Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Facilitating the Provision of Spectrum-Based	)	WT Docket No. 02-381
Services to Rural Areas and Promoting	)	
Opportunities for Rural Telephone Companies	)	
To Provide Spectrum-Based Services	)	

REPLY COMMENTS OF SPACE DATA CORPORATION

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Space Data Corporation ("Space Data") is pleased to submit these reply comments in the above-captioned NOI addressing the development of spectrum-based services in rural areas.[1] As a startup venture with its primary focus on extending terrestrial wireless services to rural and other underserved areas, Space Data applauds the Commission's initiative in issuing this NOI.

I. INTRODUCTION AND SUMMARY

Vast geographical areas are underserved by wireless operators because the population bases within those areas cannot economically support the installation and operation of base stations and their requisite antenna towers. This constraint is common to all of the conventional common carrier services, including paging, messaging, data, and voice. In evaluating this serious deficiency, Space Data has concluded that an economically viable solution is possible, and has proceeded to develop an innovative system that is nearing commercial deployment.

The Space Data system utilizes inexpensive weather balloons (SkySites™) to carry miniature radio repeaters to a height of approximately 100,000 feet. A constellation of such balloons can substantially provide ubiquitous wireless coverage of the continental United States. The Commission has granted Space Data a waiver to operate these devices as terrestrial base

[1] *See Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services,* Notice of Inquiry, FCC 02-325 (Dec. 20, 2002) (*"NOI")*. Because of the FCC closing on February 18, 2003, as a result of adverse weather conditions, the comment deadline was extended to February 19, 2003, pursuant to subsections 1.4(e)(1) and (j) of the Commission's rules. *See* 47 C.F.R. §§ 1.4(e)(1) and (j); *see also* FCC Public Notice, *FCC Closed February 18, 2003* (Feb. 19, 2003). All comments filed in this proceeding will hereinafter be short cited.

stations. Space Data currently is licensed to provide Narrowband PCS services on a 50 kHz paired nationwide channel. Moreover, Space Data has participated in spectrum Auction No. 41, and has acquired sufficient additional spectrum to accommodate regional and nationwide operations.[2]

Several commenters in this proceeding have advocated that allowable power levels be increased in rural areas in order to allow coverage of larger areas and thus improve the economics of antenna site infrastructure in sparsely populated regions. Another way to increase coverage areas for antennas is to make the antenna higher. Increasing tower height, however, quickly reaches inherent limits due to aircraft safety and the strength of materials. Space Data, and several other companies developing stratospherically based communications platforms, are pursuing approaches of very high antennas without the limits of towers. Since specific technologies are not the primary focus of this proceeding, readers are referred to our web site (www.spacedata.net) for additional system information.

Although the NOI focuses on the role of rural telcos, Space Data emphasizes that its business plan is based on providing system enhancement services to primary wireless carriers. Space Data does not intend to become a competing carrier or to market its services directly to the consumer. Our objective is to be a carrier's carrier. As such, Space Data contends that the Commission's rules should permit, through mutual agreement, flexible use of spectrum licensed to other entities. Such flexible access should be applicable to both the Commercial and Private Radio Services.

II. THE REALITY OF DEMOGRAPHICS AND THE STATE OF WIRELESS COVERAGE IN RURAL AREAS

The NOI requests information on the availability of wireless services in rural areas, particularized data on wireless coverage and provision of services in rural areas. Exhibit A contains excerpts of a presentation I recently made at the 2002 Tower Summit and Trade Show, which contains much information on these topics.[3] The lack of availability of advanced services in rural areas is a simple matter of demographics. As Slide 1 in Appendix A shows, based on data from the 2000 Census at the ZIP Code Tract Area (ZCTA) level, approximately 80% of the

[2] Universal Licensing System File Nos. 0000646751, 0000646753, 0000646785, and 0000646790.
[3] Gerald Knoblach, Space Data Corporation, *Track Four: Expanding the Infrastructure, Alternative Resources for Better Coverage and Capacity*, Presentation at the 2002 Tower Summit and Trade Show (Nov. 14, 2002).

population lives in only 10% of the landmass of the continental U.S. If a wireless carrier can cover 80% of the population by covering only 10% of the landmass, and making the simplistic assumption that all towers cover the same area for a given technology, then a carrier is faced with a simple question: Should it build ten times the number of towers or simply ignore the sparsest 20% of the population? For an enterprise wishing to maximize profits the answer is straightforward and 20% of the population is ignored. However, since urban customers often drive between urban areas and demand wireless coverage while doing so, some national carriers build out to cover 90% of the population. Even within a coverage area there are deadzones, which leave on average 9% of the people in major urban areas uncovered by a particular carrier's network.[4] Thus, taken together, somewhere between 48 and 76 million people lack digital wireless coverage. This is equivalent to at least the combined population of California, Oregon and Washington. Thus, the problem is not that the rural markets are small. It is that the current technology (towers) cannot cost-effectively address the market.

Space Data has gathered coverage data on several types of mobile wireless services. Slide 2 in Exhibit A shows coverage of carriers with dedicated two-way text messaging networks. This data is based on the ZIP codes covered by each carrier as obtained from the carrier's website. The percent coverage is the cumulative of the 2000 Census ZCTA's population and area for those ZIP codes divided by the total population of the continental U.S. As the data shows, the carrier with the best coverage still leaves 15% of the population (42 million people) and 72% of the landmass without coverage. Slide 3 shows the coverage of the six national wireless voice carriers. This data is based on commercially available coverage contours and 2000 Census data at the census block level. The national coverage statistics were calculated using commercial Geographic Information System software (i.e. MapInfo). The numbers of towers for each carrier are from an investment banking report.[5] Again these maps show that the best national carrier leaves 13% of the population (36 million people) and 70% of the landmass uncovered. Of course the cellular and PCS carrier rely heavily on intercarrier roaming agreements to improve the coverage available to a subscriber. Slide 4 in Exhibit A shows the coverage of the six major digital wireless voice technologies to the census block level. The top row shows the 2.5G technologies with the best leaving 12% of the population and 68%

[4] John P. Kelly, CEO Crown Castle International Corporation, Speech at Fourth Annual Tower Industry Summit and Trade Show, at 16 (Nov. 2001).

of the landmass without coverage. The bottom row shows the older 2G technologies with the best leaving at 8% of the population and 40% of the landmass uncovered.

However, the coverage is actually worse than this for the typical subscriber who carries a fractional-watt handset. Often, the 850 MHz cellular areas in rural states are only built out for coverage to 3-watt user equipment. Nathan Hopper commented on this earlier in this proceeding when he said, "[w]hat worked using three-watt portable telephones so common in the early 1990s no longer provides sufficient service when used with .6–watt mobile telephones. Even on Interstate 90, the most significant east-west route in the country, continuous and reliable coverage does not exist within the state [of South Dakota]."[6] Indeed, Space Data commissioned a telephone survey last month of people living beyond one-way paging coverage (among the sparsest 5% of the population). Three-watt portable bag phones or car phones were still in use by 46% of the wireless voice subscribers in this group. This confirms what I learned last summer while traveling through Mobridge, South Dakota (population 3574). The local wireless reseller in Mobridge said that nearly half his customers still rely on three-watt user equipment because it is required to get adequate coverage. He echoed the comments of Mr. Hopper who said, "[a]s technology advances, the ability of end-users to obtain this type of equipment diminishes. Soon a point will be reached when it is simply impossible for both technological and financial reasons to obtain the equipment."[7]

Slide 5 in Exhibit A shows the aggregated analog cellular coverage with 3-watt user equipment is significantly degraded if the user relies on a fractional-watt handset. Here we approximated the best-case coverage for an analog fractional-watt handset by plotting a 12.5 mile radius around all the cellular towers locations as listed in the Universal Licensing System database and defining as covered all areas with population densities greater than 100 people per square mile, since carriers are only required to report cellular tower locations which define the three-watt coverage boundary of their network. With the recent five-year sunset on the requirement to offer AMPS service on all cellular towers, coverage in rural area may actually get worse as digital user equipment is not available in three-watt versions without an expensive in-vehicle booster accessory. In addition, the towers shown will no longer all be of one uniform

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[5] *Committed to the Tower*, MORGAN STANLEY WIRELESS TELECOM SERVICES, Mar. 27, 2002, at 21.
[6] Hopper Comments at 1 (Jan. 2, 2003).
[7] *Id.*

technology, but split between up to three non-compatible technologies. Already, major carriers have announced the early decommissioning of ancillary services to AMPS, which are not mandated by regulations, such as Cellular Digital Packet Data (CDPD).[8] This has created a new demand in the rural marketplace for innovative solution's like Space Data's.

Even if the capital markets improve and funding is available for 3G rollouts, the extra capital expenditures will not likely result in improved rural coverage. Slide 6 in Exhibit A plots the combined coverage of all cellular and PCS networks versus the cumulative capital expenditures of the industry.[9] From 1986 to 1994, the cellular duopoly existed and approximately $20 billion was expended to cover roughly 45% of the landmass. Then the PCS auctions occurred and cumulative capital expenditures for the industry more than doubled during the next three years. However, coverage remained roughly the same, as all the capital expenditures went toward building out multiple new PCS carriers in the already-covered, urban areas and the cellular operators spent heavily on deploying digital overlays in existing coverage areas. During the late 1990s, carriers made gains by building out the major highways. Since it has been reported that 3G services will require up to three times the cell site density to maintain the same coverage area, any 3G capital expenditures that the financial markets agree to fund will surely be spent in areas that are already covered.

Before leaving the coverage issue it is important to comment on how critical the resolution of the data is when calculating coverage statistics. Space Data agrees with the National Rural Telecommunications Cooperative's comments earlier in this proceeding: "NRTC applauds the Commission's reevaluation and clarification of its cable Homes Passed statistic. However, the Commission's terrestrial wireless statistics may be suffering from the same type of flawed analysis."[10] The FCC should be commended for increasing the granularity of coverage data over time. The fourth CRMS report had mapped coverage by the 493 Basic Trading Areas (BTAs). The fifth CRMS report mapped coverage by the 3219 counties. This county-level resolution has been maintained in the sixth and seventh CRMS reports. However, with some national wireless carriers having nearly 18,000 cell sites yet covering less than a quarter of the nation's landmass, the assumption that one cell site in a county means the county has service and

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[8] Mike Dano, *Carrier to Quit CDPD Network*, RCR WIRELESS NEWS, Oct. 28, 2002, at 1.
[9] Cumulative capital expenditure data from Cellular Telecommunications and Internet Association's semi-annual wireless industry survey/coverage data from *Committed to the Tower* (Mar. 27, 2002).

the entire county's landmass and population is aggregated into a national statistic obviously overstates actual coverage. The geographic resolution must be equal to or smaller than the average coverage of a cell site for statistics to be meaningful. Possible alternatives are the 33,178 ZIP Code Tract Areas defined by the Census Bureau in 2000, the 65,344 Census Tract Areas or the over 8 million Census Blocks. Coverage data at the ZIP Code resolution is typically available on a carrier's website. MapInfo, Telecom Mapping Company and others sell digital contour maps of the carriers' coverage as depicted on the carriers' websites or marketing literature. This can be correlated to any resolution of data using a commercial GIS program such as MapInfo or ArcView by ERSI. However, higher resolution is not always better. We note that rural Census Tract Areas are actually larger than rural ZIP Code Tract Areas in many regions. Also, using an approximation of considering an area covered if its centroid is covered often leads to overstating coverage as the centroid of ZIP Codes Tract Areas and Census Tract Areas are often on major highways, while the actual tract area extends for several miles away from the highway. Thus, for carriers who build out narrow corridors along highways, this method would overstate true coverage.

III. INNOVATIVE PLATFORMS FOR RURAL WIRELESS

In an ideal world, the cost to provide a person with wireless service would be the same no matter where he/she lived. If this were true, then this NOI would not be necessary and there would be no need for the Universal Service Fund. However, reality is that a carrier must recover the cost of a base station from the subscribers the base station serves. With 80% of the population in areas having average population densities thirty times greater than areas where the sparest 20% of the population lives, it makes sense to target areas where the average base station has thirty times the number of potential subscribers. The solution is to somehow expand the footprint of the base station so in rural areas it covers the same people as an urban base station covering a much smaller area. In practice this works well to the point that towers become hazards to aircraft (200 feet) or, even with special precautions to protect aviation, the strength of steel is simply not sufficient to build higher without great cost (about 2000 feet high). Until now there has been the option to go much higher with satellites. However, satellites have proven

[10] NRTC Comments at 12 (Feb. 3, 2003).

unsatisfactory for rural coverage because they require special, high-power user equipment, which is expensive and bulky because it is produced in low volume.

The most important practical constraint for a successful rural wireless system is that it must use the same user equipment as the urban market. This is because low-cost user equipment is the key to market adoption. With the rural market being a fraction of the size of the urban market and user equipment pricing being largely driven by volume, the rural market must share the mass produced user equipment. This is why the recent FCC ruling allowing MSS operators to incorporate Ancillary Terrestrial Components (ATC) into their service is unlikely to improve rural wireless service.[11] The ATC handsets are required to be dual-mode. The satellite mode either requires high power and large antennas to talk to geostationary satellites or must compensate for high Doppler shifts to talk with LEO satellites. Thus, it is by definition a specialty item that will be produced in small volume compared to the hundreds of millions of GSM handsets produced each year.

Thus, what the rural market needs is a "Goldilocks Tower" which is not too tall and not too short. Satellites are too tall since they require special user equipment. Towers are too short because even the highest tower cannot cover enough subscribers to pay for itself in many rural areas. The "Goldilocks Tower" is exactly what Space Data and at least four other companies are actively developing. They are wireless platforms which float in the stratosphere above Federal Aviation Administration (FAA) controlled airspace. Since they are above 60,000 feet, or 15 miles, high they can aggregate sparsely populated subscribers over an area equivalent to hundreds of towers into one piece of infrastructure equipment. These platforms take several forms: tethered blimps, high-altitude manned airplanes, high-altitude unmanned airships, unmanned solar airplanes and Space Data's weather balloons with miniature wireless repeaters. Some can maintain a position over one spot on earth and some drift with the wind like Space Data's. Space Data relies on continual launches to fill the constellation so that as one platform drifts out of range another one is drifting into range. A redundant constellation provides high reliability. An on-board Global Positioning System receiver provides tight control of transmit frequency, protocol timing, and transmit power near service area borders. The lightweight (less than six pounds) platforms parachute gently back to earth after 24 hours and are recovered and

reused. They are so small that, unlike the other alternatives, our system has received formal approval by the FAA to fly safely in the U.S. As they are produced in large volumes, just like the user equipment, the cost per platform is very low. Our goal for this technology is to ultimately achieve the ideal of providing wireless service to the most sparsely populated areas at approximately the same cost per person as towers provide in urban areas. We applaud the FCC for helping foster this innovation by granting Space Data a waiver to treat our SkySites™ as base stations under the Narrowband PCS rules. We have continued to develop this technology in spite of the challenging financial markets and are preparing to launch a regional, commercial network later this year.

IV. DEFINITION OF "RURAL AREA"

The Commission also has requested comment addressing the definition of "Rural Areas." The challenge facing the Commission is that this definition must be flexible. If a person or community does not have access to wireless services, they should not have to be concerned with their location having to conform to a definition. A definition that fits one type of wireless service will likely not fit another wireless service. Space Data suggests that the Commission view geographical differences in terms of how spectrum can be used. Thus, the dividing line between rural and urban communities should depend upon how spectrum is utilized, not a fixed population density or whether there are farms nearby.

Wireless systems can be broken down into two major categories: 1) high-site, high-power, "noise-limited" systems, the goal of which is to maximize coverage area for a given piece of infrastructure, and 2) multiple site, low-power, "interference-limited" systems, the goal of which is to maximize capacity for a given amount of spectrum and infrastructure. While it is the interference between these two types of systems that is currently the subject of the FCC proceeding on reducing interference between public safety and commercial mobile radio service in the SMR bands, it is important to note that interference only is a problem when the two systems use non-compatible technologies and do not allow roaming between systems.[12] The six national wireless voice carriers have both types of systems in their networks. In rural areas they

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[11] *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, Report and Order and Notice of Proposed Rulemaking, FCC 03-15 (Feb. 10, 2003).
[12] *Improving Public Safety Communications in the 800 MHz Band*, Notice of Proposed Rule Making, 17 FCC Rcd 4873 (2002).

deploy omnidirectional antennas on the highest towers practical and thus build noise-limited systems (especially when a user only has a fractional-watt handset). In urban areas they deploy multiple, low power sites and have interference-limited systems. A user standing under an urban tower would not be able to hear the rural, omnidirectional tower in the distance because of the adjacent channel interference caused by the urban tower. However, this scenario presents no problem because the user will have long ago been handed off to the urban tower if the technologies are compatible and roaming is allowed.

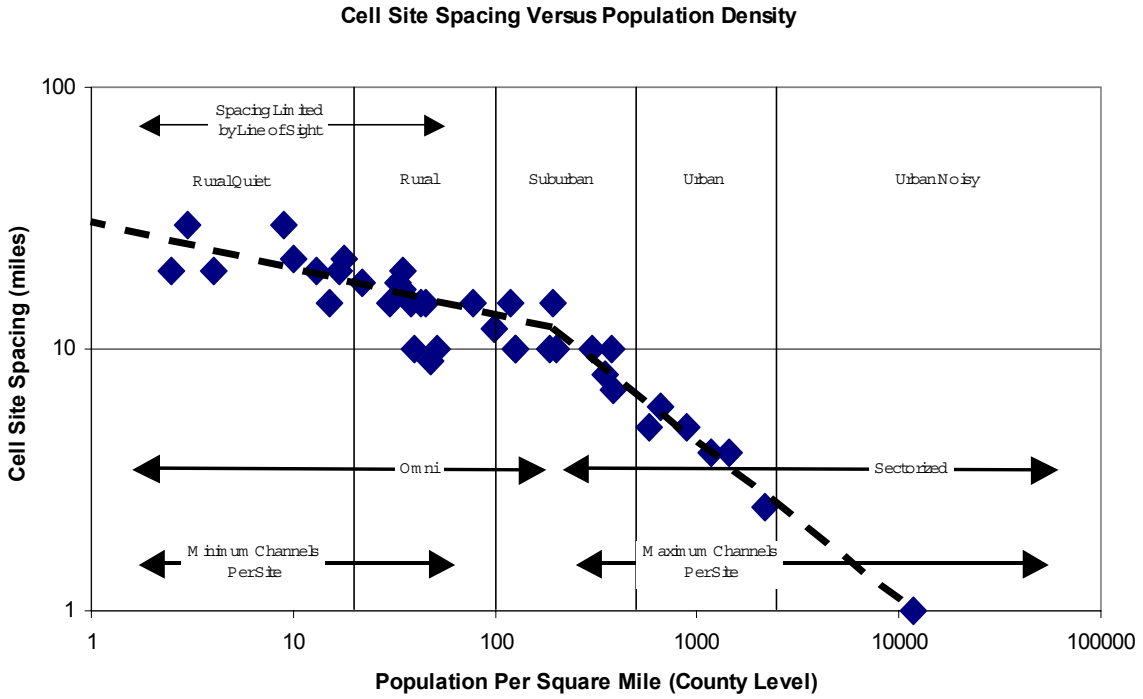
Thus, the definition of rural can best be determined by looking at a nearby cell site. If it has omnidirectional antennas on it, then the carrier likely has a surplus of spectrum, interference is low and rural spectrum management is a proper approach. If the cell site has sectored antennas on it, then there is enough traffic to justify the extra base station equipment and there is a scarcity of spectrum requiring that it must be reused more frequently. In these areas, urban spectrum management is appropriate.

An example of this dividing line was illustrated in the original petition in the AirCell proceeding,[13] for which the Commission recently issued an Order on Remand.[14] AirCell, working with its rural cellular partners, compiled a listing of cell site spacing based on county-level population density as shown below. AirCell then split the country into five regions based on population density and reported a received ambient noise plus interference floor for each region. It shows a breakpoint in the slope of cell spacing when sites are converted from omni directional to sectored sites. This analysis shows that in nearly 85% of the nation's landmass, cellular systems are built as high-site, noise limited systems. As great distances separate many of these areas from the low-site, interference-limited systems in urban areas, the potential to manage spectrum differently in these areas clearly exists. It should be noted that the break point will move to the left on this graph as the penetration of wireless services increases.

In determining how to address rural areas the Commission should thus consider the following factors: 1) range of a typical base station for particular wireless service; 2) frequency reuse of the technology; 3) how may subscribers will each physical RF channel support; 4) the

[13] Petition of AirCell, Inc., *AirCell Inc. Petition Pursuant to Section 7 of the Act for a Waiver Of the Airborne Cellular Rule, Or In the Alternative, For a Declaratory Ruling*, at 46 and App. A page 25 (Oct. 9, 1997).
[14] *AirCell, Inc.*, Order on Remand, FCC 02-324 (Feb. 10, 2003).

population density; and 5) the market penetration of the wireless service. Any regulations would acknowledge that any of these factors can change over time.



Market Type	Population Density Range (ppl/ sq. mi.)	Percent of Population	Percent of U.S. Area	Received Ambient Noise + Interference Floor
Rural Quite	0 - 20	3.7	49	-120 dBm
Rural	20 - 100	18.5	35	-118 dBm
Suburban	100 - 500	30	13	-115 dBm
Urban	500 - 2500	35.2	2.8	-107 dBm
Urban Noisy	2500 & up	12.6	0.2	-100 dBm

V. BIDDING CREDITS

The Commission has requested comment regarding its auction policies and, more specifically, bidding credits. Space Data has taken advantage of both small business and tribal land bidding credits. These credits are of immense help to startup companies such as ours. As is well known throughout the telecommunications industry, the acquisition of capital by startup ventures has been extremely difficult. These credits have been instrumental in helping Space Data during the startup phase. As such, Space Data agrees with the comments made in this proceeding by Western Wireless and Monet Mobile Networks, Inc. that the Commission should

explore a bidding credit based on the provision of wireless services to rural areas, modeled after the tribal lands bidding credit.

We further agree with Western Wireless and Monet Networks that any rural bidding credit should not be limited to rural telcos. The rural market is best served by a level playing field for all. Space Data, for instance, does not meet the statutory definition of a "rural teleco," yet is pursuing a business plan targeted solely at providing rural service.

VI. GEOGRAPHIC SERVICE AREAS

With respect to the issue of nationwide versus regional licensing, Space Data notes that the wireless services that the Commission wishes to make available to rural areas have a nationwide, or roaming, component. It is important, therefore, that service providers have the ability to provide nationwide coverage. Moreover, systems such as Space Data's require nationwide allocations so that its transmissions will neither receive or create co-channel interference. The Commission already recognized this requirement when it granted Space Data authority to provide service over its licenses.

Several commenters to this proceeding have advocated maintaining the RSA geographic area, arguing that the smaller the geographic area, the more affordable it is for rural carriers to serve. However, adopting small geographic areas goes against the predominate trend, as cited in the NOI, which "has been for operators to progressively aggregate licenses and build larger geographic footprints."[15] Another reason that some commenters favor small geographic areas is for implementing tighter performance measures. However, a hybrid approach of applying performance measures to licenses at a smaller geographic granularity would address this issue as well. This is discussed in the next section.

As Space Data has proven, a small, startup company without backing from a major wireless company can successfully gain licenses for the largest possible geographic regions, both by assignment from existing license holders and through the auction process. In early 2001, Space Data successfully was high bidder on Narrowband PCS nationwide channel 4 at a bankruptcy auction in competition with national carriers. In the fall of 2001 at Auction No. 41, Space Data was high bidder on seven additional nationwide Narrowband PCS licenses. As

[15] *NOI* ¶ 19.

explained above, the key to cost effective rural coverage is expanding the footprint served by the base station. Stratospheric platforms generally cover a very wide area. For instance, each of our wireless platforms covers a 360-mile-diameter circle in the Narrowband PCS service. Thus, granting spectrum licenses on a small, fragmented geographic basis would act to bar this important new technology from serving the rural markets. Thus, Space Data urges the Commission to always offer large geographic areas in addition to small geographic areas when more than one frequency block is being licensed.

Alternatively, the Commission could start uniformly implementing combinatorial bidding for most auctions. In theory, combinatorial bidding could eliminate this issue if all licenses were auctioned on a county level and combinatorial bidding allowed a bidder to bid on any desired package of counties up to an including all of them. However, Space Data realizes the mathematical complexities of combinatorial bidding explode as the number of potential packages grows. For this reason, we advocate that for all auctions where small geographic areas are used, combinatorial bidding for one package that aggregates all geographic areas for a given frequency block be implemented.

VII. PERFORMANCE REQUIREMENTS

Demographics allow licensees of large geographic regions to meet build-out requirements, yet leave 90% of the landmass without coverage. This allows certain licensees to warehouse spectrum in certain regions indefinitely. For instance, with Narrowband PCS, a nationwide licensee can meet a build-out requirement to provide a signal to 75% of the population without providing any coverage at all to a few large western states. To solve this problem, Space Data proposes that performance requirements be applied to a smaller geographic area than the license requirements normally would dictate. For instance instead of a nationwide licensee having to cover 75% of the nation's total population within 10 years, the performance requirement could be some percent of the population of each BTA or county. If the provider did not meet this requirement by some long-term deadline, spectrum in the areas not meeting the requirement could revert back to the FCC for reauction.

Applying performance requirements to smaller geographic areas may help the problem, but does not eliminate it. While 80% of the population lives in only 10% of the landmass of the Continental U.S., this effect of population concentrations also exists in rural areas, although to a

smaller degree. If one examines only the sparsest 20% of the nation's population and again uses a ZIP code level resolution, 80% of this rural population lives in only 50% of the landmass. Thus, applying performance requirements to smaller geographic areas will likely still result in a rural carrier making the economic decision to ignore the sparsely populated areas in the performance requirement region. Again, the real solution is to encourage the development of technologies that can serve rural areas with the same user equipment and same cost per user as urban networks.

Performance requirements are an important factor in the value of a license and, thus, the Commission should avoid modifying performance requirements for licenses that have already been issued. Changing the rules after a license has been granted could erode investor confidence during these already poor economic times.

VIII. BAND MANAGER LICENSING

Space Data supports band manager licensing and expanding the flexibility of this approach by encouraging the Commission to move quickly on the secondary markets proceeding. We agree with the position put forth by the Cellular and Telecommunications Internet Association for broad flexibility to lease spectrum by all licensed carriers.[16]

IX. TECHNICAL AND OPERATIONAL RULES

The Commission requested comments on how current technical and operational rules could be modified or made more flexible to encourage expanded service in rural areas while ensuring that the services remain free from interference. Several wireless Internet service providers have commented that they support higher power levels in rural areas in order to expand the coverage area of a base station. CTIA has commented that simply increasing base station power only solves half of the problem, as the user equipment must close the return link and it is unlikely that user equipment manufacturers will make these modifications for a relatively small size market.[17] This is why it is important that the Commission explore adding flexibility in technical and operational rules to allow the operations envisioned by developers of stratospheric platform systems.

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[16] CTIA Comments at 7 (Feb. 3, 2003).
[17] *Id.* at 9.

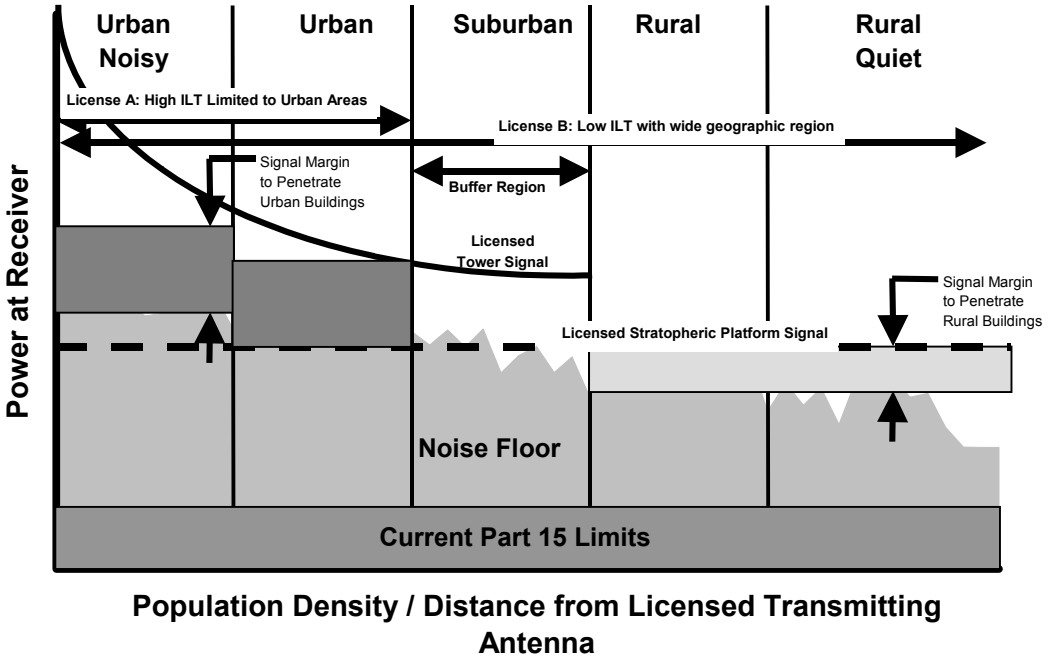
Unlike simply increasing base station power, which only solves half the problem, increasing antenna height solves both links. The path loss is improved for both the forward and return link as it largely becomes dominated by free space loss as opposed to deep fading and clutter losses, which dominate in the tower environment.

The high antenna approach also produces less potential interference than increasing the power of a tower-based transmitter because the 20-mile distance the signal travels from the transmit antenna to earth attenuates the signal from a stratospheric platform. Thus, the signal is at low level that is relatively uniform in power level across the coverage circle. Simply increasing the power on a tower-based transmitter increases the power greatly nearby the tower, which can interfere with users near the tower on adjacent channels. Also, rusty joints and other nonlinearities near a tower can cause a higher power tower-based transmitter to generate more severe intermodulation products, thereby causing out-of-band emissions. The stratospheric platforms operate in an environment free of external nonlinearities and thus do not general intermodulation interference.

To further advance the application of these exciting new technologies to the rural markets, the Commission should explore granting wide area licenses with low interference rights everywhere (even in urban areas) in order to more efficiently provide service both to rural areas and urban areas. The same spectrum could also be licensed with high interference limits for servicing urban areas. The signal required to provide service to users in a rural environment is much lower than in an urban environment. First, adjacent and co-channel interference are much lower in rural areas. Second, the link margin required to penetrate typical rural structures such as two-story, wood frame houses is at least 10 dB less than the link margin required to penetrate urban structures such as concrete and steel, multi-story buildings. A Commission-issued wide area license that limits the power level to that needed to service the rural environment would allow stratospheric platforms to operate more easily. This same frequency could be licensed at a high power level only in geographic regions, which are urban where interference and building penetration margins are high. The added interference from the stratospheric platform would be insignificant to the handsets in the urban core environment. As long as handsets in the urban core environment using the return frequency were practicing active power control, they would only put out enough power to reach the nearby antenna. The urban carrier, of course, wants to minimize the power of the handsets since the urban environment is interference limited.

Additionally, the urban canyon would effectively block the return signals of the urban handsets from significantly interfering with the return signals from rural users.

In this way the same frequency can be allocated based on Interference Temperature Limit (ITL), as advocated by the recent white paper issued by the Commission's Spectrum Policy Task Force.[18] The figure below illustrates Space Data's suggested licensing scheme based on ITL. Two licenses could be granted for the same set of frequencies. License A would be restricted to urban areas with population densities higher than say 800 people per square mile. This license allows high ITL to overcome the urban environment, but requires that user equipment be under dynamic power control. License B would be unlimited geographically, but is limited to a low ITL only suitable for servicing rural areas where noise plus interference is low and the margin to penetrate buildings is modest. The suburban areas are used as a buffer zone to protect the rural regions from interference from the urban networks.



This method of allocating spectrum makes sense from an economic approach. Based upon the most recent auction of a fully deployed, successful service (auction 35), spectrum is most highly valued in urban areas. Even though this auction may have generated peak valuations in the spectrum market and the results have largely been nullified by court rulings, the results

[18] Spectrum Policy Task Force Report, ET Docket No. 02-135 at 19, fig. 3 (Nov. 15, 2002).

provide useful benchmarks of the relative value of urban spectrum to rural spectrum. For instance, of the 422 licenses in the auction, the top two licensees for New York City generated nearly a quarter of the total auction net revenue of $16.9 billion. The top ten licenses (<2.5% of the licenses available) generated 50% of the total net revenue for the auction. The top ten licenses were for New York City, Los Angles, Chicago, Philadelphia, and Atlanta. While the top ten licenses each went for a net bid of more than $8 per MHz-pop, the bottom ten licenses each went for less than $0.20 per MHz-pop. While the net bid for each of the top ten licenses was over $250 million, the net bid for each of the bottom licenses was less than $150,000.

Applying these results more widely and using the demographics stated earlier, if spectrum to serve 80% of the nation's population was valued at $8 per MHz-pop and the spectrum to the sparsest 20% of the nation's population was valued at $0.20 per MHz-pop, then less than 1% of the value of a nationwide license spectrum is for spectrum covering the sparsest 20% of the population.[19] Thus, the market value of spectrum in rural areas is a small fraction of the value in urban areas. This may be one reason disaggregation and partitioning of spectrum to rural carriers has not been more widely used. If the value of the rural spectrum in a geographic region is only a fraction of a percent of the value of the urban spectrum, a licensee may feel there is more value in preserving the option to deploy services in the rural areas at some indefinite future date than can be gained by disaggregating parts of it to another provider, which may potentially create another nearby competitor.

While Space Data was able to obtain nationwide spectrum at all ITLs to offer Narrowband PCS services, implementing the benefits of its technology for voice and other wireless services will likely require much more spectrum and capital. Thus, this could be a large barrier to deploying this technology in the U.S. Several commenters have stated that major carriers are warehousing rural spectrum due to build-out rules that only require a small part of the landmass to be serviced. Space Data plans to use its nationwide channels in rural areas and may explore plans to disaggregate urban areas to other providers if the interference issues do not foreclose operation of our rural network. The result is the same as in the reverse situation; some spectrum lays fallow that could otherwise be used if more flexible ways of allocating spectrum

[19] Value of spectrum for sparsest areas / Total value of nationwide spectrum =
($/MHz-$Pop_{rural}$ x $\%_{rural}$) / (($/MHz-$Pop_{urban}$ x $\%_{urban}$ + $/MHz-$Pop_{rural}$ x $\%_{rural}$) =
($0.20 x 20%)/($8 x 80% + $0.20 x 20%) = 0.625%

are developed. While Space Data could potentially recover some of its spectrum investment by disaggregating our urban areas, having to purchase the urban areas when we only needed the rural areas presented a significant barrier to a startup that has to raise capital to fund our bids at the auction. In our case, we need wide area licensing and adequate bandwidth for the service being offered, but a relatively low ITL. The Commission has in the AirCell proceeding allowed a service provider with a low ITL application to operate on top of existing licenses. Space Data does not support a "commons" model of spectrum management. Licenses granted to date had the expectation that they were only divided by geography and frequency -- not by ITL. Changing this retroactively to existing licenses would be unsettling to the investment community upon which the industry depends. However, we do request that the Commission explore dividing licenses by ITL in future auctions and as an option for existing licensees under the secondary markets proceeding.

X. ELIGIBLE TELECOMMUNICATIONS CARRIERS

Finally, the Commission requested comment "generally on whether the Commission's ETC rules have promoted the development of wireless service in rural areas and greater subscribership in those areas." Space Data's vision is that someday technologies will develop that bridge the digital divide so that it costs the same to service a rural subscriber as an urban subscriber and similar services are widely available regardless of urban / rural distinctions. When this day comes the Universal Service Fund will no longer be necessary. However, in the meantime, Space Data supports comments made by the CTIA that the Commission continue the current practice of a technologically neutral process for both wireline and wireless carriers to become ETCs.[20]

XI. CONCLUSION

Space Data strongly supports the Commission's objective of encouraging wireless telecommunications providers to expand service to rural areas. This has, in fact, also been Space Data's objective for several years. In this pursuit, Space Data has expended millions of dollars for research and development, and to acquire spectrum rights. Uniquely, our system plan does not duplicate existing services or facilities, but proposed to offer primary carriers a low cost opportunity to expand the boundaries of their systems into rural and underserved areas.

[20] CTIA Comments at 5.

Unfortunately the economic state of the telecommunications sector has negatively impacted investment in such ventures. We are encouraged by the Commission's interest in exploring economic incentives, and urge it to expediently implement proposals such as we have made; e.g., at future auctions provide low interference rights licenses covering large geographic regions. We look forward to further participation in this proceeding.

Respectfully submitted,

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