (at a relative height of 150 meters) for there to be a main beam conjunction. However, since Boeing receivers must point at highly specific locations *and only at those locations* in order to receive the

Boeing satellite signal, the probability of an alignment of the main beams of Northpoint and Boeing systems is significantly reduced.[18]

Pointing limitations of the Boeing receive antenna

The Boeing receive antenna is first limited by a 30° minimum elevation angle, but in most cases the look angle to the Boeing satellite is much higher. Only when looking at azimuth angles greater than 40 degrees east or west can the elevation angle even approach 30 degrees. The geometry of the Boeing satellite orbit dictates that this minimum elevation angle is greater than 30 degrees when the receiver is looking generally North. This is illustrated in Figure 3, which is a composite of four longitudes at latitude 30 degrees. At latitude 40 degrees, the elevation mask is even higher. These look angle limitations provide a favorable sharing geometry, because they limit the possibilities of a main-beam conjunction between Northpoint and Boeing. In fact, a Boeing receiver would have to be within two hundred meters of a Northpoint transmitter before a conjunction event could occur.

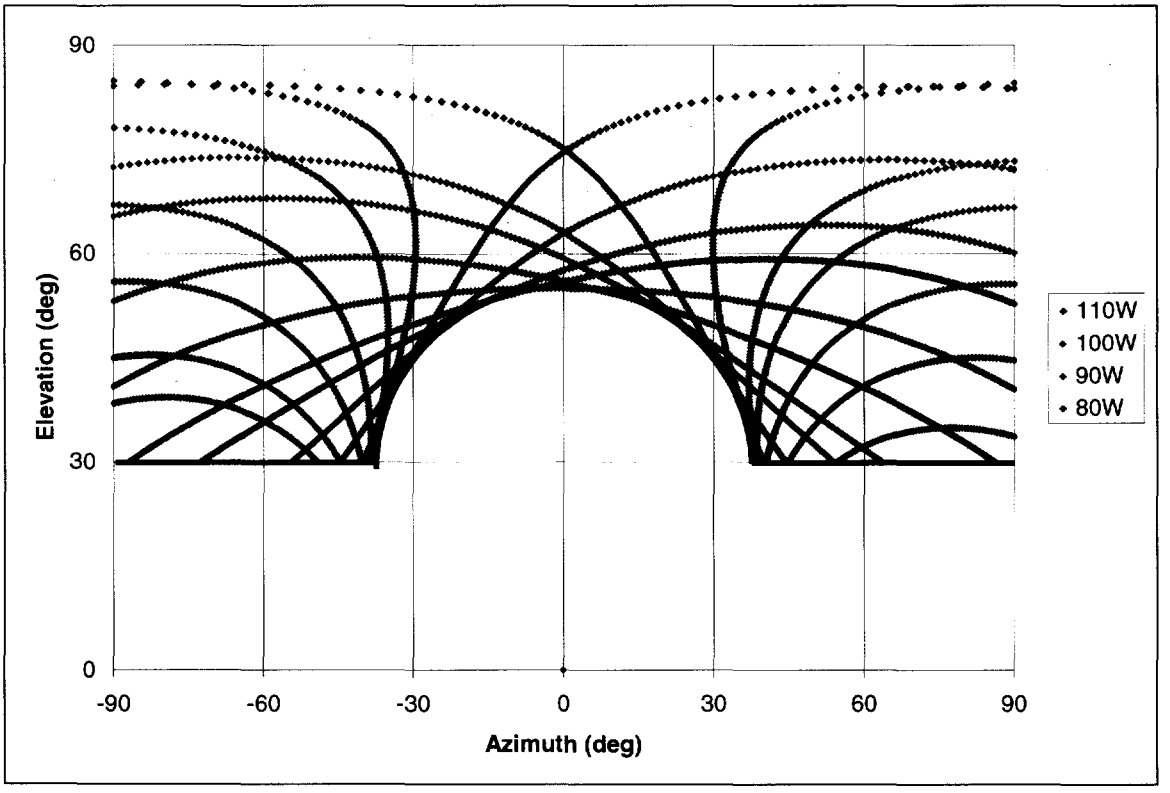

Figure 3. Composite sky traces for 80, 90, 100 & 110 W., 30 N.

I/N Contours

[18] The Boeing system has a repeating ground trace, and hence a repeating sky trace. Figures A-E in Appendix II provide a sample ground trace and example sky traces for locations in the U.S.

A spreadsheet simulation was used to determine the Northpoint signal level at each point in the Northpoint service area of 230 km^2. The calculations were done at each point on a grid with fidelity of 50 meters, or 90,000 points. Then, using the pointing limitations of the Boeing system, the maximum possible I/N that potentially could be received at each point on the grid was determined. The assumptions are listed in the following table; the results are shown in the figures following the table.

Table 2. Analysis Assumptions for Boeing Contours

Item	Units	Value
Boeing Max Antenna Gain	dBi	36.4
Receiver noise bandwidth	MHz	166.7
Boeing system noise temperature	°K	237.1
Polarization isolation	dB	-3
Boeing antenna side lobe pattern	Slope = 29-25*log(θ)	
Northpoint transmit EIRP	dBW	-17.5
Transmit bandwidth	MHz	27
Effective EIRP	dBW/166 MHz	-12.6
Northpoint transmitter height	km	0.15
Northpoint transmitter beam tilt	deg	0.0

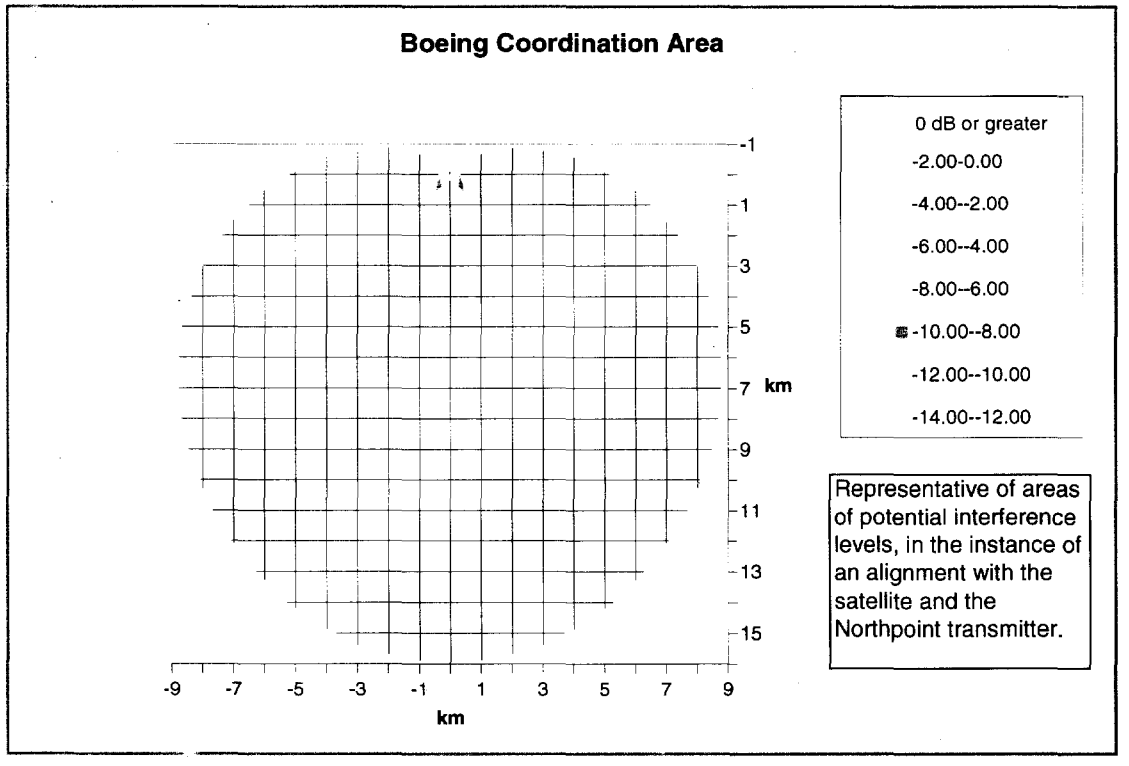

Figure 4. Boeing Coordination Area within Northpoint Service Area

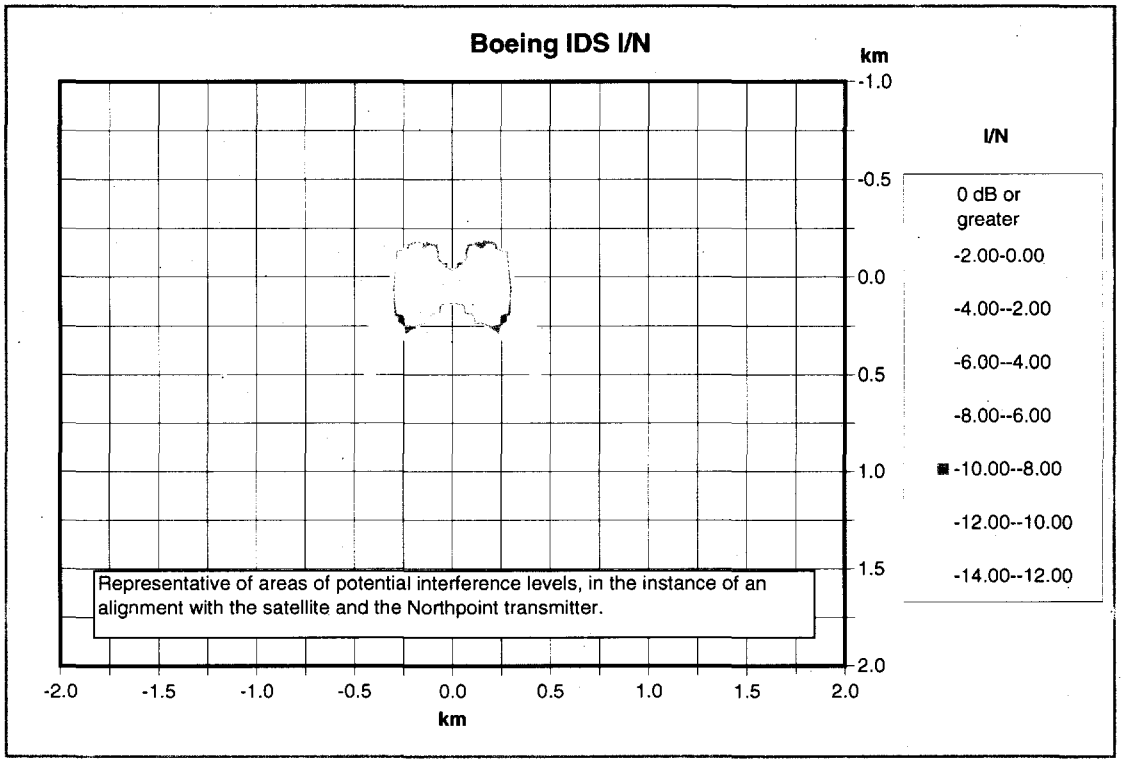

Figure 5. Peak I/N Contours for the Boeing IDS system.

An I/N of -12 dB could only be exceeded within a few hundred meters of the Northpoint transmitter, as shown in Figure 5. Outside of the -12 dB contour, no interference would be possible. Therefore, this region defines the area of possible concern for interference from Northpoint into the Boeing system. It does not tell us how often interference may occur in this region. Additionally, the contours describe peak I/N values that would only exist for the fraction of time when the Boeing antenna is looking at the Northpoint transmitter. Based upon the discussion in Section 2, Northpoint maintains that a peak I/N of 0 dB is sufficient to protect the Boeing system. A thorough dynamic analysis would reveal the nature and extent, if any, of potential interference within this small region.

4 Interference Mitigation

Previous analysis by Boeing and Northpoint shows that only in a small portion of the Northpoint service area will there exist a potential for interference. Boeing asserts an area of 3.5%.[19] Northpoint asserts that this region is less than 0.1% of the Northpoint service area. Should Boeing desire to operate in the Northpoint band in this area, some forms of mitigation will be necessary in that 0.1% of the Northpoint service area. Northpoint proposes no less than five methods for mitigating this interference, and Boeing summarily rejects each one. As discussed below, Boeing's rejection of Northpoint's frequency diversity plan is particularly perplexing.

4.1 Frequency Diversity Allows for Mutual Coexistence – Without Affecting System Design

As documented repeatedly by Northpoint in this proceeding, frequency diversity will allow for NGSO operation without undue burden on NGSO FSS systems.[20] The only reason that Boeing provides for rejecting frequency diversity is that Boeing asserts "most transmissions will involve point-to-multipoint communications."[21] However, most point-to-multipoint (or broadcast) communications do not require the advantages that NGSO FSS systems can provide: low delay in providing interactive broadband. By contrast, GSO systems *are* designed to provide point-to-multipoint communications (or broadcast) at a lower cost.[22]

Nor Boeing does explain why point-to-multipoint traffic would be the primary purpose of its NGSO system. Such traffic, such as entertainment broadcasting, or even web page cache updating is not interactive, and as such does not require the advantages of an NGSO system (low delay in providing interactive broadband). Further, at least one other NGSO FSS proponent (Virgo) anticipates that only 5% of its traffic will be point-to-multipoint, as opposed to the majority of traffic asserted by Boeing.[23] Given the

---

19 See section 3 of this report.

20 Frequency diversity is a mitigation method whereby the band 11.7 – 12.2 GHz would be used by NGSO FSS systems to serve customers in the mitigation zone.

21 Page 20 of the Boeing Analysis.

22 The Boeing Application does not state that point-to-multipoint will be the majority of traffic, nor do NGSO systems have the ability to efficiently provide such services. Boeing's Application states that its NGSO FSS system is "designed to provide 'bandwidth on demand' ("BOD") communications services," (Boeing Application, page 3). According to Boeing: a "BOD satellite network can provide … a single data stream that can include basic voice telephony, facsimile transmission, video-conferencing, high-speed data transfer for local area networks ("LANs"), Internet access, data broadcasts and other services." While "data broadcasts" were mentioned in the Boeing Application, it is not the majority of its traffic.

23 Virgo estimates that broadcast traffic will be about 5% of its total throughput of 10-12 Gbps. "Application of Virtual Geosatellite, LLC for Authority to Launch and Operate a Global System of Non-Geostationary Satellites in Sub-Geosynchronous Elliptical Orbits," ("Virgo Application"), page 35, January 8, 1999.

physics of satellite communications, it would be highly inefficient to utilize NGSO FSS systems for broadcast traffic. To see why this is true, we must start with a description of Boeing's low spectral efficiency and throughput.

Boeing System Spectral Efficiency is Low

The Boeing system, while very expensive to deploy has very low spectral efficiency. Boeing spectral efficiency is less than 0.2 bits per Hertz.[24] As compared to typical QPSK modulation, a standard *bt* product of 0.7 provides 1.4 bits per Hertz, or seven times the spectral efficiency of Boeing's proposed CDMA signal. In other words, a system using QPSK modulation could provide the same data in one-seventh the bandwidth that Boeing proposes to use for service links.

Boeing System Throughput is Small

Given that Boeing's spectral efficiency is so low, it is not surprising that Boeing's capacity for system throughput is also small. There are two 166 MHz bands used in each cell, one in the band 11.7 – 12.2 GHz, and one in the band 12.2 – 12.7 GHz.[25] From the previous section, each 166 MHz bandwidth carries a gross data rate of 31.2 Mbps, and each cell therefore can be served with a maximum bit rate of 62.4 Mbps.

---

[24] Each Boeing 166 MHz channel has three orthogonal CDMA signals on each of two polarizations, for a total of six signals per 166 MHz, (Boeing Application, page 21). Each signal has a gross data rate of 5.2 Mbps, (Boeing Application page 14). Therefore, the total throughput per 166 MHz channel is 6 * 5.2 = 31.2 Mbps, in 166 MHz. This equals 0.2 bits per Hertz, or far less than one bit per Hertz.

[25] Boeing Application, page 21.

Figure 6. Coverage of North America with 1800 km diameter cells.

Therefore, with the Boeing system, 20 satellites provide 490 Mbps throughput for the United States in 1,000 MHz. As a comparison, *one* DBS satellite longitude provides 1,200 Mbps (with 30 channels of 40 Mbps each), in a bandwidth of only 500 MHz.[26] By comparison, a new GSO can now be launched for $200 – 300 million[27] as opposed to the $6 billion investment currently contemplated by Boeing.[28]

For Boeing's IDS service, each beam is 1800 km in diameter. This would mean that 17 beams would serve all of North America. Boeing, by its own admission, can only serve an area with one beam at a time.[29] The overlap among beams is small. The maximum possible Boeing data throughput in the United States is only 490 Mbps. For all of North America, the total throughput is only 1040 Mbps. This is the gross data rate. After accounting for coding overhead, the practical data rate useable by a customer would be less.

---

[26] Another example of low capacity of the Boeing system is a competing NGSO FSS system (VIRGO) that can provide at least 16 Gbps throughput in North America, with only a 15 satellite constellation (Virgo Application, page 35).

[27] Figures based on Echostar's $219 million estimate of the amount of its "constructive total loss" from the failure of the deployment of Echostar IV – Echostar Communications Corp. Annual Report Form 10-K; Filed March 17, 1999

[28] Boeing Letter, page 7.

[29] See page 4 of the Boeing Letter, which reads: The "design of Boeing's NGSO FSS system does not permit Boeing to provide simultaneous beams from more than one satellite to the same location."

In summary, Boeing's objection to frequency diversity, that the majority of its traffic will be broadcast, vanishes. Boeing states the purpose of its system is to provide "bandwidth on demand" applications, which are not broadcast or point-to-mulitpoint. Other NGSO FSS system applicants disagree with Boeing's estimate for broadcast traffic. They specify that broadcast applications are not the majority of traffic, but only a tiny fraction. Moreover, geostationary satellite systems are far more efficient at providing such broadcast services. Further, it is found that Boeing's system has a low efficiency, and that its entire system throughput in the U.S. for *twenty* satellites is less than half of *each* DBS geostationary orbital position.

4.2 Other Mitigation Techniques are Appropriate

Notwithstanding the fact that frequency diversity can fully provide for coexistence, the other sharing techniques proposed by Northpoint also have merit, and Boeing's analysis on these subjects is lacking in substance.

- Boeing's analysis on artificial shielding assumes a parabolic antenna – yet its system uses a flat planar array antenna.
- Although Boeing's system lacks the capacity to use satellite diversity, other NGSO FSS systems may use this method.
- Boeing rejects band segmentation as a solution, yet it has never demonstrated a need for 1,000 MHz of service link spectrum. As shown in section 5.1, Boeing has very low spectral efficiency and thus is a very inefficient user of bandwidth. It is poor public policy to allow inefficient systems to monopolize resources when, with minimal accommodation, these less efficient systems can share with far more efficient ones.
- Rooftop co-location of Boeing receivers and Northpoint transmitters would also be possible, as shielding can provide sufficient isolation.

5 Refutation of Other Boeing Technical Errors

Boeing makes a number of erroneous statements in its filing, which are refuted in this section.

5.1 Northpoint's System Design Properly Accounts for Rain Margin

The Boeing filing attacks Northpoint's system, claiming that it will not work at the power levels indicated and therefore Boeing claims it can read Northpoint's intentions as a plan to operate at a higher power. Northpoint is not playing bait and switch, as Boeing implies. This topic was fully addressed in the Northpoint Comments. The Boeing statements depend entirely on using a Northpoint design criteria of 0.3% for the

worst month.[30] Boeing justifies this assertion by stating "this is comparable to ITU-R processes, which used a 'worst month' rain-caused unavailability to establish its BSS system and plan parameters."[31] However, the ITU-R Radio Regulations unequivocally prescribe 1.0% of the worst month to determine the system availability, not 0.3%.[32] Therefore, it is not surprising that Boeing's suggested rain margins are many dB higher than required.

Northpoint has also used the ITU-R approach in developing the predicted attenuation due to rain. When properly applied, it results in acceptable cell size with the nominal EIRP of -17.5 dB, as fully explained in the Technical Annex to the Northpoint Comments.

5.2 Northpoint Did Participate in International Spectrum Sharing Studies

Boeing wrongly states that Northpoint did not participate in international spectrum studies.[33] Northpoint did submit papers to the ITU-R JTG 4-9-11 and did send representatives to ITU meetings in Toulouse, France and Long Beach, CA. Northpoint's documents were submitted to the June 1998 meeting of JTG 4-9-11, see documents JTG 4-9-11/88 and 4-9-11/125. However, it is also important to note that as important as the ITU is for international issues, the results of sharing studies performed in the ITU groups comprise "recommendations" and are not binding on any Administration. Fundamental to the concept of national sovereignty is each nation's right to regulate the domestic use of its own radio spectrum. Therefore, in the United States, the FCC is in charge of spectrum allocations and service rules.

In this connection, the FCC issued a Notice of Proposed Rulemaking and established Docket 98-206 as the appropriate domestic forum for public comment about Northpoint, NGSO FSS and DBS sharing. Northpoint has been one of the most active participants in this docket, which is the only docket where the issue of Northpoint's service is actually being considered.

5.3 Fixed Services Are Still Operating in the 12.2 – 12.7 GHz band

According to Boeing, the band 12.2 – 12.7 GHz is "a frequency band that was long since cleared by the Commission for satellite use"[34] as if there are no fixed services currently operating in the band. In fact, vital FS services continue to exist throughout the U.S. in this band. Northpoint contracted with COMSEARCH to perform a survey of

---

[30] See Boeing Analysis, pages 12-14.

[31] Page 12 of the Boeing Analysis.

[32] ITU Radio Regulations, AP30 Appendix 5, Section 2.4, which reads: "The propagation loss on a space-Earth path is equal to the free space path loss plus the atmospheric absorption loss plus the rain attenuation exceeded for 1% of the worst month."

[33] Boeing Filing, page 2.

[34] Boeing Letter, page 8.

existing FS uses in the band 12.2 – 12.7 GHz. This survey (attached) shows that the band is currently in use by a number of public safety and educational institutions.

5.4 Northpoint PFD Is Not A Burden On Boeing

In the Northpoint Comments, Northpoint proposed a revision to the PFD limit to protect its system.[35] Northpoint has demonstrated that this PFD limit is not a burden on NGSO FSS systems.[36] Boeing claims that its system "will exceed a PFD of -158 dBW/m^2-4kHz at elevation angles below 2 degrees" and therefore the PFD limit is excessively constraining on Boeing.

However, based upon the information contained in the Boeing system application, it is unclear why Boeing would assert its system would cause a PFD greater than –158 dBW/m^2-4kHz. The following analysis demonstrates that both the Boeing IDS and Backhaul Data Services ("BDS") PFD would in fact be below the Northpoint criterion. This analysis uses only Boeing system values from the Boeing Application, and is the PFD generated in a single beam footprint by a single satellite. It is not necessary to consider the aggregate PFD from multiple satellites in this case.

Note that the PFD for both IDS and BDS systems is below -158 dBW/m^2-4kHz. However, the Boeing IDS service PFD is only 2.8 dB below the criterion. As Boeing points out in its application, each satellite can generate up to 37 beams. Therefore, there is a need to account for the additional power from other transmitters operating on the same frequency. Boeing's IDS system follows a three-cell frequency re-use pattern. The maximum number of cells that would be used on any given frequency is 13. None of these cells would be adjacent, however. According to the Boeing IDS antenna patterns, non-adjacent beams would have *at least* 20 dB of antenna discrimination towards the point in question.

If one assumes the worst case (that each of 12 other beams has a PFD of –20 dB relative to –160.8) then the total PFD of all 13 beams is -160.3 dBW/m^2-4kHz, which is still below the Northpoint criterion.

[35] Northpoint Comments in 12 GHz NPRM, page 31.

[36] Comments of Northpoint Technology, Ltd., "In the Matter of NGSO FSS Results from the Conference Preparatory Meeting on Technical, Operational and Regulatory /Procedural Matters to be Considered by the 2000 World Radiocommunication Conference," Dec. 20, 1999,

Table 3. Calculation of Boeing PFD levels at 2 degrees in elevation

Item	Units	Boeing IDS	Boeing BDS
Transmit power per channel	dBW	14.2	2.3
Number of channels per carrier		3	1
Transmit losses	dB	-1	-1
Antenna gain	dB	31.7	42
EIRP	dBW	49.7	43.3
Transmit bandwidth	MHz	166.7	24
EIRP (4 kHz)	dBW - 4 kHz	3.5	3.6
Orbital radius	km	26560	26560
Path length at elevation of 2 degrees	km	25561	25561
Pathloss	dB	-202.5	-202.5
Difference between pathloss and spreading loss	dB-m2	43.4	43.4
Minimum pointing elevation angle	degrees	30	30
Antenna off bore sight angle to 2 degrees, as measured at the satellite	degrees	1.9	1.9
Transmit antenna discrimination	dB	-3.5	-13.3
Gaseous attenuation	dB	-1.7	-1.7
Polarization isolation*	dB	0	-3
Power flux density	dBW/m^2-4kHz	-160.8	-171.6

*Boeing IDS operates on both LH and RHCP, BDS only on RHCP.

Therefore, the Boeing system, as described in its application, will not exceed the Northpoint PFD criterion at an elevation angle of two degrees. Below two degrees in elevation, the PFD will further be attenuated by gaseous absorption and path loss, and therefore will be further below the Northpoint criterion of -158 dBW/m2-4kHz. Based upon the information contained in the Boeing system application, and the analysis in the above table, there is no basis for Boeing to assert its system would exceed the Northpoint PFD limit.

6 Summary and Conclusions

This paper has demonstrated that Boeing has greatly overestimated the possible size of any mitigation zone. This paper has demonstrated that Boeings proposed criterion of -19.4 dB was developed through misapplication of ITU-R Recommendations. A steady-state I/N of -12.2 dB is sufficient, and an I/N of 0 dB would be allowable for small percentages of time. In addition, in performing a "back-lobe analysis," Boeing disregards essential Northpoint system parameters. A corrected back-lobe analysis shows that there are no back-lobe issues. Therefore, a back-lobe analysis is insufficient to characterize I/N contours. Northpoint performed a detailed analysis demonstrating that the size of the mitigation zone would be at least an order of magnitude smaller, and would occupy less than 0.1% of the Northpoint service area.

However, even a 10 or 20% mitigation zone is not a significant burden on sharing for NGSO FSS in this band. Frequency diversity and other effective techniques to mitigate this interference are available that do not require any changes in NGSO system design, and do not affect throughput or efficiency. Therefore, there is no undue burden on either the Boeing NGSO FSS system, or on the Northpoint system. The Commission should disregard the Boeing analysis.

Appendices

I. Boeing Link Budgets.

II. Azimuth-Elevation angle analyses.

III. COMSEARCH data on FS use of 12 – 12.7 GHz band.

BEAM 00 - Latitude 30	Units	Clear	Case B	Case D	Case E	Case K	Case M	Case N
1. Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2
2. Power	Watts	10.5	10.5	10.5	10.5	10.5	10.5	10.5
3. Power	dB	10.2	10.2	10.2	10.2	10.2	10.2	10.2
4. Xmit Gain	dB	25.0	25.0	25.0	25.0	25.0	25.0	25.0
5. Line Loss	dB	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
6. EIRP	dBW	34.2	34.2	34.2	34.2	34.2	34.2	34.2
7. El Angle (BEAM EOC)	deg	78.5	78.5	78.5	78.5	78.5	78.5	78.5
8. Orbtial Altitude	km	26560	26560	26560	26560	26560	26560	26560
9. Path	km	20279	20279	20279	20279	20279	20279	20279
10. Path Loss	dB	-200.3	-200.3	-200.3	-200.3	-200.3	-200.3	-200.3
11. Atmos Loss	dB	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
12. Latitude	deg	-	30.0	30.0	30.0	30.0	30.0	30.0
13. Availability	%	-	99.9922	99.9688	99.9532	99.7611	99.4073	98.6450
14. % Unavailability Allowed	%	-	18%	16%	15%	13%	12%	12%
15. Resultant Unavailability	%	-	99.9908	99.9639	99.9461	99.7296	99.3345	98.4874
16. Outage Hours per Year due to Terrestrial		-	0.07	0.27	0.41	2.09	5.19	11.87
17. Rain Region		-	B	D	E	K	M	N
18. Rain Loss	dB	0.0	-1.806	-1.806	-1.806	-1.806	-1.806	-1.806
19. Rx Gain	dBi	36.1	36.1	36.1	36.1	36.1	36.1	36.1
20. Rx Loss	dB	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
21. Rx Power	dBW	-130.6	-132.4	-132.4	-132.4	-132.4	-132.4	-132.4
22. Data Rate	dB-Hz	67.2	67.2	67.2	67.2	67.2	67.2	67.2
23. Eb	dBW/Hz	-197.8	-199.6	-199.6	-199.6	-199.6	-199.6	-199.6
24. Rx Noise Temp	k	231.2	231.2	231.2	231.2	231.2	231.2	231.2
25. Noise Increase due to Rain	dB	0.0	1.5	1.5	1.5	1.5	1.5	1.5
26. No	dBW/Hz	-205.0	-203.4	-203.4	-203.4	-203.4	-203.4	-203.4
27. Eb/No	dB	7.2	3.8	3.8	3.8	3.8	3.8	3.8
28. Eb/Io (intra system)	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0
29. Eb/Io (GSO Networks)	dB	16.7	15.5	15.5	15.5	15.5	15.5	15.5
30. Eb/Io (Other NGSO)	dB	16.0	14.7	14.7	14.7	14.7	14.7	14.7
31. Composiite Eb/Io w/o Northpoint	dB	6.12	3.16	3.16	3.16	3.16	3.16	3.16
32. Eb/Io (Terrestrial)	dB	99.0	17.5	17.5	17.5	17.5	17.5	17.5
33. Total Eb/Io	dB	6.1	3.0	3.0	3.0	3.0	3.0	3.0
34. Required Eb/No	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0
35. Link Degradation due to Terrestri	dB		0.16	0.16	0.16	0.16	0.16	0.16
36. Margin	dB	3.124	0.0	0.0	0.0	0.0	0.0	0.0

37. Allow Int. Power	dBW/Hz		-217.2	-217.2	-217.2	-217.2	-217.2	-217.2
38. **Io/No***	**dB**		**-12.2**	**-12.2**	**-12.2**	**-12.2**	**-12.2**	**-12.2**

*No referenced to line 26, case "Clear"

BEAM 30 - Latitude 30	**Units**	**Clear**	**Case B**	**Case D**	**Case E**	**Case K**	**Case M**	**Case N**
1. Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2
2. Power	Watts	26.3	26.3	26.3	26.3	26.3	26.3	26.3
3. Power	dB	14.2	14.2	14.2	14.2	14.2	14.2	14.2
4. Xmit Gain	dB	28.0	28.0	28.0	28.0	28.0	28.0	28.0
5. Line Loss	dB	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
6. EIRP	dBW	41.2	41.2	41.2	41.2	41.2	41.2	41.2
7. El Angle (BEAM EOC)	deg	30.0	30.0	30.0	30.0	30.0	30.0	30.0
8. Orbital Radius	km	26560	26560	26560	26560	26560	26560	26560
9. Path	km	22790	22790	22790	22790	22790	22790	22790
10. Path Loss	dB	-201.3	-201.3	-201.3	-201.3	-201.3	-201.3	-201.3
11. Atmos Loss	dB	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
12. Latitude	deg	-	30	30	30	30	30	30
13. Availability	%	-	99.9927	99.9720	99.9587	99.81	99.6019	99.3134
14. % Unavailability Allowed	%	-	11%	9%	9%	8%	8%	7%
15. Resultant Availability	%	-	99.9919	99.9694	99.9549	99.7984	99.5717	99.2633
16. Outage Hours per Year due to Terrestrial		-	0.06	0.25	0.36	1.63	3.49	6.01
17. Rain Region		-	B	D	E	K	M	N
18. Rain Loss	dB	0.0	-3.028	-3.030	-3.030	-3.030	-3.029	-3.029
19. Rx Gain	dBi	32.0	32.0	32.0	32.0	32.0	32.0	32.0
20. Rx Loss	dB	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
21. Rx Power	dBW	-128.8	-131.9	-131.9	-131.9	-131.9	-131.9	-131.9
22. Data Rate	dB-Hz	67.2	67.2	67.2	67.2	67.2	67.2	67.2
23. Eb	dBW/Hz	-196.0	-199.1	-199.1	-199.1	-199.1	-199.1	-199.1
24. Rx Noise Temp	k	237.1	237.1	237.1	237.1	237.1	237.1	237.1
25. Noise Increase due to Rain	dB	0.00	2.08	2.08	2.08	2.08	2.08	2.08
26. No	dBW/Hz	-204.9	-202.8	-202.8	-202.8	-202.8	-202.8	-202.8
27. Eb/No	dB	8.82	3.71	3.71	3.71	3.71	3.71	3.71
28. Eb/Io (intra system)	dB	23.0	22.8	23.0	23.0	23.0	23.0	23.0
29. Eb/Io (GSO Networks)	dB	18.5	16.0	16.0	16.0	16.0	16.0	16.0
30. Eb/Io (Other NGSO)	dB	17.8	15.3	15.3	15.3	15.3	15.3	15.3
31. Composiite Eb/Io w/o Northpoint	dB	7.77	3.14	3.14	3.14	3.14	3.14	3.14
32. Eb/Io (Terrestrial)	dB	99.0	18.0	18.0	18.0	18.0	18.0	18.0

33. Total Eb/(No+Io)	dB	7.8	3.0	3.0	3.0	3.0	3.0	3.0
34. Required Eb/(No+Io)	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0
35. Link Degradation due to Terrestri	dB		0.14	0.14	0.14	0.14	0.14	0.14
36. Link Margin	dB	4.8	0.0	0.0	0.0	0.0	0.0	0.0
37. Allow Io	dBW/Hz		-217.1	-217.1	-217.1	-217.1	-217.1	-217.1
38. **Io/No***	**dB**		**-12.2**	**-12.3**	**-12.2**	**-12.2**	**-12.2**	**-12.2**

*No referenced to line 26, case "Clear"

Row	BEAM 00 - Latitude 40	Units	Clear	Rain	Rain	Rain	Rain	Rain	Rain
1.	Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2
2.	Power	Watts	10.5	10.5	10.5	10.5	10.5	10.5	10.5
3.	Power	dB	10.2	10.2	10.2	10.2	10.2	10.2	10.2
4.	Xmit Gain	dB	25.0	25.0	25.0	25.0	25.0	25.0	25.0
5.	Line Loss	dB	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
6.	EIRP	dBW	34.2	34.2	34.2	34.2	34.2	34.2	34.2
7.	El Angle (BEAM EOC)	deg	78.5	78.5	78.5	78.5	78.5	78.5	78.5
8.	Orbtial Altitude	km	26560	26560	26560	26560	26560	26560	26560
9.	Path	km	20279	20279	20279	20279	20279	20279	20279
10.	Path Loss	dB	-200.3	-200.3	-200.3	-200.3	-200.3	-200.3	-200.3
11.	Atmos Loss	dB	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
12.	Latitude	deg	-	40.0	40.0	40.0	40.0	40.0	40.0
13.	Availability	%	-	99.9953	99.9798	99.9692	99.8336	99.5749	98.9987
14.	% Unavailability Allowed	%	-	19%	17%	16%	14%	13%	12%
15.	Resultant Unavailability	%	-	99.9944	99.9765	99.9644	99.8110	99.5213	98.8798
16.	Outage Hours per Year due to Terrestrial		-	0.04	0.18	0.27	1.46	3.72	8.77
17.	Rain Region		-	B	D	E	K	M	N
18.	Rain Loss	dB	0.0	-1.806	-1.806	-1.806	-1.806	-1.806	-1.806
19.	Rx Gain	dBi	36.1	36.1	36.1	36.1	36.1	36.1	36.1
20.	Rx Loss	dB	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
21.	Rx Power	dBW	-130.6	-132.4	-132.4	-132.4	-132.4	-132.4	-132.4
22.	Data Rate	dB-Hz	67.2	67.2	67.2	67.2	67.2	67.2	67.2
23.	Eb	dBW/Hz	-197.8	-199.6	-199.6	-199.6	-199.6	-199.6	-199.6
24.	Rx Noise Temp	k	231.2	231.2	231.2	231.2	231.2	231.2	231.2
25.	Noise Increase due to Rain	dB	0.0	1.5	1.5	1.5	1.5	1.5	1.5
26.	No	dBW/Hz	-205.0	-203.4	-203.4	-203.4	-203.4	-203.4	-203.4
27.	Eb/No	dB	7.2	3.8	3.8	3.8	3.8	3.8	3.8
28.	Eb/Io (intra system)	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0

29. Eb/Io (GSO Networks)	dB	16.7	15.5	15.5	15.5	15.5	15.5	15.5
30. Eb/Io (Other NGSO)	dB	16.0	14.7	14.7	14.7	14.7	14.7	14.7
31. Composiite Eb/Io w/o Northpoint	dB	6.12	3.16	3.16	3.16	3.16	3.16	3.16
32. Eb/Io (Terrestrial)	dB	99.0	17.5	17.5	17.5	17.5	17.5	17.5
33. Total Eb/Io	dB	6.1	3.0	3.0	3.0	3.0	3.0	3.0
34. Required Eb/No	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0
35. Link Degradation due to Terrestri	dB		0.16	0.16	0.16	0.16	0.16	0.16
36. Margin	dB	3.124	0.000	0.000	0.000	0.000	0.000	0.000
37. Allow Int. Power	dBW/Hz		-217.2	-217.2	-217.2	-217.2	-217.2	-217.2
38. **Io/No***	**dB**		**-12.2**	**-12.2**	**-12.2**	**-12.2**	**-12.2**	**-12.2**

*No referenced to line 26, case "Clear"

Row	BEAM 30 - Latitude 40	Units	Clear	Case B	Case D	Case E	Case K	Case M	Case N
1.	Frequency	GHz	12.2	12.2	12.2	12.2	12.2	12.2	12.2
2.	Power	Watts	26.3	26.3	26.3	26.3	26.3	26.3	26.3
3.	Power	dB	14.2	14.2	14.2	14.2	14.2	14.2	14.2
4.	Xmit Gain	dB	28.0	28.0	28.0	28.0	28.0	28.0	28.0
5.	Line Loss	dB	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
6.	EIRP	dBW	41.2	41.2	41.2	41.2	41.2	41.2	41.2
7.	El Angle (BEAM EOC)	deg	30.0	30.0	30.0	30.0	30.0	30.0	30.0
8.	Orbtial Radius	km	26560	26560	26560	26560	26560	26560	26560
9.	Path	km	22790	22790	22790	22790	22790	22790	22790
10.	Path Loss	dB	-201.3	-201.3	-201.3	-201.3	-201.3	-201.3	-201.3
11.	Atmos Loss	dB	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
12.	Latitude	deg	-	40	40	40	40	40	40
13.	Availability	%	-	99.9952	99.9804	99.9706	99.8585	99.6859	99.4308
14.	% Unavailability Allowed	%	-	11%	10%	9%	8%	8%	7%
15.	Resultant Availability	%	-	99.9946	99.9785	99.9678	99.8470	99.6619	99.3892
16.	Outage Hours per Year due to Te		-	0.04	0.17	0.26	1.24	2.75	4.99
17.	Rain Region		-	B	D	E	K	M	N
18.	Rain Loss	dB	0.0	-3.029	-3.029	-3.029	-3.029	-3.029	-3.029
19.	Rx Gain	dBi	32.0	32.0	32.0	32.0	32.0	32.0	32.0
20.	Rx Loss	dB	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
21.	Rx Power	dBW	-128.8	-131.9	-131.9	-131.9	-131.9	-131.9	-131.9
22.	Data Rate	dB-Hz	67.2	67.2	67.2	67.2	67.2	67.2	67.2
23.	Eb	dBW/Hz	-196.0	-199.1	-199.1	-199.1	-199.1	-199.1	-199.1
24.	Rx Noise Temp	k	237.1	237.1	237.1	237.1	237.1	237.1	237.1

25. Noise Increase due to Rain	dB	0.00	2.08	2.08	2.08	2.08	2.08	2.08
26. No	dBW/Hz	-204.9	-202.8	-202.8	-202.8	-202.8	-202.8	-202.8
27. Eb/No	dB	8.82	3.71	3.71	3.71	3.71	3.71	3.71
28. Eb/Io (intra system)	dB	23.0	23.0	23.0	23.0	23.0	23.0	23.0
29. Eb/Io (GSO Networks)	dB	18.5	16.0	16.0	16.0	16.0	16.0	16.0
30. Eb/Io (Other NGSO)	dB	17.8	15.3	15.3	15.3	15.3	15.3	15.3
31. Composiite Eb/Io w/o Northpoint	dB	7.77	3.14	3.14	3.14	3.14	3.14	3.14
32. Eb/Io (Terrestrial)	dB	99.0	18.0	18.0	18.0	18.0	18.0	18.0
33. Total Eb/(No+Io)	dB	7.8	3.0	3.0	3.0	3.0	3.0	3.0
34. Required Eb/(No+Io)	dB	3.0	3.0	3.0	3.0	3.0	3.0	3.0
35. Link Degradation due to Terrestri	dB		0.14	0.14	0.14	0.14	0.14	0.14
36. Link Margin	dB	4.8	0.0	0.0	0.0	0.0	0.0	0.0
37. Allow Io	dBW/Hz		-217.1	-217.1	-217.1	-217.1	-217.1	-217.1
38. **Io/No***	**dB**		**-12.2**	**-12.2**	**-12.2**	**-12.2**	**-12.2**	**-12.2**

*No referenced to line 26, case "Clear"

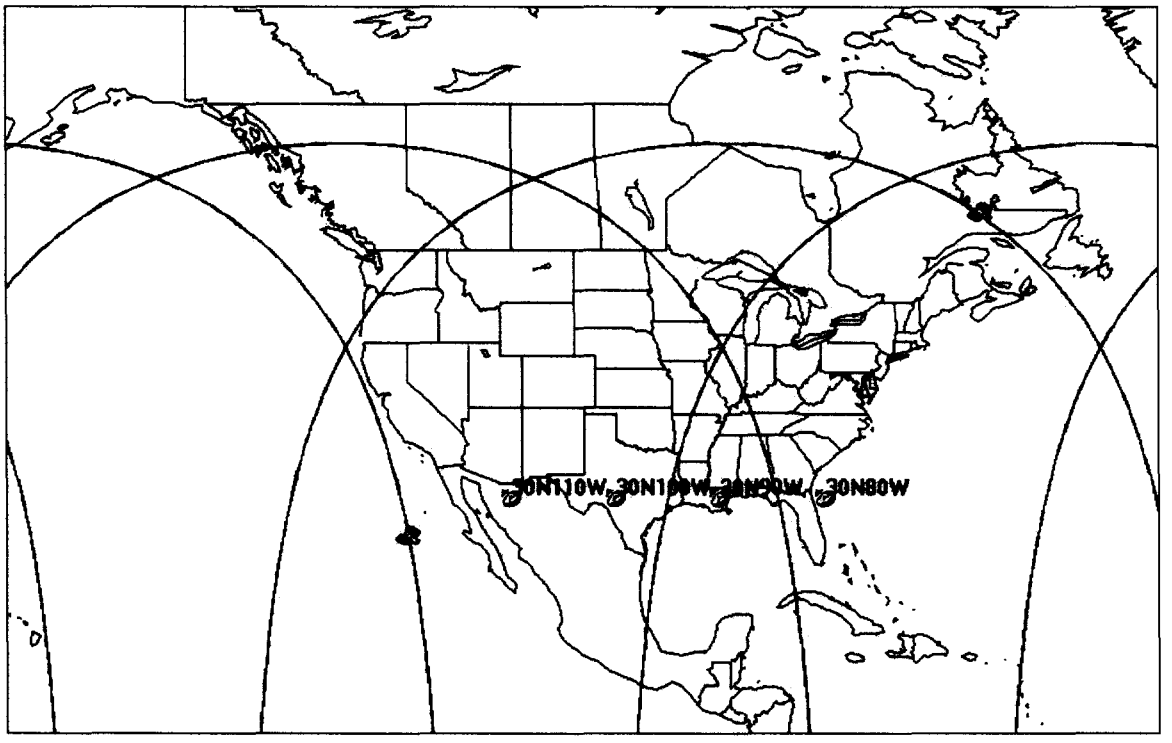

Figure A. Boeing ground traces over the United States

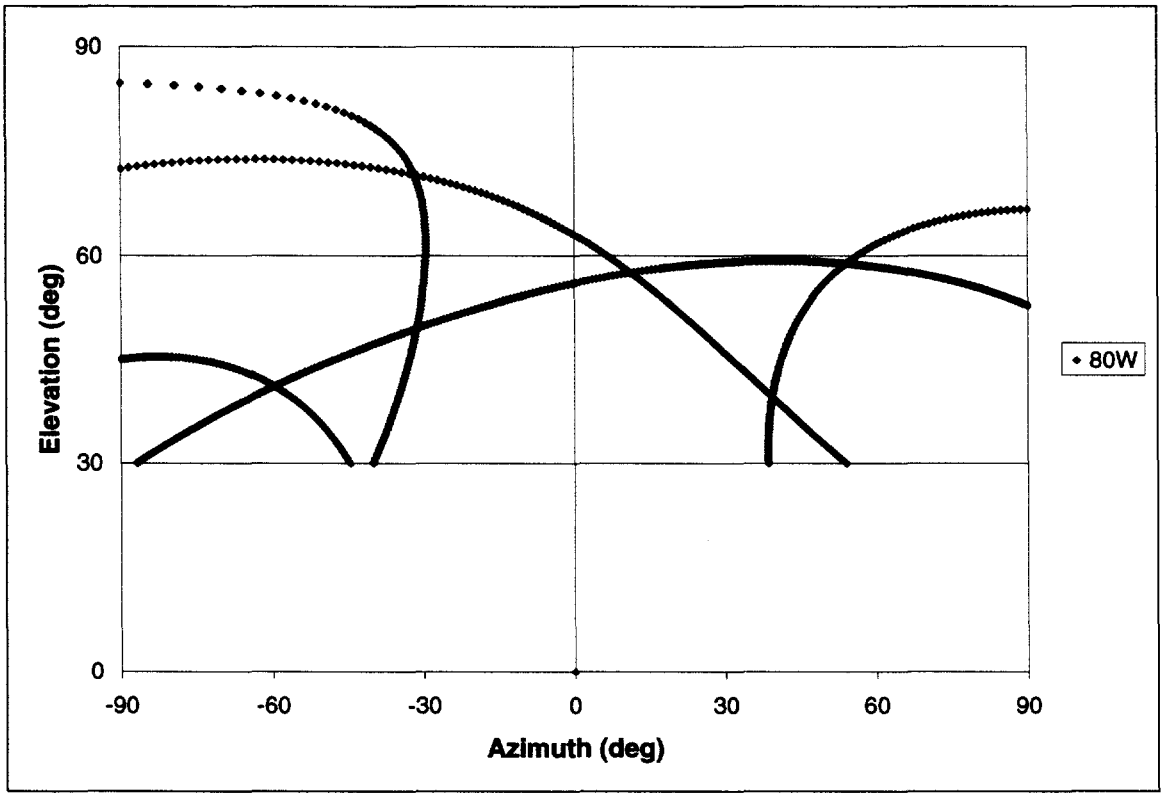

Figure B. Boeing Azimuth-Elevation for Longitude 80 W., Latitude 30 N.

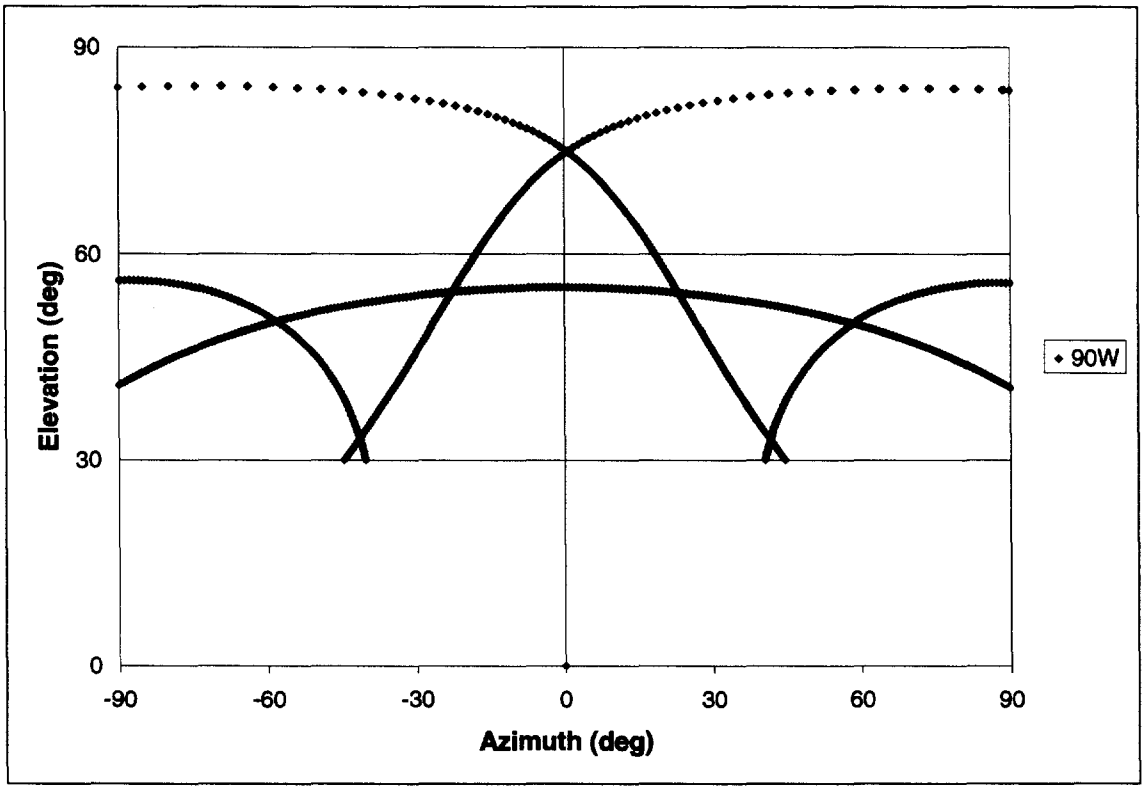

Figure C. Boeing Azimuth-Elevation for Longitude 90 W., Latitude 30 N.

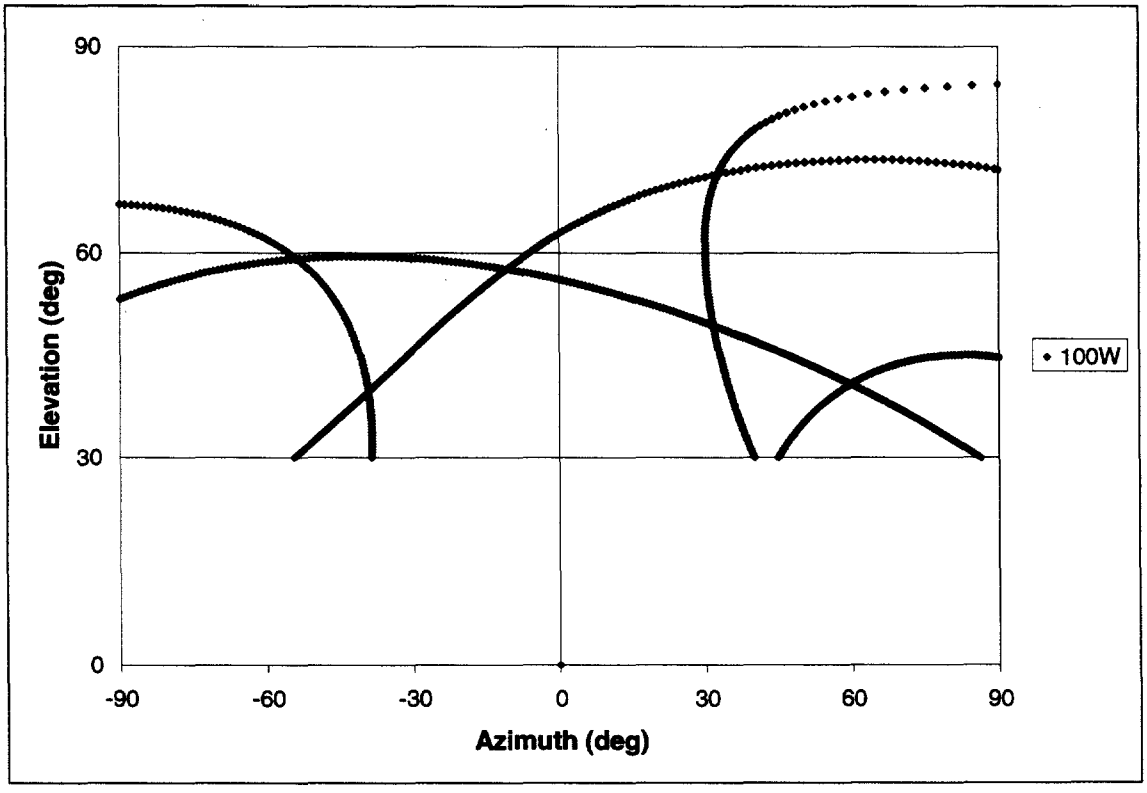

Figure D. Boeing Azimuth-Elevation for Longitude 100 W., Latitude 30 N.

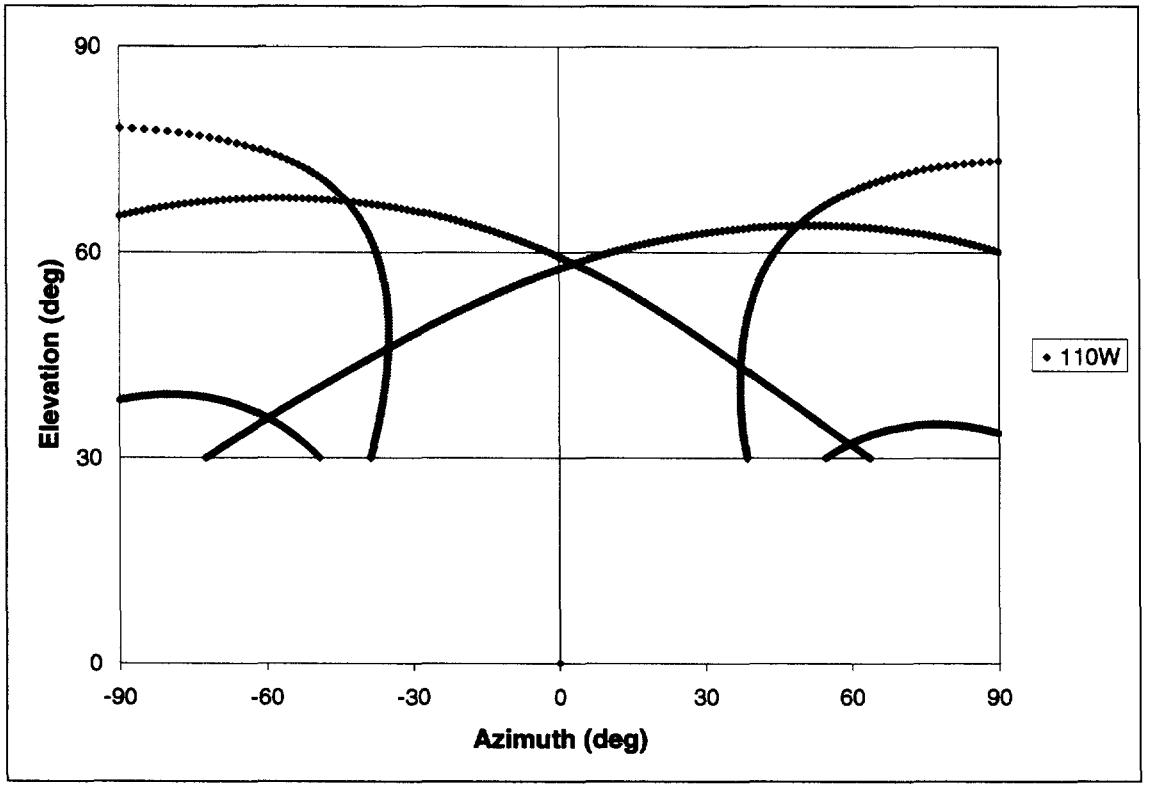

Figure E. Boeing Azimuth-Elevation for Longitude 110 W., Latitude 30 N.

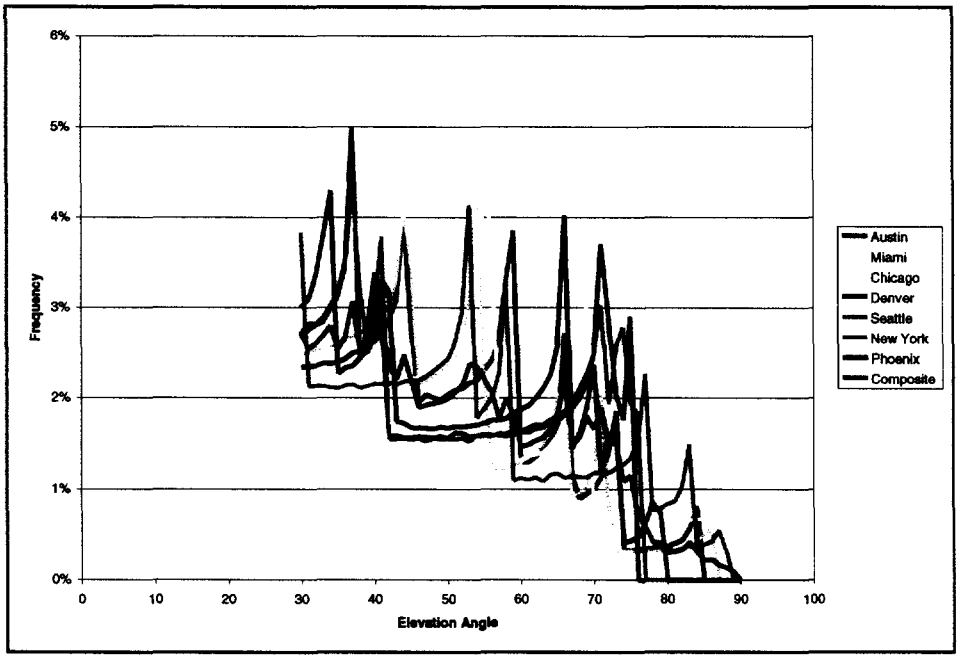

Figure F. Elevation angle probability density functions for selected U.S. Cities

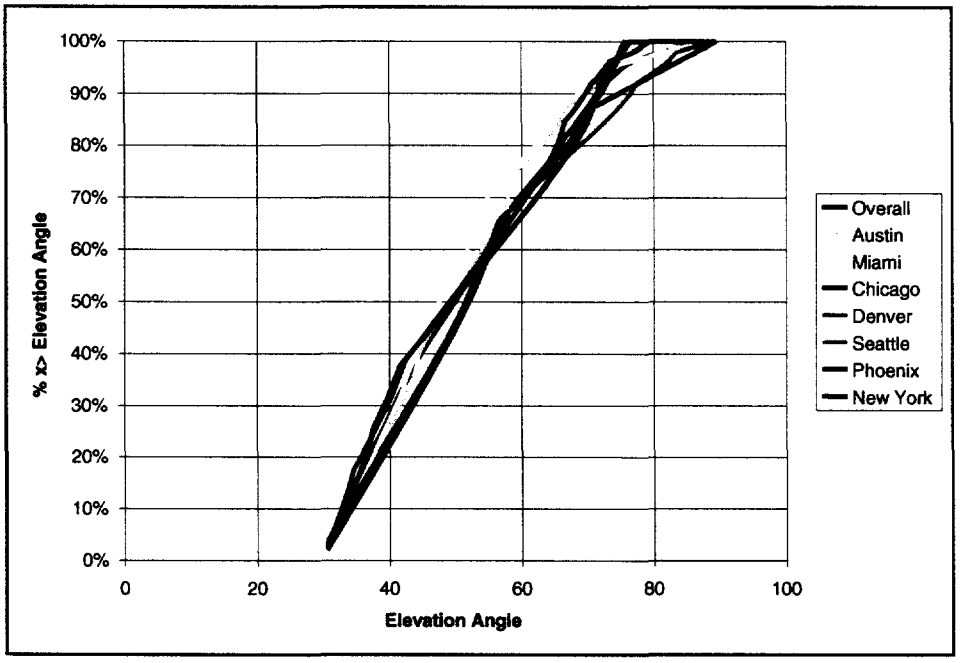

Figure G. Elevation angles cumulative density function

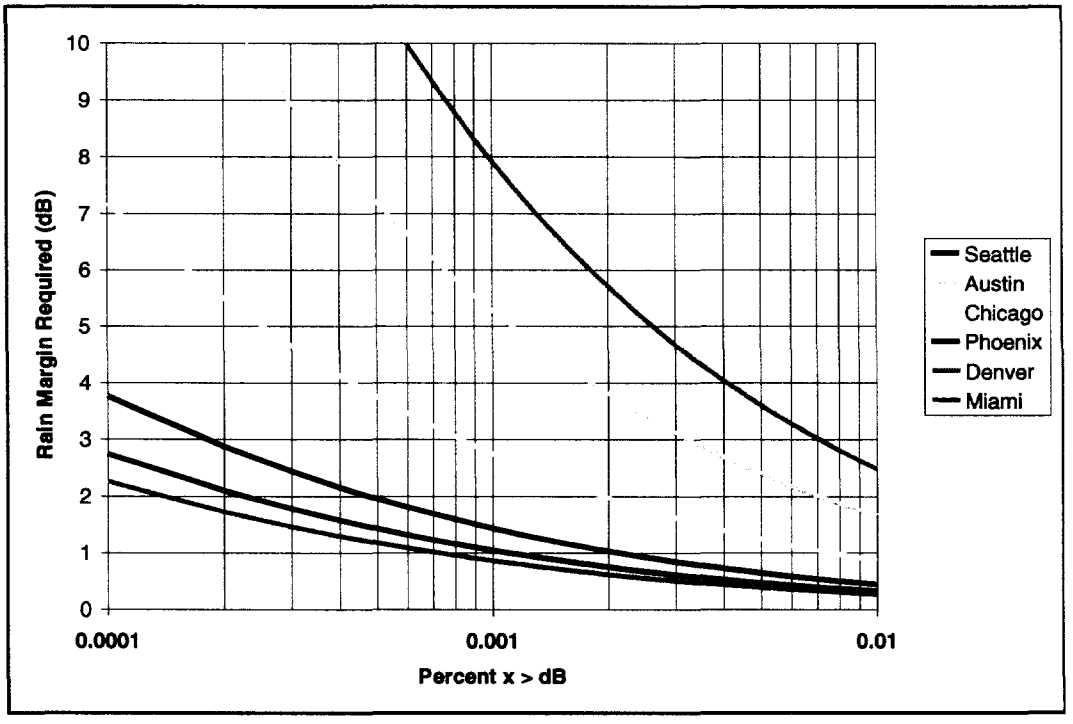

Figure H. ITU Rain margins for selected U.S. cities.

Appendix III

site1	call1	status	company1	freq1_1	freq1_2	freq1_3	freq1_4	freq1_5	freq1_6	site2	call2	status	company2	freq2_1	freq2_2	freq2_3	freq2_4
FREEPORT MI	KGF78	L	INDEPENDENCE MINING CO INC	12220.00000V						PASSIVE	RXONLY	L	INDEPENDENCE MINING CO INC				
PASSIVE	KGF78P	L	INDEPENDENCE MINING CO INC	12220.00000V						FREEPORT MI	RXONLY	L	INDEPENDENCE MINING CO INC				
CY HALL ANX	KGM50	L	PHILADELPHIA CITY OF	12450.00000H						28TH/CAMBRI	KGM56	L	PHILADELPHIA CITY OF	12690.00000H			
SOMERTON TN	KGM51	L	PHILADELPHIA CITY OF	12690.00000H						WATER PUMP	KGM54	L	PHILADELPHIA CITY OF	12450.00000H			
SOMERTON TN	KGM51	L	PHILADELPHIA CITY OF	12570.00000H						OAK LN RESV	KGM57	L	PHILADELPHIA CITY OF	12210.00000H			
WATER PUMP	KGM54	L	PHILADELPHIA CITY OF	12210.00000H						CY HALL ANX	KGM50	L	PHILADELPHIA CITY OF	12570.00000H			
PHILADELPHIA	KGM55	L	PHILADELPHIA CITY OF	12690.00000H						QUEEN LANE	KGM58	L	PHILADELPHIA CITY OF	12450.00000H			
28TH/CAMBRIA	KGM56	L	PHILADELPHIA CITY OF	12210.00000H						PHILADELPHIA	KGM55	L	PHILADELPHIA CITY OF	12330.00000H			
QUEEN LANE	KGM58	L	PHILADELPHIA CITY OF	12210.00000H						UPR ROXBORO	KGM59	L	PHILADELPHIA CITY OF	12330.00000H			
UPR ROXBORO	KGM59	L	PHILADELPHIA CITY OF	12450.00000H						OAK LN RESV	KGM57	L	PHILADELPHIA CITY OF	12690.00000H			
ST JOSEPHS	KHJ69	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO	12270.00000H	12350.00000H	12430.00000H				CHEESECOTE	RXONLY	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO				
ST JOSEPHS	KHJ69	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO	12270.00000H	12350.00000H	12430.00000H				BEACON	RXONLY	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO				
ST JOSEPHS	KHJ69	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO	12270.00000H	12350.00000H	12430.00000H				EMPIRE STAT	RXONLY	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO				
MOUNT BEACO	KHJ70	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO	12510.00000H	12590.00000H	12670.00000H				RHINECLIFF	RXONLY	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO				
MT BEACON	KHJ70	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO	12510.00000H	12590.00000H	12670.00000H				LOOMIS	RXONLY	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO				
EMPIRE STAT	KHY84	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO	12510.00000H	12590.00000H	12670.00000H				STATEN ISL	RXONLY	L	ARCHDIOCESE OF NEW YORK DEPT OF EDUCATIO				
GRANDVIEW	KJO28	L	KANSAS CITY SOUTHERN RAILWAY COMPANY	12450.00000V						KNOCHE YARD	RXONLY	L	KANSAS CITY SOUTHERN RAILWAY COMPANY				
CAROL DR	KMD36	L	SANTA CLARA COUNTY	12530.00000H						N CNTY BLDG	KHQ66	L	SANTA CLARA COUNTY	12270.00000H			
CAROL DR	KMD36	L	SANTA CLARA COUNTY	12630.00000V						BASCOM AVE	WOW71	L	SANTA CLARA COUNTY	12370.00000V			
CAROL DR	KMD36	L	SANTA CLARA COUNTY	12490.00000V						70 W HEDDING	WOW72	L	SANTA CLARA COUNTY	12230.00000V			
CAROL DR	KMD36	L	SANTA CLARA COUNTY	12570.00000H						1555 BERGER	WOW73	L	SANTA CLARA COUNTY	12310.00000H			
TAGER	KXV35	L	ALLIANCE FOR HIGHER EDUCATION	12390.00000V	12530.00000V					RO COLLINS	RXONLY	L	ALLIANCE FOR HIGHER EDUCATION				
TAGER	KXV35	L	ALLIANCE FOR HIGHER EDUCATION	12390.00000V	12530.00000V					RO TEXAS IN	RXONLY	L	ALLIANCE FOR HIGHER EDUCATION				
TAGER	KXV35	L	ALLIANCE FOR HIGHER EDUCATION	12390.00000V	12530.00000V					RO RISD	RXONLY	L	ALLIANCE FOR HIGHER EDUCATION				
CAMPE ST	KXV37	L	ALLIANCE FOR HIGHER EDUCATION	12683.00000H	12689.00000H					FORT WORTH	RXONLY	L	ALLIANCE FOR HIGHER EDUCATION				
CENN BLDG	KZY97	L	ALLIANCE FOR HIGHER EDUCATION	12630.00000V						SHERMAN	RXONLY	L	ALLIANCE FOR HIGHER EDUCATION				
ENID	RXONLY	L	OKLAHOMA STATE REGNTS FOR HIGHER ED							JET	WHC763	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12510.00000V			
N STAR RD	WAL360	L	OHIO DEPT OF ADMIN SVC/CDS MARCS PROJECT	12310.00000H						E BROAD ST	WAL364	L	OHIO DEPT OF ADMIN SVC/CDS MARCS PROJECT	12570.00000H			
E CENTRAL U	WAM273	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12470.00000V	12550.00000V					FITTSTOWN	WEE843	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12210.00000V			
EMPLOYE PAR	WAN212	L	KANSAS CITY AVIATION DEPARTMENT	12360.00000H						CONTROL TWR	WAN213	L	KANSAS CITY AVIATION DEPARTMENT	12650.00000H			
DAVIS	WAP560	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12290.00000V						SUTTER BUTT	WAP561	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12550.00000V			
DAVIS	WAP560	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12670.00000H						STOCK BLVD	WBD364	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12410.00000H			
SUTTER BUTT	WAP561	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12410.00000V						BUTTE HALL	WAP562	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12670.00000V			
TUSCAN BUTTE	WAQ637	L	CALIFORNIA STATE UNIVERSITY CHICO	12470.00000V						BUTTE HALL	WAQ638	L	CALIFORNIA STATE UNIVERSITY CHICO	12210.00000V			
TUSCAN BUTTE	WAQ637	L	CALIFORNIA STATE UNIVERSITY CHICO	12310.00000V						SHASTA BALL	WIA951	L	CALIFORNIA STATE UNIVERSITY CHICO	12570.00000V			
603 W CNTRL	WAS385	L	LEGGETT & PLATT	12470.00000H						BROOKLUN HGT	WAS386	L	LEGGETT & PLATT	12210.00000H			
SQUARE BTTE	WAT713	L	MINNKOTA POWER COOPERATIVE, INC.	12580.00000V						CENTER	RXONLY	L	MINNKOTA POWER COOPERATIVE, INC.				
SILVER CITY	WAY515	L	PHELPS DODGE CORPORATION	12250.00000H						PASSIVE	WAY516P	L	PHELPS DODGE CORPORATION	12510.00000H			
PASSIVE	WAY515P	L	PHELPS DODGE CORPORATION	12250.00000H						JACKS PEAK	WAY516	L	PHELPS DODGE CORPORATION	12510.00000H			
JACKS PEAK	WAY516	L	PHELPS DODGE CORPORATION	12610.00000H						PLAYAS	WAY517	L	PHELPS DODGE CORPORATION	12350.00000H			
MAPLE AVE	WBB786	L	DALLAS COUNTY SHERIFF'S DEPT	12460.00000V						DALLAS RX	RXONLY	L	DALLAS COUNTY SHERIFF'S DEPT				
LA JOLLA	WBD362	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12590.00000V						SAN DIEGO	WBD363	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12330.00000V			
BATTLEBORO	WBH429	L	STERN-LEACH CO.	12210.00000V						RECEIVE	RXONLY	L	STERN-LEACH CO.				
EAST PEORIA	WBH457	L	CATERPILLAR OF DELAWARE INC	12470.00000V						EAST PEORIA	WBH458	L	CATERPILLAR OF DELAWARE INC	12210.00000V			
WILLOUGHBY	WBH631	L	VIRGINIA COMMONWEALTH STATE POLICE	12470.00000V						NORTH ISLAN	WBH632	L	VIRGINIA COMMONWEALTH STATE POLICE				
S ISLE CHES	WBH633	L	VIRGINIA COMMONWEALTH STATE POLICE	12490.00000H						NORTH ISLAN	WBH632	L	VIRGINIA COMMONWEALTH STATE POLICE				
MEDICAL CNT	WBK93	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12210.00000V						RECEIVE ONL	RXONLY	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA				
TAFT WTR TW	WBM530	L	UNION CARBIDE CHEMICALS & PLASTICS CO	12460.00000H						TAFT ADMIN	RXONLY	L	UNION CARBIDE CHEMICALS & PLASTICS CO				
TAFT PLANT	WBM531	L	UNION CARBIDE CHEMICALS & PLASTICS CO.	12220.00000H						TAFT ADMIN	RXONLY	L	UNION CARBIDE CHEMICALS & PLASTICS CO.				
AMSTERDAM A	WBM576	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12570.00000V						NEW YORK RX	RXONLY	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY				
FT LEE	WBM577	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12610.00000H						NEW YORK RX	RXONLY	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY				
WEST TOWER	WBM578	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12470.00000V						NEW YORK RX	RXONLY	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY				
GWB NY TWR	WBM579	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12530.00000H						NEW YORK RX	RXONLY	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY				
FAIRBANKS	WBV242	L	ALASKA STATE INFORMATION SERVICES DIV.	12690.00000V						STATE COURT	WBV266	L	ALASKA STATE INFORMATION SERVICES DIV.	12430.00000V			
OSTEOPATHIC	WBV244	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12270.00000V						SAND SPRING	WDR28	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12530.00000V			

Appendix III

site1	call1	status	company1	freq1_1	freq1_2	freq1_3	freq1_4	freq1_5	freq1_6	site2	call2	status	company2	freq2_1	freq2_2	freq2_3	freq2_4
DECATUR	WBX343	L	CATERPILLAR OF DELAWARE INC	12220.00000V						RECEIVE ONL	RXONLY	L	CATERPILLAR OF DELAWARE INC				
ONE WILSHIR	WBX348	L	ARCO COMMUNICATIONS, INC. (LOS ANGELES)	12270.00000H						ARCO PLAZA	KMM58	L	ARCO COMMUNICATIONS, INC. (LOS ANGELES)	12530.00000H			
AGUSTA	WBX396	L	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	12670.00000H						SETON HOSP	WNTU625	L	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	12410.00000H			
PLTFRM H	WCE399	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12590.00000H	12610.00000H	12650.00000H	12670.00000H			JOURNAL SQ	RXONLY	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY				
COMMERCE ST	WCE999	L	DALLAS COUNTY	12460.00000V						INDUSTRIAL	RXONLY	L	DALLAS COUNTY				
SEARS BLDG	WCF283	L	MERCANTILE TRUST COMPANY	12580.00000H						BANK BRANCH	RXONLY	L	MERCANTILE TRUST COMPANY				
BANK BLDG	WCF284	L	MERCANTILE TRUST COMPANY	12340.00000V						SEARS BLDG	WCF283	L	MERCANTILE TRUST COMPANY				
SF GEN HOSP	WCP806	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12670.00000V						MISSION CTR	WCP808	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12410.00000V			
MOFFITT HOSP	WCP807	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12250.00000V						SF GEN HOSP	WCP806	L	REGENTS OF THE UNIVERSITY OF CALIFORNIA	12510.00000V			
EAST PEORIA	WCP809	L	CATERPILLAR OF DELAWARE INC	12220.00000V						PASSIVE B/B	WCP810P	L	CATERPILLAR OF DELAWARE INC	12460.00000V			
PASSIVE B/B	WCP809P	L	CATERPILLAR OF DELAWARE INC	12220.00000V						EAST PEORIA	WCP810	L	CATERPILLAR OF DELAWARE INC	12460.00000V			
STATION 5	WCP853	L	YONKERS NEW YORK, CITY OF POLICE DEPT.	12300.00000V						N COMMAND	WCP854	L	YONKERS NEW YORK, CITY OF POLICE DEPT.	12540.00000V			
POLICE HDQT	WCP855	L	YONKERS NEW YORK, CITY OF POLICE DEPT.	12580.00000V						STATION 5	WCP853	L	YONKERS NEW YORK, CITY OF POLICE DEPT.	12340.00000V			
CENTRAL PAR	WCP856	L	YONKERS NEW YORK, CITY OF POLICE DEPT.	12500.00000V						STATION 5	WCP853	L	YONKERS NEW YORK, CITY OF POLICE DEPT.				
OKLAHOMA CY	WDQ35	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12470.00000H	12550.00000H					EL RENO	WEE547	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12290.00000H			
LUCIEN	WDQ37	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12550.00000V	12610.00000V					ENID	RXONLY	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
POTEAU MTN	WED424	L	OKLAHOMA STATE REGNTS FOR HIGHER ED							BIG CEDAR	WEG497	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12670.00000V			
WAHL HALL	WED435	L	UNIVERSITY OF KANSAS	12470.00000H						KANSAS CITY	WED436	L	UNIVERSITY OF KANSAS	12210.00000H			
LOCKPORT	WED521	L	DELPHI AUTOMOTIVE SYSTEMS, LLC	12300.00000V						LOCKPORT RX	RXONLY	L	DELPHI AUTOMOTIVE SYSTEMS, LLC				
VILAS COMM	WED535	L	WISCONSIN EDUCATIONAL COMMUNICATIONS BO	12310.00000H						RECEIVE ONL	RXONLY	L	WISCONSIN EDUCATIONAL COMMUNICATIONS BOA				
TAFT ADMIN	WEE274	L	UNION CARBIDE CHEMICALS & PLASTICS CO	12580.00000H						RECEIVE ONL	RXONLY	L	UNION CARBIDE CHEMICALS & PLASTICS CO				
HOLLOW	WEE353	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12470.00000V	12550.00000V					NE OKLA A&M	WEE352	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12290.00000V			
RAMONA	WEE354	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12470.00000H	12550.00000H					TUXEDO RD	WEE355	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12210.00000H			
TUXEDO RD	WEE355	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12250.00000V	12330.00000V					HOLLOW	WEE353	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12510.00000V			
BALD KNOB	WEE422	L	GOVERNOR'S OFFICE FOR TECHNOLOGY	12250.00000H						FRANKLIN PR	WHJ780P	L	GOVERNOR'S OFFICE FOR TECHNOLOGY	12510.00000H			
FRANKLIN PR	WEE422P	L	GOVERNOR'S OFFICE FOR TECHNOLOGY	12250.00000H						CAPITOL BLD	WHJ780	L	GOVERNOR'S OFFICE FOR TECHNOLOGY	12510.00000H			
GEARY	WEE546	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12490.00000H	12570.00000H					SW OKLA SU	WEE548	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12230.00000H			
EL RENO	WEE547	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12250.00000H	12330.00000H					RECEIVE ONL	RXONLY	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
EL RENO	WEE547	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12250.00000V	12330.00000V					GEARY	WEE546	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12590.00000V			
EMET	WEE841	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12470.00000V	12550.00000V					SE OSU OK	WEE842	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12210.00000V			
FITTSTOWN	WEE843	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12250.00000H	12330.00000H					EMET	WEE841	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12510.00000H			
GATES CIRCL	WEE951	L	MILLARD FILLMORE HOSPITAL	12260.00000H						KIMBALL HAL	WNEK283	L	MILLARD FILLMORE HOSPITAL	12500.00000H			
MAPLE ROAD	WEE952	L	MILLARD FILLMORE HOSPITAL	12590.00000H						KIMBALL HAL	WNEK283	L	MILLARD FILLMORE HOSPITAL	12330.00000H			
PARSIPPANY	WEF447	L	BASF CHEMICAL DIVISION	12220.00000V						RECEIVE ONL	RXONLY	L	BASF CHEMICAL DIVISION				
BLDG 96	WEF586	L	EASTMAN KODAK COMMUNICATIONS INC	12220.00000H	12300.00000H					BLDG 62	WEF585	L	EASTMAN KODAK COMMUNICATIONS INC	12460.00000H			
HAUPPAUGE	WEF611	L	STATE UNIVERSITY OF NEW YORK STONY BROOK	12250.00000V						STONY BROOK	WEF612	L	STATE UNIVERSITY OF NEW YORK STONY BROOK	12510.00000V			
WORCESTER	WEG202	L	WYMAN-GORDON COMPANY	12230.00000H						BANK PR	WEG203P	L	WYMAN-GORDON COMPANY	12490.00000H			
BANK PR	WEG202P	L	WYMAN-GORDON COMPANY	12230.00000H						N GRAFTON P	WEG203	L	WYMAN-GORDON COMPANY	12490.00000H			
4222 PEACH	WEG380	L	SAINT VINCENT HEALTH CENTER	12460.00000H						ST VINCENT	RXONLY	L	SAINT VINCENT HEALTH CENTER				
4222 PEACH	WEG380	L	SAINT VINCENT HEALTH CENTER	12460.00000H						WQLN TV	WHC752	L	SAINT VINCENT HEALTH CENTER	12220.00000H			
380 MTN RD	WEG394	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12610.00000V						UNION CTY R	RXONLY	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY				
GARDEN CITY	WEG436	L	AMERICAN TELEPHONE & TELEGRAPH COMPANY	12290.00000V	12370.00000V					OAKTON	WEG437	L	AMERICAN TELEPHONE & TELEGRAPH COMPANY	12550.00000V	12630.00000V		
BIG CEDAR	WEG497	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12490.00000V	12570.00000V					SHERWOOD	WEG498	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12230.00000V			
SHERWOOD	WEG498	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12290.00000H	12370.00000H					IDABEL	WEG499	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12630.00000H			
MTN VIEW	WEH246	L	LORAL SPACE SYSTEMS	12370.00000V						RECEIVE	RXONLY	L	LORAL SPACE SYSTEMS				
SOUTHFIELD	WEH337	L	DETROIT DEPT OF PUBLIC WORKS, CITY OF	12460.00000H						RECEIVE ONL	RXONLY	L	DETROIT DEPT OF PUBLIC WORKS, CITY OF				
TANANA RIVE	WEH385	L	ALYESKA PIPELINE SERVICE COMPANY AGENT	12210.00000V	12250.00000V	12290.00000V	12330.00000V			PUMP STN 9	WEH384	L	ALYESKA PIPELINE SERVICE COMPANY AGENT	12590.00000V			
RT 3 GATE	WEH461	L	SOLUTIA INC.	12260.00000H						PASSIVE	RXONLY	L	SOLUTIA INC.				
PASSIVE	WEH461P	L	SOLUTIA INC.	12260.00000H						SECURITY OF	RXONLY	L	SOLUTIA INC.				
STA BARBARA	WEH477	L	SANTA BARBARA COUNTY	12220.00000V						LA CUMBRE P	WEH478	L	SANTA BARBARA COUNTY	12460.00000V			
LA CUMBRE P	WEH478	L	SANTA BARBARA COUNTY	12500.00000V						ANAPAMU ST	WEH479	L	SANTA BARBARA COUNTY	12260.00000V			
FORD HDQTRS	WEH534	L	FORD COMMUNICATIONS, INC.	12250.00000V						KELLY BLDG	WEH533	L	FORD COMMUNICATIONS, INC.	12510.00000V			
DAVISON	WEH808	L	DETROIT DEPT OF PUBLIC WORKS, CITY OF	12220.00000H	12300.00000H					RUSSEL-FERR	RXONLY	L	DETROIT DEPT OF PUBLIC WORKS, CITY OF				
BANK BLDG	WEH809	L	FIRST SECURITY BANK OF IDAHO	12300.00000V						DATA CENTER	RXONLY	L	FIRST SECURITY BANK OF IDAHO				
FARMINGTON	WGD58	L	UNIVERSITY OF CONNECTICUT HEALTH CENTER	12290.00000H						NEWINGTON	WGD59	L	UNIVERSITY OF CONNECTICUT HEALTH CENTER	12510.00000V			

Appendix III

site1	call1	status	company1	freq1_1	freq1_2	freq1_3	freq1_4	freq1_5	freq1_6	site2	call2	status	company2	freq2_1	freq2_2	freq2_3	freq2_4
CITY HALL	WGT37	L	PHILADELPHIA CITY OF	12630.00000V						STATE ROAD	WBH636	L	PHILADELPHIA CITY OF	12510.00000V			
CRAWFORD HI	WGX719	L	CAPITAL DIST REG OFFTRACK BETTING CORP	12290.00000V						510 SMITH S	RXONLY	L	CAPITAL DIST REG OFFTRACK BETTING CORP				
CRAWFORD HI	WGX719	L	CAPITAL DIST REG OFFTRACK BETTING CORP	12290.00000V						RECEIVE ONL	RXONLY	L	CAPITAL DIST REG OFFTRACK BETTING CORP				
SARATOGA	WGX720	L	CAPITAL DIST REG OFFTRACK BETTING CORP	12270.00000V						CRAWFORD HI	WGX719	L	CAPITAL DIST REG OFFTRACK BETTING CORP				
SYCAMORE MT	WGX746	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12270.00000V						WILBURTON	WPP84	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
CPS	WGX760	L	BP COMMUNICATIONS ALASKA INC	12630.00000V						MOC	WPH45	L	BP COMMUNICATIONS ALASKA INC	12370.00000V			
GC 3	WGX761	L	BP COMMUNICATIONS ALASKA INC	12670.00000H						MOC	WPH45	L	BP COMMUNICATIONS ALASKA INC	12410.00000H			
GC 1-PRUDHO	WGX765	L	BP COMMUNICATIONS ALASKA INC	12510.00000H						MOC	WPH45	L	BP COMMUNICATIONS ALASKA INC	12250.00000H			
GC 2	WGX772	L	BP COMMUNICATIONS ALASKA INC	12550.00000V						MOC	WPH45	L	BP COMMUNICATIONS ALASKA INC	12290.00000V			
SEATTLE	WGY341	L	KING COUNTY	12220.00000H						RECEIVER	RXONLY	L	KING COUNTY				
NATL PRESS	WGY531	L	PYRAMID VIDEO, INC.	12290.00000V	12370.00000V					SKYLINE TWRS	WGY530	L	PYRAMID VIDEO, INC	12550.00000H	12630.00000H		
N PROVIDENC	WGY592	L	SAINT JOSEPH HOSPITAL	12590.00000H						PROVIDENCE	WNEF345	L	SAINT JOSEPH HOSPITAL				
COAL BINS P	WGY671P	L	UNITED STATES STEEL CORP.	12260.00000V						ANTENNA	RXONLY	L	UNITED STATES STEEL CORP.				
BLDG 102	WGY699	L	LOCKHEED CORPORATION	12690.00000V						BLDG 202	WNEP815	L	LOCKHEED CORPORATION	12430.00000V			
ALLIANCE SO	WGY732	L	BURLINGTON NORTHERN RAILROAD COMPANY	12220.00000V	12300.00000V					ALLIANCE	WEE984	L	BURLINGTON NORTHERN RAILROAD COMPANY				
ALLIANCE WS	WGY733	L	BURLINGTON NORTHERN RAILROAD COMPANY	12260.00000H	12300.00000H					ALLIANCE	WEE984	L	BURLINGTON NORTHERN RAILROAD COMPANY				
BLDG 15	WGY751	L	EASTMAN KODAK COMMUNICATIONS INC	12650.00000V						E RIVER RD	WGY750	L	EASTMAN KODAK COMMUNICATIONS INC	12270.00000H	12330.00000H	12370.00000H	12430.00000H
GREEN LAKE	WHC412	L	BP CHEMICALS INC	12220.00000V						GUARD HOUSE	RXONLY	L	BP CHEMICALS INC				
PAYAS CLINI	WHC611	L	PHELPS DODGE CORPORATION	12670.00000V						SMELTER RD	WHC612	X	PHELPS DODGE CORPORATION	12410.00000V			
JET	WHC763	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12470.00000V	12650.00000V					ALVA	RXONLY	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
ADMIN BLDG	WHH456	L	DELAWARE RIVER & BAY AUTHORITY	12580.00000V						S DEL TOWER	WHH457	L	DELAWARE RIVER & BAY AUTHORITY	12290.00000V			
ADMIN BLDG	WHH456	L	DELAWARE RIVER & BAY AUTHORITY	12580.00000V						NEW CASTLE	WHH460	L	DELAWARE RIVER & BAY AUTHORITY	12410.00000V			
N NJ TOWER	WHH458	L	DELAWARE RIVER & BAY AUTHORITY	12350.00000V						ADMIN BLDG	WHH456	L	DELAWARE RIVER & BAY AUTHORITY	12580.00000V			
N DEL TOWER	WHH459	L	DELAWARE RIVER & BAY AUTHORITY	12230.00000V						ADMIN BLDG	WHH456	L	DELAWARE RIVER & BAY AUTHORITY	12580.00000V			
SOUTH GRAND	WHH538	L	CROCKER NATIONAL BANK	12410.00000H						PARK PLACE	WHH537	L	CROCKER NATIONAL BANK	12670.00000H			
SHINGLE SPR	WHH646	L	CALIFORNIA STATE UNIV SACRAMENTO	12670.00000V						AUBURN REC	RXONLY	L	CALIFORNIA STATE UNIV SACRAMENTO				
PILOT HILL	WHH649	L	CALIFORNIA STATE UNIV SACRAMENTO	12450.00000V						RECEIVER	RXONLY	L	CALIFORNIA STATE UNIV SACRAMENTO				
COLLINS RD	WHH681	L	ROCKWELL COLLINS, INC.	12370.00000V						BLDG 137	WHH680	L	ROCKWELL COLLINS, INC.	12630.00000V			
DAM 1	WHH829	L	PORTLAND, CITY OF OREGON	12490.00000V						SANDY PASSV	WHH830P1	L	PORTLAND, CITY OF OREGON	12230.00000V			
SANDY PASSV	WHH829P1	L	PORTLAND, CITY OF OREGON	12490.00000V						DAM 1 PASSV	WHH830P2	L	PORTLAND, CITY OF OREGON	12230.00000V			
DAM 1 PASSV	WHH829P2	L	PORTLAND, CITY OF OREGON	12490.00000V						HEADWORKS	WHH830	L	PORTLAND, CITY OF OREGON	12230.00000V			
USF&G BLDG	WHH831	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12570.00000V						TRAYLOR BLD	WHH833	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12310.00000V			
USF&G BLDG	WHH831	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12690.00000V						ROWLAND HAL	WHH834	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12430.00000V			
USF&G BLDG	WHH831	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12530.00000H	12630.00000H					JOHNS HOPKI	WNTR246	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12270.00000H	12370.00000H		
TRAYLOR BLD	WHH833	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12390.00000H						ROWLAND HAL	WHH834	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12650.00000H			
SECOND AVE	WHH843	L	DETROIT PUBLIC TELEVISION WTVS	12310.00000V						PASSIV REC	RXONLY	L	DETROIT PUBLIC TELEVISION WTVS				
SECOND AVE	WHH843	L	DETROIT PUBLIC TELEVISION WTVS	12310.00000V						PASSIV REC	RXONLY	L	DETROIT PUBLIC TELEVISION WTVS				
PASSIV REC	WHH843P	L	DETROIT PUBLIC TELEVISION WTVS	12310.00000V						LOTHROP ST	RXONLY	L	DETROIT PUBLIC TELEVISION WTVS				
PASSIV REC	WHH843P	L	DETROIT PUBLIC TELEVISION WTVS	12310.00000V						LOTHROP ST	RXONLY	L	DETROIT PUBLIC TELEVISION WTVS				
INLET	WHI239	L	ATLANTIC CITY HOUSING AUTHORITY	12470.00000V						RECIEVER	RXONLY	L	ATLANTIC CITY HOUSING AUTHORITY				
INLET	WHI239	L	ATLANTIC CITY HOUSING AUTHORITY	12470.00000V						RECIEVER	RXONLY	L	ATLANTIC CITY HOUSING AUTHORITY				
INLET	WHI239	L	ATLANTIC CITY HOUSING AUTHORITY	12470.00000V						RECIEVER	RXONLY	L	ATLANTIC CITY HOUSING AUTHORITY				
SHORE PARK	WHI241	L	ATLANTIC CITY HOUSING AUTHORITY	12470.00000V						RECIEVER	RXONLY	L	ATLANTIC CITY HOUSING AUTHORITY				
SHORE PARK	WHI241	L	ATLANTIC CITY HOUSING AUTHORITY	12470.00000V						RECIEVER	RXONLY	L	ATLANTIC CITY HOUSING AUTHORITY				
SHORE PARK	WHI241	L	ATLANTIC CITY HOUSING AUTHORITY	12470.00000V						RECIEVER	RXONLY	L	ATLANTIC CITY HOUSING AUTHORITY				
WHITE PLAIN	WHI270	L	PRIMERICA CORPORATION	12300.00000H						HEADQUARTER	RXONLY	L	PRIMERICA CORPORATION				
SPILLWAY	WHI275	L	TEXAS UTILITIES ELECTRIC COMPANY	12260.00000V						TRADINGHSE	WNEG727	L	TEXAS UTILITIES ELECTRIC COMPANY				
HARTFORD	WHI386	L	CONNECTICUT PUBLIC BROADCASTING INC	12250.00000H	12290.00000H					HARTFORD RX	RXONLY	L	CONNECTICUT PUBLIC BROADCASTING INC				
VAN HOOSE	WHI629	L	JEFFERSON COUNTY PUBLIC SCHOOLS	12610.00000V						JEFFERSONTO	WHI706	X	JEFFERSON COUNTY PUBLIC SCHOOLS	12350.00000V			
DURRETT	WHI630	L	JEFFERSON COUNTY PUBLIC SCHOOLS	12290.00000V						VAN HOOSE	WHI629	L	JEFFERSON COUNTY PUBLIC SCHOOLS	12550.00000V			
W LEE ST	WHI712	L	JEFFERSON COUNTY PUBLIC SCHOOLS	12230.00000V						VAN HOOSE	WHI629	L	JEFFERSON COUNTY PUBLIC SCHOOLS	12490.00000V			
TINLEY PK	WHI719	L	GARY MUNICIPAL AIRPORT AUTHORITY DISTRIC	12650.00000V						RECEIVER	RXONLY	L	GARY MUNICIPAL AIRPORT AUTHORITY DISTRIC				
W GRAND BLV	WHI874	L	EDS SPECTRUM CORPORATION	12390.00000V						CHICAGO RD	WHI876	L	EDS SPECTRUM CORPORATION	12650.00000V			
CHICAGO RD	WHI876	L	EDS SPECTRUM CORPORATION	12510.00000V						G M TRUCK	WHI877	L	EDS SPECTRUM CORPORATION	12250.00000V			
BROOKPARK	WHI910	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND	12690.00000V						TRI-C CENTER	RXONLY	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND				

Appendix III

site1	call1	status	company1	freq1_1	freq1_2	freq1_3	freq1_4	freq1_5	freq1_6	site2	call2	status	company2	freq2_1	freq2_2	freq2_3	freq2_4
500 BELMONT	WHJ217	L	EASTERN IOWA COMMUNITY COLLEGE	12230.00000V	12390.00000V					CLINTON	WHJ215	L	EASTERN IOWA COMMUNITY COLLEGE	12490.00000V	12650.00000V		
BUFFALO	WHJ218	L	EASTERN IOWA COMMUNITY COLLEGE	12510.00000H	12590.00000H					500 BELMONT	WHJ217	L	EASTERN IOWA COMMUNITY COLLEGE	12250.00000H	12330.00000V		
152 COLORAD	WHJ219	L	EASTERN IOWA COMMUNITY COLLEGE	12290.00000V	12390.00000V					BUFFALO	WHJ218	L	EASTERN IOWA COMMUNITY COLLEGE	12550.00000V	12650.00000V		
HAYDEN PK	WHJ519	L	MOHAVE COMMUNITY COLLEGE	12470.00000H	12530.00000H					KINGMAN CAM	WHJ518	L	MOHAVE COMMUNITY COLLEGE	12210.00000H	12270.00000H		
HAYDEN PEAK	WHJ519	L	MOHAVE COMMUNITY COLLEGE	12510.00000V						CHRISTMAS T	WHJ522	L	MOHAVE COMMUNITY COLLEGE	12250.00000V			
LOWER GOAT	WHJ520	L	MOHAVE COMMUNITY COLLEGE	12230.00000H						HAYDEN PEAK	WHJ519	L	MOHAVE COMMUNITY COLLEGE	12490.00000H			
LAKE HAVASU	WHJ521	L	MOHAVE COMMUNITY COLLEGE	12470.00000V						LOWER GOAT	WHJ520	L	MOHAVE COMMUNITY COLLEGE	12210.00000V			
CHRISTMAS T	WHJ522	L	MOHAVE COMMUNITY COLLEGE	12210.00000H						BULLHEAD CI	WHJ523	L	MOHAVE COMMUNITY COLLEGE	12470.00000H			
HOUSTON	WHJ658	L	HOUSTON BAPTIST UNIVERSITY	12610.00000V						RECEIVE ONLY	RXONLY	L	HOUSTON BAPTIST UNIVERSITY				
STONYBROOK	WHJ812	L	THREE VILLAGE SCHOOL DISTRICT ADMINISTRA	12390.00000V						SETAUKET	WHJ813	L	THREE VILLAGE SCHOOL DISTRICT ADMINISTRA	12650.00000V			
35 FRUIT ST	WHL93	L	MASSACHUSETTS GENERAL HOSPITAL	12590.00000H						EAST BOSTON	WHL94	L	MASSACHUSETTS GENERAL HOSPITAL	12230.00000H			
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						CARDINAL AV	CARDIN	L	JONES COMMUNICATIONS OF ARIZONA, INC				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						NARANJA	NARANJ	L	JONES COMMUNICATIONS OF ARIZONA, INC.				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000H						N THORNYDAL	NTHORN	L	JONES COMMUNICATIONS OF ARIZONA, INC				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						PIMA CNTY	PIMACN	L	JONES COMMUNICATIONS OF ARIZONA, INC.				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						RANCHO VIST	RANCHO	L	JONES COMMUNICATIONS OF ARIZONA, INC				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						RIO CANCION	RIOCAN	L	JONES COMMUNICATIONS OF ARIZONA, INC				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						SABINO	SABINO	L	JONES COMMUNICATIONS OF ARIZONA, INC.				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						SKYLINE CC	SKYLIN	L	JONES COMMUNICATIONS OF ARIZONA, INC.				
TUCSON MTN	WHZ572	L	JONES COMMUNICATIONS OF ARIZONA, INC.	12698.75000V						SWEETWATER	SWEETW	L	JONES COMMUNICATIONS OF ARIZONA, INC				
SUPPORT BLD	WIA524	L	LOCKHEED MARTIN CORPORATION	12500.00000V						FIRE STATIO	RXONLY	L	LOCKHEED MARTIN CORPORATION				
W 7TH STREE	WIA652	L	OCCIDENTAL OIL & GAS CORPORATION	12630.00000V						129TH AVENU	WIA651	L	OCCIDENTAL OIL & GAS CORPORATION	12370.00000V			
EASTERN AVE	WIA653	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12460.00000H						E MONUMENT	WIA654	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12220.00000H			
E MONUMENT	WIA654	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12260.00000V						W BELVEDERE	WNEY437	L	JOHN HOPKINS UNIVERSITY SCHOOL OF MEDICI	12500.00000V			
BLDG J	WIA732	L	CATERPILLAR OF DELAWARE INC	12220.00000V	12260.00000V	12300.00000V	12460.00000V	12500.00000V	12540.00000V	BLDG V	RXONLY	L	CATERPILLAR OF DELAWARE INC				
METRO	WIA810	L	CUYAHOGA COMMUNITY COLLEGE	12310.00000V						EASTERN	WIA811	L	CUYAHOGA COMMUNITY COLLEGE	12570.00000V			
METRO	WIA810	L	CUYAHOGA COMMUNITY COLLEGE	12230.00000V						WESTERN	WIA812	L	CUYAHOGA COMMUNITY COLLEGE	12490.00000V			
METRO	WIA810	L	CUYAHOGA COMMUNITY COLLEGE	12270.00000H						DISTRICT	WIA813	L	CUYAHOGA COMMUNITY COLLEGE	12530.00000H			
BUTTE HALL	WIA818	L	CALIFORNIA STATE UNIVERSITY CHICO	12630.00000H						FLEA MTN	WIA819	L	CALIFORNIA STATE UNIVERSITY CHICO	12370.00000H			
FLEA MTN	WIA819	L	CALIFORNIA STATE UNIVERSITY CHICO	12550.00000H						RED HILL	WIA820	L	CALIFORNIA STATE UNIVERSITY CHICO	12290.00000H			
RED HILL	WIA820	L	CALIFORNIA STATE UNIVERSITY CHICO	12410.00000H						MOUNT HOUGH	WHI484	L	CALIFORNIA STATE UNIVERSITY CHICO	12670.00000H			
BLDG 199	WIA830	L	LOCKHEED CORPORATION	12671.00000V	12683.00000V	12689.00000V				BLDG 309	RXONLY	L	LOCKHEED CORPORATION				
BLDG 360	WIA831	L	LOCKHEED CORPORATION	12670.00000H						BLDG 309	RXONLY	L	LOCKHEED CORPORATION				
MIFFLIN	WIA871	Z	ATLANTIC PIPELINE CORPORATION	12460.00000V						MIFFLIN	RXONLY	Z	ATLANTIC PIPELINE CORPORATION				
MIFFLIN	WIA872	Z	ATLANTIC PIPELINE CORPORATION	12220.00000V						MIFFLIN	RXONLY	Z	ATLANTIC PIPELINE CORPORATION				
MAIN PLANT	WIA925	L	SOLUTIA INC	12220.00000H						RX ONLY	RXONLY	L	SOLUTIA INC.				
RIVER TERM	WIA925	L	SOLUTIA INC.	12460.00000H						MAIN PLANT	WIA925	L	SOLUTIA INC.				
MARBURG AVE	WIA992	L	MILACRON INC	12260.00000V						PASSIVE	RXONLY	L	MILACRON INC				
PASSIVE	WIA992P	L	MILACRON INC	12260.00000V						RECEIVE ONL	RXONLY	L	MILACRON INC				
LIBRARY BLD	WIO31	L	COAST COMMUNITY COLLEGE DISTRICT	12650.00000V						COMM THEATR	WIO32	L	COAST COMMUNITY COLLEGE DISTRICT	12250.00000V	12370.00000V		
LINCOLN	WJB70	L	RHODE ISLAND STATE OF	12430.00000H						DIAMOND HL	WPO25	X	RHODE ISLAND STATE OF	12670.00000H			
LINCOLN	WJB70	L	RHODE ISLAND STATE OF	12390.00000V						E PROVIDENC	WPO26	L	RHODE ISLAND STATE OF	12630.00000V			
HARVARD	WJP50	L	PRESIDENT & FELLOWS OF HARVARD	12230.00000V						RECEIVE	RXONLY	L	PRESIDENT & FELLOWS OF HARVARD				
MIT	WJP51	L	PRESIDENT & FELLOWS OF HARVARD	12490.00000H						HARVARD	WJP50	L	PRESIDENT & FELLOWS OF HARVARD	12230.00000H			
MT ASCUTNEY	WJR62	L	TRUSTEES OF DARTMOUTH COLLEGE	12630.00000V						VALLEY REG	WJR66	L	TRUSTEES OF DARTMOUTH COLLEGE	12370.00000V			
MT PLEASANT	WJR65	L	TRUSTEES OF DARTMOUTH COLLEGE	12370.00000V						CENT VT HOS	WJR64	L	TRUSTEES OF DARTMOUTH COLLEGE	12630.00000V			
MT MANSFIEL	WJR67	L	UNIVERSITY OF VERMONT LAND RECORD OFFICE	12590.00000V						BURLINGTON	WJR63	L	UNIVERSITY OF VERMONT LAND RECORD OFFICE	12330.00000V			
HITCHCOCK M	WJR68	L	TRUSTEES OF DARTMOUTH COLLEGE	12330.00000V						MT ASCUTNEY	WJR62	L	TRUSTEES OF DARTMOUTH COLLEGE	12590.00000V			
PITTSBURGH	WLX44	L	UNIVERSITY OF PITTSBURG COMPUTER CENTER	12210.00000H						EPSILON DR	WLX45	L	UNIVERSITY OF PITTSBURG COMPUTER CENTER	12470.00000H			
MED LAB BLD	WLZ28	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND	12590.00000H						BROOKPARK	RXONLY	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND				
ORANGEVILLE	WNEF423	L	HOUGHTON COLLEGE	12630.00000V						FILLMORE	WNEF424	L	HOUGHTON COLLEGE	12370.00000V			
ORANGEVILLE	WNEF423	L	HOUGHTON COLLEGE	12490.00000V						WEST SENECA	WNEF426	L	HOUGHTON COLLEGE	12230.00000V			
FILLMORE	WNEF424	L	HOUGHTON COLLEGE	12270.00000V						HOUGHTON	WNEF425	L	HOUGHTON COLLEGE	12530.00000V			
VINVALE	WNEF742	L	ARCO COMMUNICATIONS, INC. (LOS ANGELES)	12650.00000V						MONTEBELLO	WGX624	L	ARCO COMMUNICATIONS, INC. (LOS ANGELES)	12310.00000H			
11000 WOLFE	WNEG824	L	HEWLETT-PACKARD CORPORATION	12230.00000H						MONUMENT PE	RXONLY	L	HEWLETT-PACKARD CORPORATION				

Appendix III

site1	call1	status	company1	freq1_1	freq1_2	freq1_3	freq1_4	freq1_5	freq1_6	site2	call2	status	company2	freq2_1	freq2_2	freq2_3	freq2_4
MICHIGAN AVE	WNEH435	L	ARCHDIOCESE OF DETROIT	12550.00000V	12590.00000H	12630.00000V	12670.00000H			WASH BLVD PR	WNEH434	R L	ARCHDIOCESE OF DETROIT	12330.00000H	12370.00000V		
WASH BLVD PR	WNEH435P	L	ARCHDIOCESE OF DETROIT	12550.00000V	12590.00000H	12630.00000V	12670.00000H			RADIO PLACE	WNEH434	L	ARCHDIOCESE OF DETROIT	12330.00000H	12370.00000V		
SEMINARY	WNEH436	L	ARCHDIOCESE OF DETROIT	12510.00000H						WMJC	WNEH434	L	ARCHDIOCESE OF DETROIT				
SYRACUSE	WNEH747	L	BRISTOL MYERS SQUIBB CO	12420.00000H						RECEIVE	RXONLY	L	BRISTOL MYERS SQUIBB CO				
EAST YARD	WNEJ509	L	MONTANA RAIL LINK INC	12220.00000V	12260.00000V	12300.00000V				E YARD RX	RXONLY	L	MONTANA RAIL LINK INC				
WEST YARD	WNEJ510	L	MONTANA RAIL LINK INC	12220.00000V	12260.00000V	12300.00000V				W YARD RX	RXONLY	L	MONTANA RAIL LINK INC				
BLDG S13	WNEK495	L	RATHEON SYSTEMS	12580.00000V						BLDG R-16	RXONLY	L	RATHEON SYSTEMS				
BLDG S41	WNEK502	L	RATHEON SYSTEMS	12220.00000V						BLDG S50	RXONLY	L	RATHEON SYSTEMS				
MAPLE AVE	WNEO449	L	CHANNEL 13 TELEVISION	12500.00000V						WASHINGTON	RXONLY	L	CHANNEL 13 TELEVISION				
CNTY CRTHSE	WNER313	L	BREVARD COUNTY SHERIFF DEPARTMENT	12290.00000V						CNTY JAIL	WNER314	L	BREVARD COUNTY SHERIFF DEPARTMENT	12550.00000V			
CNTY JAIL	WNER314	L	BREVARD COUNTY SHERIFF DEPARTMENT	12510.00000V						RCKLND CTHS	WNES282	L	BREVARD COUNTY SHERIFF DEPARTMENT	12250.00000V			
RCKLND CTHS	WNES282	L	BREVARD COUNTY SHERIFF DEPARTMENT	12290.00000H						SARNO CNTR	WNES283	L	BREVARD COUNTY SHERIFF DEPARTMENT	12550.00000H			
SARNO CNTR	WNES283	L	BREVARD COUNTY SHERIFF DEPARTMENT	12510.00000H						MELBOURNE C	WNES281	L	BREVARD COUNTY SHERIFF DEPARTMENT	12250.00000H			
HOLBROOK	WNES568	L	NORTHLAND PIONEER COLLEGE	12470.00000H						DRY LAKE	WNES569	L	NORTHLAND PIONEER COLLEGE	12210.00000H			
HOLBROOK	WNES568	L	NORTHLAND PIONEER COLLEGE	12470.00000V	12550.00000V	12630.00000V				GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12210.00000V	12290.00000V	12370.00000V	
GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12270.00000H						SPRINGERVILL	RXONLY	L	NORTHLAND PIONEER COLLEGE				
GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12270.00000H						PIONEER SCH	WNES572	L	NORTHLAND PIONEER COLLEGE	12490.00000H			
GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12270.00000H						SPRINGERVILL	WNES573	L	NORTHLAND PIONEER COLLEGE	12530.00000H			
GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12250.00000V						SHOWLOW	WNES576	L	NORTHLAND PIONEER COLLEGE	12510.00000V			
GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12330.00000V						NPC CAMPUS	WNES577	L	NORTHLAND PIONEER COLLEGE	12590.00000V			
GREENS PEAK	WNES571	L	NORTHLAND PIONEER COLLEGE	12270.00000H						MCKAYS PEAK	WNTA632	L	NORTHLAND PIONEER COLLEGE	12570.00000H			
COOPER ST	WNES690	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12620.00000V	12660.00000V					MICHIGAN AV	WNES692	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12420.00000V			
COOPER ST	WNES690	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12540.00000H	12580.00000H					SUTTON RD	WNES695	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12300.00000H	12340.00000H		
COOPER ST	WNES690	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12460.00000V	12500.00000V					W MAIN ST	WNES696	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12220.00000V			
HORTON RD	WNES694	X	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12240.00000V	12280.00000V					WEST AVENUE	WNES691	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12480.00000V			
HORTON RD	WNES694	X	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12400.00000V	12440.00000V					JEFFERSON R	WNES693	L	JACKSON COUNTY INTERMEDIATE SCHOOL DIST	12640.00000V			
CRAWFORD HI	WNET830	L	CAPITAL DIST REG OFFTRACK BETTING CORP	12410.00000V						AMSTERDAM	RXONLY	L	CAPITAL DIST REG OFFTRACK BETTING CORP				
STATION	WNEV521	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND	12210.00000H						BROOKPARK	RXONLY	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND				
STATION	WNEV521	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND	12210.00000H						BROOKPARK	RXONLY	L	EDUCATIONAL TV ASSN OF METRO CLEVELAND				
NEW BALTIMO	WNEW382	L	RCG BOARD OF COOPERATIVE ED SERVICES	12210.00000H						CASTLETON	WNEW384	L	RCG BOARD OF COOPERATIVE ED SERVICES	12470.00000H			
ST HELEN RD	WNEW701	L	KIRTLAND COMMUNITY COLLEGE	12470.00000H	12510.00000H	12550.00000H	12590.00000H	12630.00000H	12670.00000H	HOUGHTON LAK	WNEN705	L	KIRTLAND COMMUNITY COLLEGE	12230.00000H			
ST HELEN RD	WNEW701	L	KIRTLAND COMMUNITY COLLEGE	12470.00000H	12510.00000H	12550.00000H	12590.00000H	12630.00000H	12670.00000H	MT TOM	WNEW702	L	KIRTLAND COMMUNITY COLLEGE	12210.00000H	12250.00000H		
ST HELEN RD	WNEW701	L	KIRTLAND COMMUNITY COLLEGE	12470.00000V	12510.00000V	12550.00000V	12590.00000V	12630.00000V	12670.00000V	WEST BRANCH	WNEW704	L	KIRTLAND COMMUNITY COLLEGE	12350.00000V			
ST HELEN RD	WNEW701	L	KIRTLAND COMMUNITY COLLEGE	12470.00000H	12510.00000H	12550.00000H	12590.00000H	12630.00000H	12670.00000H	GRAYLING SC	WNEX470	L	KIRTLAND COMMUNITY COLLEGE	12310.00000H			
WEST BRANCH	WNEW704	L	KIRTLAND COMMUNITY COLLEGE	12210.00000H	12250.00000H	12290.00000H	12330.00000H	12370.00000H	12410.00000H	W BRANCH SC	WNEW703	L	KIRTLAND COMMUNITY COLLEGE	12510.00000H			
ROSCOMMON	WNEW706	L	KIRTLAND COMMUNITY COLLEGE	12290.00000V						ST HELEN RD	WNEW701	L	KIRTLAND COMMUNITY COLLEGE	12470.00000V	12550.00000V		
MONUMENT PK	WNEZ826	L	HEWLETT-PACKARD CORPORATION	12470.00000V						PALO ALTO	RXONLY	L	HEWLETT-PACKARD CORPORATION				
MCKAYS PEAK	WNTA632	L	NORTHLAND PIONEER COLLEGE	12630.00000V						PASSIVE	WNTA633	R L	NORTHLAND PIONEER COLLEGE	12370.00000V			
PASSIVE	WNTA632P	L	NORTHLAND PIONEER COLLEGE	12630.00000V						WHITERIVER	WNTA633	L	NORTHLAND PIONEER COLLEGE	12370.00000V			
STEESE	WNTB241	L	PTI TELEPHONE	12330.00000V						UNIVERSITY	WNTB240	L	PTI TELEPHONE	12590.00000V			
VALLEY BLVD	WNTB354	L	LINKABIT CORPORATION	12630.00000H						SCIENCE PAR	WNTB353	L	LINKABIT CORPORATION	12370.00000H			
LANGDON	WNTD922	L	UNITED TELEPHONE MUTUAL AID CORPORATION	12210.00000V	12290.00000V					MUNICH	RXONLY	L	UNITED TELEPHONE MUTUAL AID CORPORATION				
FAIRMONT DR	WNTF259	L	INFINITY CORP OF SAN FRANCISCO	12440.00000V						MT DIABLO	RXONLY	L	INFINITY CORP OF SAN FRANCISCO				
WASHINGTON	WNTH383	L	CHANNEL 13 TELEVISION	12660.00000V						CHANNEL 13	RXONLY	L	CHANNEL 13 TELEVISION				
WVIT TV	WNTI771	L	CONNECTICUT PUBLIC BROADCASTING INC	12210.00000V	12270.00000V					WTXX AUXILI	RXONLY	L	CONNECTICUT PUBLIC BROADCASTING INC				
1982 LOCUST	WNTK229	L	PENNSYLVANIA COMMONWEALTH MEDIA SERVICE	12450.00000H						HARRISBURG	RXONLY	L	PENNSYLVANIA COMMONWEALTH MEDIA SERVICES				
A STREET	WNTL439	L	FIELDCREST CANNON INC	12220.00000V						1 LAKE CR	WNTL440	L	FIELDCREST CANNON INC	12460.00000V			
A STREET	WNTL439	L	FIELDCREST CANNON INC	12220.00000V						1 LAKE CR	WNTL440	L	FIELDCREST CANNON INC	12460.00000V			
HEBER HS	WNTT309	L	NORTHLAND PIONEER COLLEGE	12550.00000V						HEBER RIDGE	WNES569	R L	NORTHLAND PIONEER COLLEGE	12290.00000V			
HEBER RIDGE	WNTT309P	L	NORTHLAND PIONEER COLLEGE	12550.00000H						DRY LAKE	WNES569	L	NORTHLAND PIONEER COLLEGE	12290.00000H			
MED CENTER	WNTU623	L	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	12270.00000V						SAND HILL	WNTU624	L	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	12530.00000V			
SETON HOSP	WNTU625	L	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	12250.00000V						THAYER HOSP	WNTU626	L	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	12510.00000V			
PRUDHOE BAY	WPH47	L	BP COMMUNICATIONS ALASKA INC	12270.00000H						CPS	WGX760	L	BP COMMUNICATIONS ALASKA INC	12530.00000H			
CHOUTEAU AVE	WPH66	L	MANCHESTER BANK OF ST. LOUIS	12210.00000V						RECEIVE ONLY	RXONLY	L	MANCHESTER BANK OF ST. LOUIS				
SHEFFIELD Y	WPO23	L	NORFOLK SOUTHERN RAILWAY	12210.00000V	12330.00000V					RECEIVER	RXONLY	L	NORFOLK SOUTHERN RAILWAY				

Appendix III

site1	call1	status	company1	freq1_1	freq1_2	freq1_3	freq1_4	freq1_5	freq1_6	site2	call2	status	company2	freq2_1	freq2_2	freq2_3	freq2_4
SHEFFIELD Y	WPO24	L	NORFOLK SOUTHERN RAILWAY	12270.00000V	12390.00000V					RECEIVER	RXONLY	L	NORFOLK SOUTHERN RAILWAY				
PROVIDENCE	WPO27	X	RHODE ISLAND STATE OF	12630.00000H						PASSIVE	WJC97P	Z	RHODE ISLAND STATE OF	12390.00000H			
PASSIVE	WPO27P	X	RHODE ISLAND STATE OF	12630.00000H						CHOPMIST HL	WJC97	Z	RHODE ISLAND STATE OF	12390.00000H			
JOURNAL SQ	WPO92	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12210.00000V						1 WORLD TRA	WPO93	L	PORT AUTHORITY OF NEW YORK & NEW JERSEY	12470.00000V			
WILBURTON	WPP84	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12530.00000V						MCALESTER	WPP85	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
MCALESTER	WPP85	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12270.00000V						STUART	WPP86	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
STUART	WPP86	L	OKLAHOMA STATE REGNTS FOR HIGHER ED	12530.00000V						TATE MTN	WPP87	L	OKLAHOMA STATE REGNTS FOR HIGHER ED				
REISNER ST	WPZ79	X	HOUSTON CITY POLICE DEPARTMENT CID	12270.00000H						1 SHELL PLZ	WPZ80	L	HOUSTON CITY POLICE DEPARTMENT CID	12530.00000H			
CARLSON LIB	WQW42	L	UNIVERSITY OF TOLEDO	12690.00000B						LEARNING CT	WQW43	L	UNIVERSITY OF TOLEDO	12430.00000B			

Status Codes
L = Licensed
X = Expired
Z = Questionable