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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

**VIA HAND DELIVERY**

Magalie Salas Roman, Esq.  
Office of the Secretary  
Federal Communications Commission  
445 12th Street, S.W., Room TW-A325  
Washington, D.C. 20554

Re: **Comments**  
**ET Docket No. 00-232**  
**Nucentrix Broadband Networks, Inc.**

Dear Ms. Salas:

On behalf of Nucentrix Broadband Networks, Inc., please accept an original, four copies, and a stamp return copy of the attached Comments in ET Docket No. 00-232. These Comments are filed in response to the "Interim Report on Spectrum Study of the 2500-2690 MHz Band: The Potential for Accommodating Third Generation Mobile Systems," which was released on November 15, 2000.

If you have any questions, please contact the undersigned at (202) 639-5639. Thank you for your attention to this matter.

Respectfully submitted,

  
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cc: Carroll D. McHenry (by mail)  
J. Curtis Henderson, Esq. (by mail)  
Henry M. Rivera (by hand)  
Edwin N. Lavergne (by hand)  
J. Thomas Nolan (by hand)

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BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of )  
 )  
Interim Report on Spectrum Study ) ET Docket No. 00-232  
of the 2500-2690 MHz Band: )  
The Potential for Accommodating )  
Third Generation Wireless Systems )

**COMMENTS OF NUCENTRIX BROADBAND NETWORKS, INC.**

Nucentrix Broadband Networks, Inc. (“Nucentrix”) hereby submits its comments on the above-captioned Interim Report issued on November 15, 2000, by the staff of the Federal Communications Commission (“FCC” or “Commission”).<sup>1</sup> The Interim Report examines technical characteristics of third generation (“3G”) systems, the existing and planned uses of the 2500-2690 MHz band, the ability for 3G systems to share spectrum with Multipoint Distribution Service (“MDS”)<sup>2</sup> and Instructional Television Fixed Service (“ITFS”) licensees, and possible options for segmenting these frequency bands to provide spectrum for 3G systems.

**I. BACKGROUND.**

Nucentrix is the third largest holder of MDS and ITFS spectrum in the United States, and currently is preparing to roll out fixed wireless broadband service in the 2.5 GHz band.<sup>3</sup> Nucentrix

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1. Interim Report, Spectrum Study of the 2500-2690 MHz Band: The Potential for Accommodating Third Generation Mobile Systems (rel. Nov. 15, 2000) (“Interim Report”).
  2. For the purposes of these comments, Nucentrix refers to Multipoint Distribution Service (“MDS”) and Multichannel Multipoint Distribution Service (“MMDS”) collectively as “MDS.”
  3. See Exhibit A at 3.

already is providing high-speed wireless Internet service in three markets pursuant to developmental authority,<sup>4</sup> and expects to launch commercial service under final FCC authorizations in 2001.

In a special filing window that opened this past August, Nucentrix filed more than 400 applications to provide two-way service in approximately 70 markets. On November 29, 2000, the Commission issued a Public Notice announcing the applications that were tendered for filing during that window, thus setting in motion the regulatory process for receiving authorization to provide two-way service.<sup>5</sup> Nucentrix also plans to file applications early next year to deploy broadband services in 15-20 additional markets. Nucentrix's business is built around the provision of a low-cost and reliable alternative to the DSL/cable duopoly in mostly rural and other underserved regions of the country where access to broadband services is limited or completely unavailable.

## **II. NUCENTRIX CONCURS WITH SUBSTANTIALLY ALL OF THE FINDINGS IN THE INTERIM REPORT.**

Nucentrix agrees with substantially all of the staff's findings in the Interim Report. Among other things, the Interim Report finds that (i) several billion dollars have been invested to develop broadband fixed wireless data systems in the 2.5 GHz band;<sup>6</sup> (ii) the demand for affordable broadband services in the U.S. will far outpace the ability of ILECs and cable operators to provide those services;<sup>7</sup> (iii) in rural areas and underserved markets, ITFS/MDS may be the *sole provider*

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4. These markets are Austin, Sherman-Denison and Amarillo, Texas. *See* Exhibit A at 3.

5. Mass Media Bureau Multipoint Distribution Service and Instructional Television Fixed Service Applications Tendered for Filing, Public Notice, Report No. 148, November 29, 2000.

6. Interim Report at 17.

7. *Id.* at 21.

of broadband services;<sup>8</sup> (iv) the ITFS/MDS spectrum is substantially encumbered throughout the United States;<sup>9</sup> (v) sharing the 2.5 GHz band with 3G systems appears virtually impossible;<sup>10</sup> and (vi) segmenting the 2.5 GHz band to accommodate 3G services would raise serious technical and economic difficulties for incumbents.<sup>11</sup>

Nucentrix intends to file detailed comments during the comment period established by the Commission's Notice of Proposed Rule Making in this proceeding, which is expected to be released by December 31, 2000. Nonetheless, these comments are being submitted to briefly address two issues raised in the Interim Report -- (i) options for possible segmentation; and (ii) issues associated with the relocation of MDS licensees that obtained BTA rights at auction.

### **III. SEGMENTATION WOULD RAISE SERIOUS DIFFICULTIES FOR INCUMBENTS IN THE 2.5 GHz BAND.**

With regard to proposals to divide the 2.5 GHz band into two or more segments in order to devote a portion of the spectrum to both 3G and ITFS/MDS systems, the Interim Report states that "because of the regulatory flexibility that the Commission has allowed in this band and the licensing differences between each geographic area, conclusions cannot be made regarding the implementation of a typical ITFS/MDS system."<sup>12</sup> However, this statement only begins to describe the extent of the problems that band segmentation would cause.

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8. *Id.* at 22.

9. *Id.* at 18-19.

10. *Id.* at 42-53.

11. *Id.* at 56-62.

12. *Id.* at 55.

Any band segmentation plan would result in ITFS/MDS operators having less spectrum in which to deploy two-way service, which, in turn, would increase the costs of service and, in some cases, result in no service at all. In order to provide the same level of service to customers in a given area using less spectrum, the spectrum must be reused more frequently throughout the service area.<sup>13</sup> To reuse the spectrum more frequently, a system must be designed around smaller cell sizes, with more cells being used to cover the service area. This substantially increases the costs of providing service, costs that must be passed on to customers in the form of increased prices.

The impact of cost increases due to loss of spectrum from band segmentation would particularly affect the rural and less densely populated markets served by Nucentrix. Most of Nucentrix's markets can be covered by a single base station, and a multicell design for these markets would be prohibitively expensive given the market demographics. Thus, the areas that the Commission has recognized as most in need of service could be deprived of service altogether.<sup>14</sup>

An additional and significant cost of any band segmentation plan would be the resulting delay in the introduction of high-speed service. Commercial operators and ITFS licensees have spent almost two years and devoted substantial resources to the design of channel plans and radio frequency networks for the markets they serve. Approximately 2,000 applications were filed in the initial filing window in August, and many more are expected to be filed when windows reopen early next year. Service in some of these markets already has been deployed. Further deployment will

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13. *Id.* at 61.

14. *Id.* at 22 (“in rural or otherwise underserved markets in the country, ITFS/MDS may be the sole provider of broadband service”).

continue in 2001.<sup>15</sup> Implementation of a band segmentation plan would undo all the work of the past two years, forcing long-term spectrum leases and interference coordination agreements to be renegotiated and band plans to be redesigned. High-speed service to millions of Americans would continue to be delayed, and in many instances, would not be deployed at all.

#### **IV. THE INTERIM REPORT RAISES SERIOUS CONCERNS REGARDING THE AUCTION PROCESS.**

Any effort to relocate incumbent licensees raises serious legal and policy concerns that may undermine the legitimacy of the auction process. In assessing the segmentation options, the Interim Report correctly points out that “this is problematic because . . . all of the MDS channels have been licensed on a geographic basis through the competitive bidding process and these geographic licensees have legal rights to build systems anywhere within their BTA that is not encumbered.”<sup>16</sup>

MDS bidders paid for rights that today permit them to provide fixed services of all kinds, including all of the services to fixed locations that fall within the 3G service umbrella.<sup>17</sup> Each BTA authorization holder has certain rights for a ten-year term commencing on the date the Commission declared bidding closed on the BTA auction.<sup>18</sup> Moreover, a BTA authorization holder can expect that its authorization will be renewed as long as it is capable of “demonstrating substantial service during the license term and compliance with applicable Commission rules, policies and the

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15. *Id.* at 21.

16. *Id.* at 57.

17. *See* Interim Report on Federal Operations in the 1755-1850 MHz Band: The Potential for Accommodating Third Generation Mobile Systems, at 5 (rel. Nov. 15, 2000) (“NTIA Interim Report”) (stating that 3G services will support mobile and fixed users).

18. 47 C.F.R. § 21.929(a)(1). For all currently outstanding BTA authorizations, the ten year term expires on March 28, 2006.

Communications Act.”<sup>19</sup> The rights of a BTA holder include: (i) the *exclusive* right to apply for authority to construct and operate new MDS facilities within the BTA;<sup>20</sup> (ii) the *exclusive* right to provide service within the PSA of an MDS incumbent whose license has been forfeited;<sup>21</sup> and (iii) the *exclusive* right to apply for authority to construct and operate a commercial station on ITFS channels.<sup>22</sup>

If a portion of the 2.5 GHz spectrum is reauctoned for 3G services, the MDS BTA authorization holders, who paid for certain exclusive rights in the 2.5 GHz spectrum, would find themselves in competition with others who have a conflicting claim to the same rights. In addition, the rights obtained at auction and the amounts paid therefor were based on, and are closely related to, long-term spectrum leases that were already in place. The loss of any or all of these rights may not be compensable, even if a compensation scheme were attempted.

The reauction of this spectrum is also problematic from a policy standpoint. If the spectrum could be reauctoned once, there appears to be no limit on the reauction process. If a “fourth-generation” wireless service emerges in the future, can the operation be repeated and the same spectrum sold again? Bidders competing for the right to provide 3G services in the reclaimed 2.5

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19. *Amendment of Parts 21 and 74 of the Commission’s Rules With Regard to Filing Procedures in the Multipoint Distribution Service and in the Instructional Television Fixed Service and Implementation of Section 309(j) of the Communications Act – Competitive Bidding*, Memorandum and Order on Reconsideration, 10 FCC Rcd 13821, 13822 (1995).

20. *See* 47 C.F.R. §21.903(b). Any MDS license issued pursuant to a BTA authorization will have a term that is coterminous with the BTA authorization itself. 47 C.F.R. §21.929(b).

21. *See* 47 C.F.R. §21.932(c).

22. *See Amendment of Parts 21 and 74 of the Commission’s Rules With Regard to Filing Procedures in the Multipoint Distribution Service and in the Instructional Television Fixed Service and Implementation of Section 309(j) of the Communications Act – Competitive Bidding*, Report and Order, 10 FCC Rcd 9589, 9612 (1995).

GHz spectrum surely will be mindful that the shoe could be on the other foot at some time in the future. Fundamentally, reauctioning spectrum is incompatible with the theory on which spectrum auctions are founded – the theory that the market, not the regulator, is in the best position to determine the most valuable use of spectrum.<sup>23</sup> A reauction would inevitably involve the Commission and, likely the courts, in decisions regarding the comparative value of different spectrum bands and different uses of the same spectrum band, and how to compensate purchasers for lost value. That is clearly not what Congress had in mind when it authorized the Commission to conduct spectrum auctions in the first instance.

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23. *See Implementation of Section 309(j) of the Communications Act -- Competitive Bidding*, Second Report and Order, 9 FCC Rcd 2348, 2361, ¶¶ 72-78 (1994).

## CONCLUSION

Nucentrix appreciates the opportunity to submit these comments on the Interim Report. We commend the Commission staff for preparing a comprehensive and accurate report on the use of the 2.5 GHz band and for recognizing that any reallocation of the band would be extremely problematic from a legal, operational and policy standpoint.

Respectfully submitted,

NUCENTRIX BROADBAND  
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December 5, 2000

## CERTIFICATE OF SERVICE

I, Shelia Wright, hereby certify that on this 5th day of December, 2000, I caused copies of the foregoing Comments by Nucentrix Broadband Networks, Inc. to be hand-delivered to the following:

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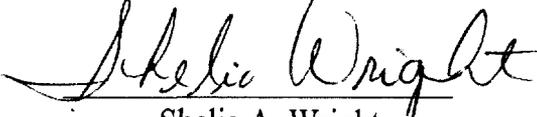
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Shelia A. Wright

# **EXHIBIT A**

## Executive Summary



### Corporate Background

*Organization* Nucentrix Broadband Networks, Inc. ("Nucentrix") is a Delaware corporation with corporate headquarters in Plano, Texas.

*Stock* NASDAQ: NCNX

*Mission Statement* Nucentrix's mission, as a facilities based carrier, is to provide low cost, reliable wireless IP broadband data and voice service, to regions of the United States in which the cable company and ILEC duopoly have either rolled out broadband service in limited areas or have ignored altogether due to the inherent economic limitations of their wire-based deployment models. Nucentrix provides a broadband bridge to reach virtually all businesses and residences in areas of 3,800 square miles around our transmission sites, regardless of size or geographic proximity to wireline duopoly infrastructures.

*Strategic Alliances* Nucentrix and Cisco Systems, Inc. have invested substantial resources in the research and development of new broadband wireless Internet and IP solutions which link customers to the Nucentrix network. Nucentrix and Cisco successfully completed wireless deployment trials in August 2000 using VOFDM technology, a non-line of sight technology which decreases the effects of multipath fading and narrowband interference that can exist in wireless operating environments.



*Spectrum* Up to 196 MHz of radio spectrum in the 2.1 and 2.5-2.7 GHz band. Nucentrix is the third largest holder of MMDS and ITFS spectrum in the United States behind WorldCom and Sprint.

*Households Covered* 9.4 million

## Service Offerings

- Video*           ★ multichannel video programming in 58 markets all of which use some or all of the ITFS spectrum
- Internet<sup>1</sup>*       ★ small business, SOHOs, telecommuters  
★ residential  
★ access at speeds from 128 Kbps (\$59.95 per month) to 1.54 Mbps  
★ technical support available 24 hours per day, 7 days per week  
★ e-mail  
★ Web design & hosting  
★ VPN (virtual private network)  
★ DNS (domain name service)
- Voice<sup>2</sup>*         ★ Local telephone service  
★ Long distance telephone service

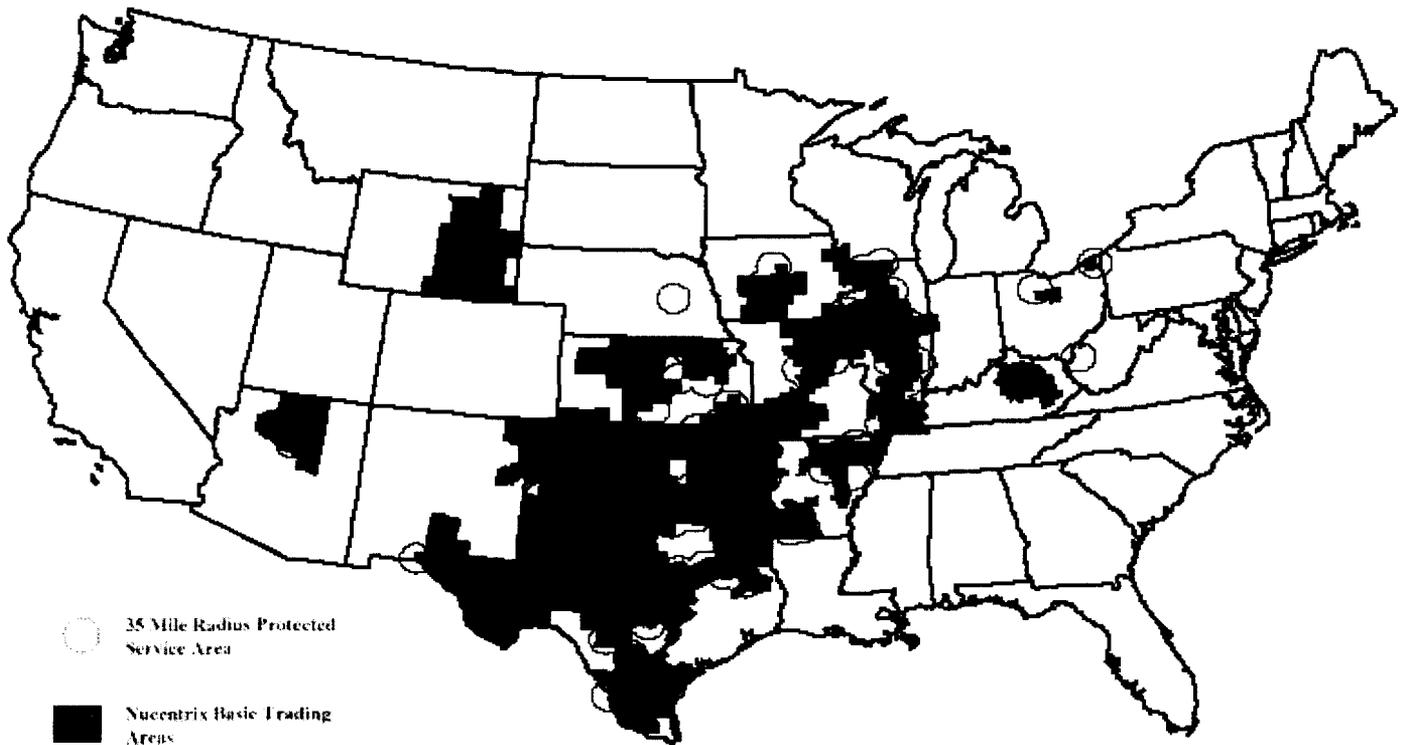
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<sup>1</sup> Currently available in Austin and Sherman-Denison, TX. High-speed Internet service will be deployed in other markets following the grant of pending FCC applications for two-way service.

<sup>2</sup> Nucentrix plans to add voice services as part of a bundled offering of voice, video and data services.

## The Market

*Licensed Coverage Area* Nucentrix has created a broadband wireless network by engineering systems which include leased ITFS spectrum and its own MMDS incumbent licenses and BTA stations. The combination of ITFS and MMDS spectrum provides the capacity needed to serve Nucentrix's coverage area of an estimated 9.4 million households in 95 markets across Texas and the midwestern United States. The map below depicts Nucentrix's markets (BTAs and PSAs).



*Current Video Markets* Nucentrix operates multichannel video businesses over its wireless transmission facilities in 58 markets throughout its BTAs.

*Current Two-Way Markets* Since 1999, Nucentrix has been providing two-way wireless broadband Internet access in Austin, Texas and Sherman-Denison, Texas over MMDS spectrum under developmental FCC licenses. In 2000, Nucentrix began providing two-way service over MMDS, MDS and ITFS spectrum in Amarillo, Texas, under additional developmental FCC licenses.

*Pending Two-Way Applications* In the FCC's initial filing window for two-way service held in August 2000, Nucentrix filed 410 applications to provide service in 70 markets. (see Figure 1, attached, which identifies those markets for which Nucentrix filed two-way

applications).

*Two-Way Infrastructure*

Of 70 markets filed, approximately 85% are large single-cell or "supercell" architecture. This network design justifies coverage to less dense, rural areas, but will require more bandwidth than multicell architecture.

*One-Day Rolling Filing Window*

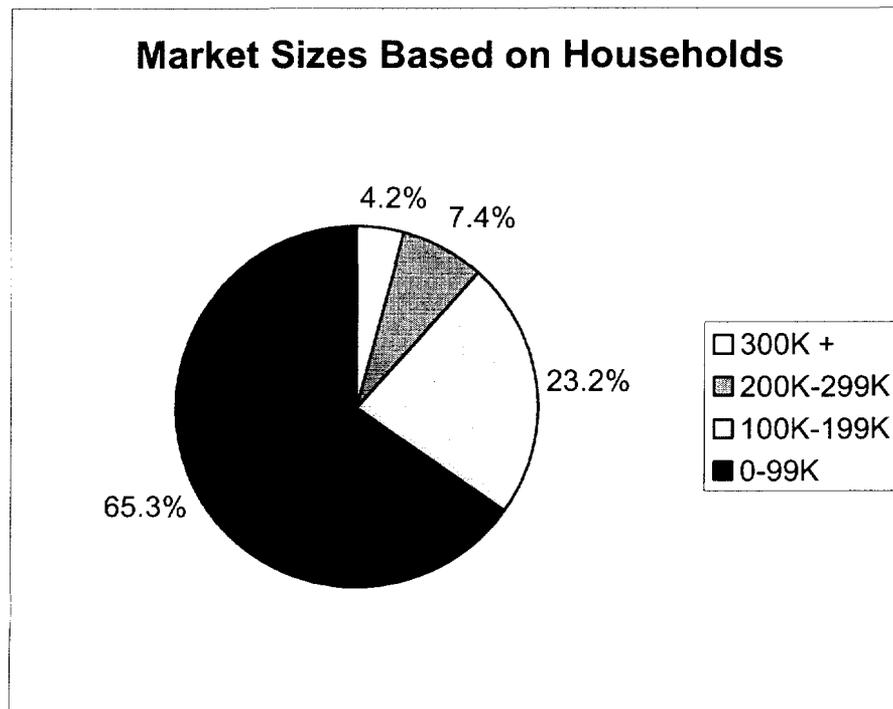
Nucentrix plans to file applications in the FCC's rolling filing window in early 2001 to provide two-way service for its remaining markets.

*Continued Expansion*

Nucentrix intends to continue expanding service throughout its existing service areas and in new service areas through acquisition opportunities, extending its network's reach further into rural America. The company plans to launch facilities based broadband wireless Internet service in 15-20 new markets in 2001.

*Nucentrix Markets*

Nucentrix currently owns 93 BTAs, which Nucentrix acquired in the FCC auction in 1996, and which, along with incumbent MMDS licensees and leased ITFS spectrum, cover an estimated 9.4 million households. (see *Figure 1*, attached, for a complete listing of Nucentrix markets). Nucentrix's dedication to reaching unserved markets is reflected in the following chart, which shows that approximately two-thirds of Nucentrix markets have less than 100,000 households.



## Nucentrix's MMDS/ITFS Network

**Bandwidth** Up to 196 MHz per market (see Figure 2 for MDS/MMDS/ITFS assigned frequencies)

**Speed** Per channel symmetrical data rates of up to 20 Mbps

**Coverage Area** 3,800 square miles per tower (based on the 35 mile radius of an MMDS/ITFS network)

**Advantages** Fast & cost efficient deployment. Infrastructure consists of a transmit/receive tower connected to the Internet. Once the tower is deployed, customers can be immediately connected with the installation of a transmit/receive antenna anywhere within the 35 mile coverage area of the tower. Other than the initial tower construction, Nucentrix only incurs the added infrastructure expense of connecting *actual* customers when they want service, unlike the wireline models which require the substantial investment and long construction timelines for constructing systems to pass by *prospective* customers.

Rural applications. Systems operating on the MMDS/ITFS bands are particularly well suited for the deployment of broadband access in rural areas because they have the largest coverage area (up to 35 mile radius from the transmit/receive tower) which reaches enough customers in sparsely populated areas to justify network construction costs in these markets. Because the propagation characteristics at frequencies above the 2.5 GHz band significantly decrease the coverage area, competitive broadband wireless alternatives cannot reach enough customers in sparsely populated areas to justify rural deployment.

Dedicated Connection. Nucentrix provides customers with secure, dedicated broadband connections.

## Competitive Alternatives

### Wired Systems

**Analog Modem** Coverage Area: Generally, wherever touch tone service is available. Speed: 28.8 Kbps – 56 Kbps. Advantages: Cheapest method for accessing the Internet. Disadvantages: Extremely slow download rates. Because access is not dedicated, customers may not be able to connect during peak hours and may be disconnected in the middle of Internet access sessions. Narrow bandwidth severely hampers a customer's ability to access broadband multimedia sites.

*ISDN*            Speed: **56 Kbps – 128 Kbps.** Advantages: Dedicated. Internet connection does not tie up the line enabling the placement or receipt of telephone calls. Disadvantages: Inefficient because bandwidth lies unused but dedicated for a large percentage of the time.

*DSL*            Coverage Area: **13 – 80 square miles.** Speed: **144 Kbps – 1.54 Mbps (symmetrical).** Advantages: Dedicated. Disadvantages: Because current deployment is limited to 18,000 feet from ILEC's central office, service is available only in limited areas. Speed generally degrades significantly if the distance to customer is greater than 13,000 feet from the serving central office. Copper plant generally needs extensive conditioning, if possible, before a central office can be set up for DSL service.

*Cable Modem*    Speed: **128 Kbps – 2 Mbps.** Advantages: Can be bundled with video. Disadvantages: Shared bandwidth drops as the number of subscribers accessing the Internet simultaneously increases. Cable systems typically do not pass businesses. Consequently, service is generally limited to residential areas.

*Fiber*            Speed: **high speed; only limited by electronics/hardware.** Advantages: Bandwidth Disadvantages: Because of its extreme deployment costs (\$50,000 - \$100,000 per mile), fiber optic cable is generally used only in dense urban centers or large office complexes. Therefore, many businesses and the majority of households are not located on fiber rings.

### Wireless Systems

*Cellular / PCS*    Speed: **56 Kbps; 144 Kbps (expected late 2000); 384 Kbps (expected 2003 using 3G)** Advantages: Narrowband e-mail bundled with voice. Disadvantages: System capacity is shared with mobile PCS operations. High deployment/upgrade costs. Narrow bandwidth. Insufficient speed. Limited applications for mobile phones and PDAs.

*LMDS*            Speed: **up to 155 Mbps.** Advantages: High capacity. Disadvantages: Not suitable for areas without significant population densities because systems only provide 2-3 mile path links. Limited by line of sight and distance. Extremely small size of radio wave such that signals can be affected by inclement weather.

*Satellite*        Speed: **upstream (currently limited to phone line return); downstream (56Kbps – 768 Kbps)** Advantages: Can be bundled with video. High geographic coverage area. Disadvantages: Limited upstream capability. Distance that IP traffic must travel can cause latency.

## Spectrum Licenses & Leases

*Frequencies* See Figure 2, attached, for MDS/MMDS/ITFS assigned frequencies.

*MDS 1,2/2A* Frequency (MHz): 2150-2162

*H1-H3<sup>3</sup>* Frequency (MHz): 2650-2656 (H1); 2662-2668 (H2); 2674-2689 (H3)

*MMDS E1-F4* Frequency (MHz): 2596-2644

Nucentrix owns 75% of its MDS and MMDS channels and leases the remaining 25%.

*ITFS A1-D4* Frequency (MHz): 2500-2596

*G1-G4* Frequency (MHz): 2644-2650 (G1); 2656-2662 (G2); 2668-2674 (G3);  
2680-2686 (G4)

The bulk of network bandwidth comes from ITFS licensees who lease excess capacity to Nucentrix under long term leases of **10-15 years** with one or two automatic renewal periods. If the leased channels are used for analog video, the licensee leases to Nucentrix capacity in excess of 20 hours per week per channel reserved to the licensed institution for educational purposes. If the leased channels are used for digital transmission, the licensee leases up to **95%** of the channel capacity to Nucentrix. The remaining **5%** is reserved for the institution's educational usage.

No. of ITFS Licensees: 408

No. of ITFS Leases: 447

*Sample  
Band Plans*

Figure 3 represents the template band plan guidelines used by Nucentrix in designing its two-way fixed wireless broadband networks. The templates were derived from guidelines agreed upon among industry operators and licensees in various system coordination agreements. The company's currently anticipated technology platform currently requires up to 36 MHz (six 6 MHz channels) of guard band separation between the upstream and downstream channels used in a system. In order to make the most efficient use of allocated spectrum, it is necessary to locate the upstream and guard band channels on either the upper or lower edge of the frequency band. This allows an operator to take advantage of having only one side of the band adjacent to the downstream channels thereby limiting the necessity for guard band channels to only one side of upstream frequency band. Nucentrix and its licensees filed in 1998 and 1999 modification applications to add digital emissions designators to substantially all of their Commission authorizations.

<sup>3</sup> The MDS H1, H2, and H3 channels are interleaved with the ITFS G1, G2, G3, and G4 channels.

In super-cell configurations, Nucentrix plans to utilize existing or previously filed ITFS/MDS/MMDS authorizations for downstream transmissions. Only upstream response station and response station hub applications were filed in the August 2000 filing window for super-cell market configurations. In multi-cell or cellular configurations, both hub/upstream response stations and downstream booster station applications were filed in the window.

*Channel Separation*

The table below depicts the current guard band requirement guidelines for the duplexers of the company's currently anticipated technology platform. Similar requirements currently are necessary for other commercially available platforms.

**Guard Band Guideline**

<b>Passband Bandwidth (MHz)</b>	<b>Minimum Band Separation (MHz)</b>
6	24
12	24
18	30
24	30
30	30
36	30
42	36
48	36
54	36
60	36

Nucentrix plans to make efficient use of guard band channels to provide video services or for point-to-point backhaul links in its broadband wireless network.

**FIGURE 1**

**NUCENTRIX MARKETS**

<u>Market</u>	<u>Estimated Total Households</u>	<u>Operating Video Market</u>	<u>Two-Way Application Pending</u>
<b><u>Texas</u></b>			
Fischer, TX	444,035		
Austin, TX	441,732	✓	✓
El Paso, TX	237,595		✓
Corpus Christi, TX	169,553	✓	✓
Temple/Killeen, TX	140,213	✓	✓
Amarillo/Borger, TX	134,314		✓
Tyler, TX	126,050		✓
Midland/Odessa, TX	119,556	✓	✓
Waco, TX	114,379	✓	✓
Lubbock, TX	113,357	✓	✓
Sherman/Denison, TX	111,665	✓	✓
Longview, TX	106,164		✓
Jourdanton/Charlotte, TX	102,143	✓	✓
Corsicana/Athens, TX	96,711	✓	✓
Texarkana, TX	81,680	✓	✓
Palestine/Kossuth, TX	72,684		✓
Lufkin, TX	71,664		✓
O'Donnell, TX	66,666	✓	✓
Wichita Falls, TX	65,910	✓	✓
Abilene, TX	64,446	✓	✓
Mt. Pleasant, TX	58,531	✓	✓
Laredo, TX	51,647	✓	✓
Burnet, TX	51,359		✓
Paris, TX	43,326	✓	✓
Strawn/Ranger, TX	43,286	✓	✓
Gainesville, TX	40,848	✓	✓
Kerrville, TX	37,416	✓	✓
Kingsville/Falfurrias, TX	32,809	✓	✓
Hamilton, TX	31,754	✓	✓
Olton, TX	27,606	✓	✓
George West, TX	23,469	✓	✓
Uvalde, Sabinal, TX	18,713	✓	✓
<b>Total</b>	<b>3,341,281</b>		

<u>Market</u>	<u>Estimated Total Households</u>	<u>Operating Video Market</u>	<u>Two-Way Application Pending</u>
<b><u>Illinois</u></b>			
Rockford, IL <sup>4</sup>	250,000		✓
Ottawa/LaSalle, IL	240,995		
Peoria, IL	206,728	✓	✓
Freeport, IL	140,880	✓	
Springfield/Decatur, IL	107,033		✓
Champaign, IL	105,578	✓	✓
Vandalia, IL	94,938	✓	
Taylorville, IL	93,341	✓	
McLeansboro, IL	89,370	✓	✓
Macomb/Walnut Grove, IL	85,051	✓	
Olney, IL	71,785	✓	
Quincy, IL	68,230		✓
Jacksonville, IL	45,253	✓	✓
<b>Total</b>	<b>1,599,182</b>		
<b><u>Oklahoma</u></b>			
Tulsa, OK	328,108	✓	✓
Lawton, OK	82,780	✓	✓
Stillwater, OK	82,402	✓	✓
Bartlesville/Ponca City, OK	81,564		✓
Muskogee, OK	80,772	✓	✓
Lindsay, OK	59,317	✓	✓
Lenapah, OK	56,708		✓
Ardmore, OK	53,606	✓	✓
Ada, OK	49,077	✓	✓
Holdenville, OK	49,061		✓
Enid, OK	40,519	✓	
McAlester, OK	39,376	✓	
Weatherford, OK	29,284	✓	✓
Altus, OK	27,529		
Elk City, OK	26,270		
Watonga, OK	24,185	✓	✓
Woodward, OK	14,322	✓	✓
<b>Total</b>	<b>1,124,880</b>		

<sup>4</sup> Subject to pending definitive agreement or letter of intent to acquire and FCC approval.

<u>Market</u>	<u>Estimated Total Households</u>	<u>Operating Video Market</u>	<u>Two-Way Application Pending</u>
<b><u>Arkansas</u></b>			
Forrest City, AR	174,040		
Paragould, AR	143,895	✓	
Fayetteville, AR <sup>4</sup>	109,910		
Fort Smith, AR <sup>4</sup>	101,955		
El Dorado, AR	79,821		
Searcy, AR	77,704		✓
Magnolia, AR	<u>59,005</u>		
<b>Total</b>	<b>746,330</b>		
<b><u>Missouri</u></b>			
Springfield, MO	145,194		✓
Sikeston/Cape Girardeau, MO	132,236	✓	
Columbia, MO	103,910		✓
Jefferson City, MO	47,488		✓
Montgomery City, MO	91,991	✓	✓
Monroe City/Lakenan, MO	<u>70,898</u>	✓	✓
<b>Total</b>	<b>591,717</b>		
<b><u>Kansas</u></b>			
Topeka, KS	113,665		✓
Chanute, KS	56,717	✓	✓
Marion KS	55,620	✓	
Great Bend, KS	54,404		✓
Manhattan, KS	53,247	✓	✓
Sterling, KS	45,901	✓	✓
Medicine Lodge/Anthony, KS	30,322	✓	
Hays, KS	29,330		✓
Beloit, KS	<u>20,686</u>	✓	✓
<b>Total</b>	<b>459,892</b>		
<b><u>Pennsylvania</u></b>			
Greenville, PA	<u>342,684</u>	✓	
<b>Total</b>	<b>342,684</b>		
<b><u>Kentucky</u></b>			
Lexington, KY <sup>4</sup>	247,500		✓
Paducah/Mayfield, KY	<u>77,157</u>		
<b>Total</b>	<b>324,657</b>		

<u>Market</u>	<u>Estimated Total Households</u>	<u>Operating Video Market</u>	<u>Two-Way Application Pending</u>
<b><u>Iowa</u></b>			
Des Moines, IA	227,572		✓
Radcliffe/Story City, IA	<u>76,546</u>	✓	✓
<b>Total</b>	<b>304,118</b>		
<b><u>Ohio</u></b>			
Bucyrus, OH	<u>239,225</u>	✓	✓
<b>Total</b>	<b>239,225</b>		
<b><u>West Virginia</u></b>			
Charleston, WV	<u>185,583</u>		
<b>Total</b>	<b>185,583</b>		
<b><u>Wyoming</u></b>			
Cheyenne, WY	34,279		✓
Casper, WY	<u>31,554</u>		✓
<b>Total</b>	<b>65,833</b>		
<b><u>Florida</u></b>			
Lake City, FL	<u>51,790</u>		
<b>Total</b>	<b>51,790</b>		
<b><u>Arizona</u></b>			
Flagstaff, AZ	<u>46,150</u>		
<b>Total</b>	<b>46,150</b>		
<b>Market Total</b>	<b>9,423,322</b>		

**FIGURE 2**

# MDS-ITFS-MMDS Assigned Frequencies

ITFS, MDS and MMDS Channels  
 Each Channel = 6 MHz  
 ITFS = A, B, C, D, G  
 MMDS = E, F  
 MDS = H1, H2, H3, I, 2/2A  
 Response Channels = I(H4)

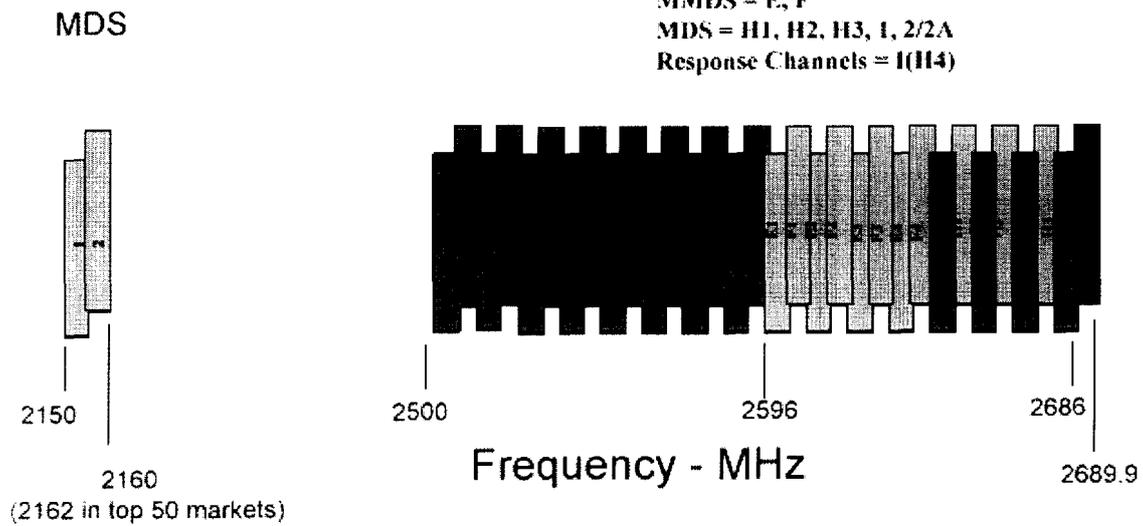
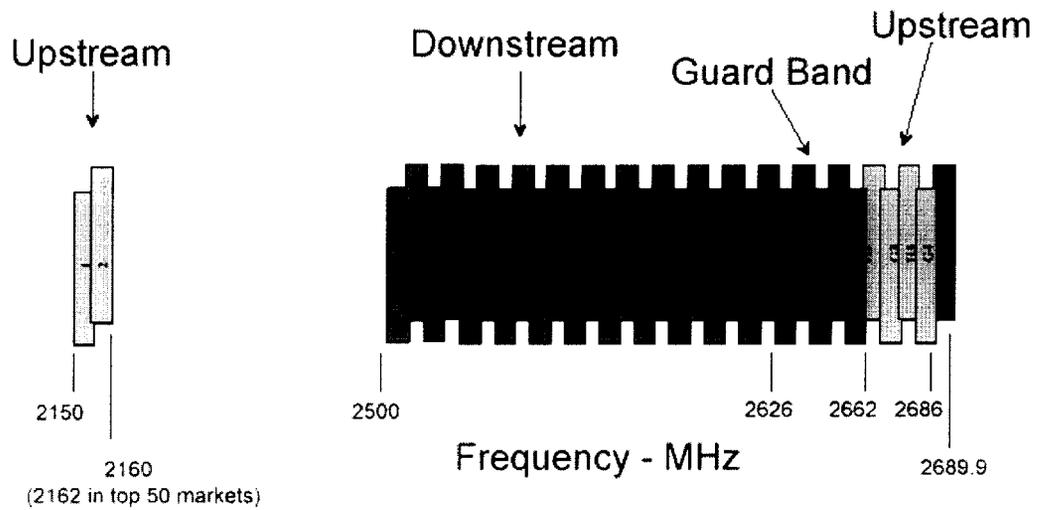


FIGURE 3

## Nucentrix Band Plan 1



## Nucentrix Band Plan 2

