

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

To: The Commission)	
In the Matter of)	
)	ET Docket No. 00-221
Reallocation of the 216-220 MHz,)	RM-9267
1390-1369 MHz, 1427-1429 MHz)	RM-9692
1429-1432 MHz, 1432-1435 MHz,)	RM-9797
1670-1675 MHz,)	RM-9854
and 2385-2390 MHz)	
Government Transfer Bands)	

Comments of MicroTrax™

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I. SUMMARY

MicroTraxTM urges the rapid deployment of unallocated spectrum that is the subject of this rule making and the adoption of a technical standard that would limit adjacent band interference and the power of all emitters in the subject frequencies to 4 watts. In addition, the Commission to adopt a Personal Location And Monitoring Service (PLMS) in which the power of all emitters would be restricted to a maximum of 0.25 watts *average power* limit over a 60-second time interval.

MicroTraxTM urges the Commission to adopt a PLMS and to allocate the spectrum at 1670-1675 MHz to that service. Following adoption of the service and allocation of the 1670-1675 MHz band, those interested may bid at auction to offer a PLMS service. The 2385-2390 MHz band is unsuitable for PLMS primarily because of the high cost that would be imposed upon the service by reason of the Strom Thurman National Defense Authorization Act, eliminating the possibility of offering PLMS to average citizens at low cost.

Should the Commission be unpersuaded to designate an allocation for PLMS at 1670-1675 MHz, it should then to reconsider its plans for the 1.4 GHz band. The present plan makes an unwarranted assumption that certain quantities of spectrum must be offered in paired bands and assumes that the 1.4 GHz band is best suited for that purpose. By doing so, it arbitrarily dismisses realistic competitors for that spectrum. Economic analysis argues for an approach by which all parties interested in the spectrum at 1.4 GHz have an opportunity to bid on packages which do not exhibit a pre-defined technological preference. MicroTraxTM offers alternative methods for packaging the 1.4 GHz band to accomplish this goal. The Commission should also

adopt a combinatorial auction approach that will allow pairing of frequencies, or other approaches that may prove novel.

Further, the Commission's auction plan fails to account for the presence of substantial economic externalities. In the presence of unaccounted for substantial externalities, auctions will lead to inefficient allocations of scarce spectrum and will prevent the auctions from meeting their promised allocative efficiency. This is particularly true of PLMS which offers overwhelming economic externalities that will accrue to the benefit of the public at large as well the individual bidder at auction. MicroTraxTM suggests that the Commission create a PLMS and allocate spectrum to it create an auction-bidding credit for PLMS.

MicroTraxTM also proposes several technical and service rules that should be imposed upon PLMS providers. PLMS should be:

- small enough to be body-worn or hidden small personal assets,
- located both indoors or outdoors without materially protecting performance,
- provide location accuracy an order of magnitude better than enhanced 911,
- offered nationwide,
- limited to terrestrial-based systems or uplink only satellite systems.

In addition, voice must be prohibited and data restricted to that associated with the PLMS.

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Comments of MicroTrax™

II. INTRODUCTION

MicroTrax (“MicroTrax™”) by counsel and pursuant to Section 1.415 of the Commission's Rules, hereby submits its comments in the above captioned rule making proceeding.¹ On November 11, 1999, MicroTrax™ filed its petition for rule making, RM-9797, that has formed a part of this proceeding. MicroTrax™ sought the allocation of a series of bands of electromagnetic spectrum made available by the Federal Government pursuant to the Omnibus Budget Reconciliation Act of 1993 (OBRA-93)² and Title III of the Balanced Budget Act of 1997 (BBA-97)³, and the establishment of a new Personal Location and Monitoring Service to which some of this spectrum would be dedicated.

As stated in its petition, MicroTrax™ believes strongly that the rapid deployment of the unallocated spectrum that is the subject of this rulemaking is strongly in the public interest. As MicroTrax™ predicted, there are several prospective applicants, including MicroTrax™, anxious to

¹*Reallocation of the 216-220 MHz, 1390-1369 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, ET Docket No. 00-221, Notice of Proposed Rule Making, FCC 00-395 (released Nov. 20, 2000) (Notice).

² Pub. L. 103-66, 107 Stat. 312 (1993).

apply for licenses that propose creative spectrum-dependent, beneficial uses. MicroTrax™ has identified several bands awaiting allocation and assignment that could be useful to its own proposed application. Accordingly, in addition to supporting an immediate allocation, MicroTrax™ renews its call for the creation of a Personal Location and Monitoring Service (PLMS) and resubmits its proposed rules, already a part of this proceeding by reason of its petition in RM-9797, for consideration and comment by the public. Stated directly, it is our hope that they might yet be adopted in this proceeding.

MicroTrax™ is a venture in the process of formation with technology of Harris Corporation and capital from Venture First Associates, both of Melbourne, Florida. Harris Corporation's many contributions to the state of the art of wireless technology are well known to the Commission.⁴ MicroTrax™ is one of several new ventures formed or being formed to develop private sector applications of Harris research technologies, thereby bringing the benefits they offer to average citizens at reasonable cost. MicroTrax™ technology requires a moderate size band of spectrum on a semi-exclusive or exclusive basis. The bands proposed by the Commission at 1670 – 1675 MHz and 2385 – 2390 MHz are both useful for the service, although there are qualities to the 2385 – 2390 MHz band that make it comparatively unsuitable for a service that could be life-saving and available to ordinary citizens from all walks of life at low

³ Pub. L. 105-33, 111 Stat. 251 (1997).

⁴ Harris is an international communications equipment company focused on providing product, system and service solutions to its customers. The company provides a wide range of products and services for commercial and government communications markets such as wireless, broadcast, government and network support. The company has sales and services in nearly 90 countries. Within the wireless market, Harris supplies a wide range of digital microwave radios, wireless local loop telephony systems, broadband wireless access products, secure communications systems, and military radios. Customers range from those engaged in providing telecommunications and cellular/PCS services to defense, air traffic, and law enforcement

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cost. Were the Commission to reconsider its scheme for the 1.4 GHz band, there may also be portions there that would be well suited to PLMS.

III. SPECTRUM

A. TECHNICAL STANDARDS

MicroTrax™ proposes a standard that will allow for compatibility between a new service occupying the spectrum in this band and its government neighbors. Therefore, MicroTrax™ recommends an adjacent band interference standard on any frequency outside the authorized bandwidth of $55+10\log(P)$ dB, where (P) is the highest emission in watts of the transmitter inside the authorized bandwidth.

To properly measure the out-of-band emissions, the resolution bandwidth of the instrumentation used to measure powers should be 100 kHz, except that a minimum spectrum analyzer resolution bandwidth of 300 Hz should be used for measurement of center frequencies within 1 MHz of the authorized sub-band. If a video filter is used, its bandwidth should not be less than the resolution bandwidth. Emission power should be measured in peak values. While MicroTrax™ proposes a peak power limit generally of 4 watts in all bands, in any band to be used for PLMS, power should be restricted to a maximum of 0.25 watts *average power* limit over a 60-second time interval. Using an average power standard would protect a situation a number of mobile units might congregate such that their combined emissions would exceed the permissible out-of-band limit. Thus, over a 1-minute interval, the averaged transmitted power from any one mobile unit would be only 1/16 the peak power limit of 4 watts. Proposed rules for this standard are as an appendix to these comments.

markets. Further information about Harris can be found at the company's web site
Footnote Continues on next page

B. 1670 – 1675 MHz

At Paragraph 38 of the Notice, the Commission recognizes MicroTrax™'s thesis that 1670 – 1675 MHz is a very desirable band for the PLMS service that would be compatible with the protection requirements of in-band government sites such as Wallop's Island and Fairbanks, Alaska, and which will require protection indefinitely. In addition, as will be clear from MicroTrax™'s proposed technical standards, PLMS emitters would be sufficiently low in power that all likelihood of interference to radio astronomy operations in the subjacent 1660-1670 MHz band would be minimized.

C. 2385-2390 MHz

2385-2390 MHz, like 1670-1675 MHz, presents characteristics that allow it to be a good technical fit for PLMS. However, other aspects of the band make it far less desirable. The goal of PLMS is to provide personal location and monitoring services at a cost so low and so accurate as to make the service available to average Americans for every day personal needs, such as finding their children in a crowded shopping mall, their pets on busy city streets, or stolen property. PLMS would advance the safety of police officers and firefighters trapped in burning buildings and enable the families of Alzheimer patients to find their lost parents.

These purposes cannot be advanced when the ultimate cost of the spectrum will not be known until very late in the game due to additional costs imposed by relocating government users pursuant to the Strom Thurmond National Defense Authorization Act (Thurmond Act)⁵.

<http://www.harris.com>.

⁵ The Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (NDAA-99), Pub. L. 105-261, 112 Stat. 1920, § 1064(c)(3) (codified at 47 U.S.C. § 923(c)(3)(B)).

The Thurmond Act requires persons who occupy spectrum made available under BBA-97 to reimburse the Federal Government entity for any relocation costs required to make the band available to the private sector. 2385-2390 MHz was provided through BBA-97, to which the Thurmond Act applies, while 1670-1675 MHz was provided pursuant to OBRA-93 to which Thurmond does not apply. Moreover, even under the National Telecommunications and Information Administration (NTIA) plan⁶, costs for relocation will not be known until six months before the auction, too late to base reliance at this juncture. In fact, 2385-2390 MHz has 17 government installations, each of which likely will have to be relocated, whereas 1670-1675 MHz has two government installations that can exist compatibly with PLMS. Accordingly, MicroTrax™'s proposed first goal for a PLMS spectrum allocation set forth below cannot be met.

D. Comparison of 1670-1675 MHz to 2385-2390 MHz

Consistent with the Commission's public interest responsibilities, the MicroTrax™ PLMS proposal advances three major goals should be served in selecting an allocation useful for PLMS. Those goals are:

1. low consumer cost for applications affecting the average citizen;
2. capability of developing a low-power device for a mass market low-power device;
and
3. advancing the cause of public safety.

⁶ *Mandatory Reimbursement Rules for Frequency Band or Geographic Relocation of Federal Spectrum-Dependent Systems*, National Telecommunications and Information
Footnote Continues on next page

The 1670-1675 MHz band meets the goal of facilitating low consumer cost more than the 2385-2390 MHz band, most particularly because of the Thurmond Act implications. It is well situated for a PLMS system capable of developing a mass market. At 1.6 GHz, it is capable of penetrating buildings and other dense structure, and provides sufficient propagation distance so that a cost-effective receiver infrastructure can be created. A low cost PLMS will advance the public safety and consumer welfare for the reasons already cited in describing the PLMS.

By contrast, the 2385-2390 MHz band is not a good allocation for PLMS primarily because of the Thurmond amendment. The technical differences between it and 1670-1675 MHz are negligible. However, the government relocation costs are potentially staggering. The actual cost associated with moving the 17 government systems is utterly unknown at this time and would likely be prohibitive for a low cost consumer service such as PLMS. Moreover, given their numerous locations in major metropolitan areas, it would be impractical, indeed impossible, to create a nation-wide service that would avoid contact with these systems were they not be moved. Increasing the cost of PLMS to the average citizen user will harm the public safety aspects of PLMS. Increasing the cost would raise the threshold at which the service could be made available to the general public, possibly resulting in it being available only for commercial applications, wealthy individuals or others who could justify a more expensive service, significantly reducing the public welfare.⁷ Thus, locating the PLMS at 2385-2390 MHz would serve none of the three goals enumerated above, and therefore it would not serve the public interest.

Administration, U.S. Department of Commerce, Docket No. 001206341-0341-01, 66 Fed Reg
Footnote Continues on next page

E. 1.4 GHz Band

The Commission sets forth clearly its preference for market allocation of spectrum at paragraph 36, where it states: "...we are not inclined to allocate spectrum for particular kinds of services unless there is a clear and compelling public interest to do so." Notwithstanding this clear statement, the Commission's companion discussion and conclusion respecting alternative uses of the 1.4 GHz band violates that very preference.

In paragraphs 24 through 37, the Commission discusses possible uses of the 13 MHz of spectrum at 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, and 1432-1435 MHz (the 1.4 GHz blocks). The Commission goes through a careful analysis of the alternatives and proposes three options. Each of these three options includes paired spectrum for use by conventional land mobile systems. But the paired spectrum options explicitly discriminate against some technologies and applications and in favor of others, without regard to the public benefits traceable to either. Thus, the Commission in essence is using a simple technical rule/convention to drive an important policy result with no analysis of the broader public interest goals it is obliged and intends to pursue. The choice of only paired spectrum options in the 1.4 GHz bands effectively excludes MicroTrax™, AeroAstro and ArrayComm, since they each have represented that their proposed use does not contemplate paired spectrum, but rather 5 MHz of unpaired frequencies. Thus, important technologies and uses are arbitrarily excluded by the Commission's non-public interest based, inadequately justified preference for spectrum pairing.

Further, in addition to violating its own preference for not choosing one technology or application over the other, the Commission violates the principles advanced recently in the

4771, January 18, 2001, at ¶ 35

Comments of 37 Concerned Economists⁸. There, in addressing the need to allow secondary markets to develop and function freely, they make clear their view that “...unnecessary restrictions prevent beneficial uses of the spectrum.”⁹ Indeed, the commission’s pairing restrictions fly in the face of both its most compelling rationale for auctions (assuring that spectrum goes to its highest valued use) and the counsel of economists who advise the Commission to move “decisively to broaden the rights generally granted licensees, *permitting flexible use of the allocated spectrum.*”¹⁰ The economists further address precisely the class of issue involved here in the Commission’s unjustified exclusion of applications and technologies on purely “technical” grounds. In the discussion of primary markets, the 37 economists argue that technical rules not based on the need to assure noninterference are counter to the requirements of efficient spectrum use. “...So long as a new technology respects existing interference boundaries, it should be allowed.”¹¹ They go on to condemn a previous Commission action that closely resembles the proposed pairing requirement here: “For example, the commission recently forbade the use of cellular technology in the 700 MHz guard bands rather than simply setting requirements to protect public safety users. This eliminated a potentially valuable technology.”¹²

The Commission simply assumes that the 1.4 GHz bands are best suited for two-way, paired frequency use and on the basis of that assumption and without regard to the public interest

⁷ See discussion of economic externalities at Section IV.

⁸ See *Comments of 37 Concerned Economists In The Matter of Promoting Efficient Use of Spectrum Through Elimination of Barriers to Development of Secondary Markets*, WT Docket No. 00-230, February 7, 2001.

⁹ *Id.*, at p. 2

¹⁰ *Id.*, at p. 5 (emphasis in the original)

¹¹ *Id.*, at p. 6

¹² *Ibid.*

impacts of it or its alternatives dismisses MicroTrax™, AeroAstro and ArrayComm as realistic competitors for that spectrum. With no justification offered by the Commission, we are hard pressed to rebut this apparently *ad hoc*, arbitrary determination.

Both reasoned economic analysis and the requirement that spectrum allocation serve the public interest mandate full consideration of the economic welfare and public benefits (and costs) associated with feasible alternatives. There are of course many, but MicroTrax™ presents here one very attractive alternative to the options suggested by the Commission. This alternative would permit use of either new or traditional two-way technology in this band and would create substantial value for the public, when compared to the Commission approach.

The Commission could auction the five blocks of spectrum in a single combinatorial auction. Under this option, Microtrax believes that efficiency would be served best if these blocks were auctioned on a nationwide basis. In such a combinatorial auction the Commission would take bids on 7 units as shown in the table below

Block (MHz)	Comments
1390-1392	2 MHz unpaired
1392-1395	3 MHz unpaired
1427-1429	2 MHz unpaired
1429-1432	3 MHz unpaired
1432-1435	3 MHz unpaired
1390-1392 paired with 1427-1429	4 MHz paired
1392-1395 paired with 1432-1435	6 MHz paired

The Commission would compare the sum of the high bids for 1390-1392 MHz and 1427-1429 MHz with the high bid for the same spectrum as a paired block. The higher of the two bids would then be the winner. A similar process would be applied to the other paired spectrum.

The advantage of this approach is that it takes the FCC out of the technology choice business. The FCC can focus on imposing technical constraints on operations in each of the five blocks that will control interference.

One way to improve the efficiency of the above combinatorial auction would be to expand slightly the number of combinations considered by allowing bids for contiguous blocks. The table below illustrates this approach.

Package	Auction Unit (MHz)	Comments
A	1390-1392	2 MHz unpaired
B	1392-1395	3 MHz unpaired
C	1427-1429	2 MHz unpaired
D	1429-1432	3 MHz unpaired
E	1432-1435	3 MHz unpaired
F	1390-1392 paired with 1427-1429	4 MHz paired
G	1392-1395 paired with 1432-1435	6 MHz paired
H	1390-1395	5 MHz contiguous
I	1427-1432	5 MHz contiguous
J	1427-1435	8 MHz contiguous
K	1429-1435	6 MHz contiguous

The Commission could solicit bids for all 11 packages described above. It would then calculate the set of consistent, non-overlapping bids that delivered the largest value. The Commission would grant the bids in that set. For example packages A and H cannot both be in the winning set of bids since each package contains the range 1390-1392 MHz. The underlying computation of the winning bids is straightforward, if complicated, and well within the skill set of the Commission's auction administrators. The calculation is simple enough to be done by hand in this case.

This auction design would allow the market to make the technology choice between the use of TDD versus FDM for multiplexing in these bands. Similarly, it would allow the market to make the choice of block size rather than picking a block size reflecting a specific technology. For example, if modern technology and current market needs make contiguous spectrum more valuable than paired spectrum then the bids for packages H and K together would exceed all other bids.

The combinatorial auction approach can include all three options suggested by the Commission and permit an efficient, market-based choice among those alternatives.

This approach might be particularly appropriate when Arraycomm's proposal is considered. *Rather than offer new or innovative services, ArrayComm's primary claim is that their TDD system technology will provide more efficient use of the limited radio spectrum.* That use would be primarily for existing services such as mobile voice and data. Of course, if this is the case then the existing wireless carriers should have strong incentives to adopt this technology. We note that ArrayComm has been active in other Commission proceedings in an attempt to make sure that the rules governing new bands, e.g., the new 700 MHz Land Mobile

bands (WB 99-168) will accommodate ArrayComm's technology, and ArrayComm actively markets its equipment to the existing wireless carriers (see, <http://www.arraycomm.com/IntelliCell/mobile.html>). Thus, in any band in which ArrayComm's TDD operates its proposed two-way service, it will provide no **new** service to consumers—rather it will provide an additional source of two-way voice and data services. Thus, the auction options suggested by this section will give existing two-way voice operators an incentive to try TDD spectrum efficient technology rather than make further commitments to paired bands and the FDM technology that they will, *ipso facto*, have chosen because of the pairing format in which they would otherwise be required to bid. It should be noted that ArrayComm has often stated that an effective implementation of TDD requires more spectrum than any one of these bands can provide. In that sense, the Commission's arbitrary placing it in the 1670-1675 MHz category with MicroTrax™ and AeroAstro does not serve ArrayComm's goals.¹³

In sum, the approach suggested here finesses the arbitrary exclusion of value creating uses of the spectrum that will result if the Commission's pairing proposal were to be adopted. Moreover, the suggested approach is consistent with market principles of spectrum policy and very much in line with the Commission's desire to move more of its procedures in that direction.

¹³ "No single one of these segments would satisfy the medium or long-range needs of the TDD community. In fact the sum total of the entire spectrum that will be under consideration, given that a portion of each band will be to some degree, unusable, is probably inadequate. ArrayComm's engineers, however, believe that its TDD system is so spectrally efficient that with careful engineering a sufficient portion of each band may yield enough utility to enable ArrayComm to initiate service." Letter of Leonard S. Kolsky, Counsel for ArrayComm, Inc. to Shaun (sic) White, Esq., Federal Communications Commission dated January 11, 2001. Attached as Exhibit A

IV. THE FCC PLAN TO DESIGNATE AMONG COMPETING USERS BY AUCTION IS FLAWED

At paragraph 42 the Commission sets forth its familiar rationale for using auctions to allocate spectrum and applies it to the band at 1670-1675 MHz. The Commission proposes to adopt technical rules that make the band usable by several different potential services, and then to auction the licenses and rights to provide the service to the highest bidder. The Commission reasons that doing so will lead to the party willing to pay the most money for the spectrum to put it to its highest valued use and thereby maximize the public benefits from use of the scarce spectrum in this band.

However, the Commission's argument for auctions here is flawed for at least two reasons. First, the Commission has been recently counseled by some of the nation's leading economists on the limitations of only partially relying on the marketplace in its spectrum management policies. In particular, the "Comments of 37 Concerned Economists" quite correctly advises that the benefits of auctions are undermined if some applications or firms are excluded from the auction process and/or if there is no freely functioning secondary market operating to allow constant revaluation of the spectrum in response to improved market information or improved technology after the initial auction. As discussed below, the latter is especially egregious here, since there are substantial uncertainties and externalities associated with the value of this band if used to provide the proposed PLMS services.

The second reason limiting the value of auctions of this band is the presence of very substantial externalities – external benefits accruing to society and the economy that are not likely to be recognized or captured by private parties and reflected in their valuations and bids. The efficiency and public interest implications for auctions of the presence of externalities are

well known and recognized by the Commission.¹⁴ Bluntly stated, *in the presence of substantial externalities, auctions may well lead to inefficient allocation of scarce spectrum*. More particularly, in the presence of significant external benefits, the winning bidder may put the spectrum to use in inferior applications. The highest valued application – considering the sum of both private and public benefits – will not win the auction and those services will not be provided.

Thus, pitting three technologies with different structures of private and public benefits against each other in an open auction, as envisaged at Paragraph 42, takes no account of the significant economic externalities that are associated with PLMS and that must be accounted for if the auctions are to meet their promised allocative efficiency.

Thus, as a general principle, externalities ought to be reflected in spectrum management practices if we are to achieve maximum public benefit from its use. We note in passing that current practice in parts of the spectrum management function at least implicitly recognize the existence of “public” values that would not necessarily, or even likely, be reflected in private bidding processes. Specifically, the practice of dividing spectrum between public and private use as the first cut in the allocation process recognizes that the public value of national security, public safety, emergency services, air traffic control, and so forth exceeds the purely private value, so that spectrum for those and related purposes are first set aside. Further, even within the “private” bands, the FCC routinely uses nonauction methods to allocate spectrum for purposes of determining what services will allowed to use particular bands. This practice, and particularly its

¹⁴ See, for example, the discussion at paragraph 11 of *Principles for Reallocation of Spectrum to Encourage the Development of Telecommunication Technology in the New Millennium*, 14 FCC Rcd 19868 (1999).

reliance on nonauction methods, is based in part on the belief that some spectrum management functions, because of the particular nature of the public benefits involved, should not be left to market forces.

Several external benefits would be created by PLMS – benefits that would not be captured in auctions. It is noteworthy that PLMS external benefits are very similar to those used to rationalize special allocations for public safety and emergency services in both the public and private spectrum allocation functions referred to above of both NTIA and the FCC. PLMS would improve the quality, make more efficient and reduce the costs of assorted law enforcement functions and efforts. For example, the cost to society associated with mobilizing a large effort to find missing persons and stolen property alone, are enormous and can be substantially reduced by a well-deployed service such as PLMS. Those benefits flow only in part to subscribers, but in large measure to non-subscribers and to society as a whole.

The PLMS service that MicroTrax™ has proposed would permit the location of small tags indoors or out with high accuracy—accuracy many times better than required for the E911 application. The PLMS service has numerous applications—finding lost children, tracking parents with Alzheimer’s disease, keeping track of valuable objects such as personal computers, paintings, or automobiles. Each of these applications generates benefits for the users of the service, but they also generate substantial benefits to society at large as well.

Consider the external effects of two of these applications of the service—tracking Alzheimer’s patients and locating high-value personal possessions. Not everyone has a family member with Alzheimer’s, but no one knows in advance that their family members will avoid this disorder as they age. The presence of PLMS in the market would give everyone an option as

they look to the future—an option that, with luck, they would not need to explore. Nevertheless, options and expanded choice are valuable. Everyone with a family member who may get Alzheimer’s in the future will benefit from having available the option of using the PLMS service. Likewise, not everyone has a child, but when PLMS is used to locate a missing or exploited child, the benefit accrues not only to the child’s parents, but to society as a whole in knowing it’s young are a little bit safer and that the cost to public services such as police in finding the child may be lessened substantially.

Similarly, attaching PLMS tags to high-value personal possessions will increase the rate of recovery of thefts and should increase the rate of apprehension and conviction of thieves. Reducing the profitability of theft should reduce the rate of theft, all other things being equal. Locking up thieves stops their thievery while they are incarcerated. Because PLMS tags can be made small and concealable, thieves cannot easily identify which personal possessions are tagged. Consequently, the benefits of reduced crime rates will flow to all consumers—not just to the subscribers to the PLMS service. On the other end of that particular externalities spectrum, the benefit to society in improved monitoring of persons under so-called “house arrest” will provide an efficiency that will lessen the cost for police monitoring and possibly allow more “light offense” law breakers to be sentenced to house arrest without having society incur the expense of their incarceration.

The Firefighters Task Force and International Association of Firefighters have stated that locating and monitoring the firefighter is their highest priority technology. There are approximately 35,000 fire departments in the U.S. of which 20% are in metro areas with high-rise buildings and warehouses. Each year, there are approximately 100 firefighter deaths in the

line of duty, many of which occur because firefighters overcome by smoke cannot be found quickly.¹⁵

The external benefits are not limited to missing persons and missing property, but extend to a variety of other location services as well. Some of those external benefits have already been recognized by the Commission when it cited the comments of BI, Inc. and Curtis Protective Services, Inc. at footnote 62 of the Notice. Those commenters praised the value of PLMS for enhancing the house arrest service as an alternative to incarceration. Attached as Exhibit B is a list of additional PLMS applications that offer public service external benefits.

These externalities are cited to sharpen the Commission's perception of the differences between conventional mobile services and PLMS. When more spectrum is made available for wireless mobile services in New York City, for example, it lowers the cost of building out wireless systems and otherwise expands capacity. The market provides a good measure of the benefits in this case and, if the wireless market is reasonably competitive, we can expect that the bulk of the benefits will flow to wireless service subscribers. In contrast, when the FCC creates a new service, such as PLMS, benefits flow not just to the subscribers and users of the service but to others in society. Consequently, a simple market test of the value of the new service may lead to the wrong conclusion.

In view of these considerations, the Commission should exercise its statutory responsibility to allocate spectrum in the public interest and make special provision to see that these benefits are captured in its spectrum management processes. MicroTrax™ believes that

¹⁵ USFA Reports Firefighter Fatalities Increased in 1999
http://www.usfa.fema.gov/nfdc/ff_casualties.htm The database on this site indicates that of the
Footnote Continues on next page

the presence of externalities and the broader public interest case for PLMS has been clearly demonstrated. The Commission should make a determination that PLMS will serve the public interest for the many reasons already stated in these comments and adopt PLMS service rules for a 5 MHz band of spectrum. Thereafter, an auction can be held among all those who wish to offer PLMS service. For this purpose, MicroTrax™ again submits, for consideration in this docket, the rules it proposed in RM-7373.

Specifically, the Commission must find a means of factoring in these external values, not inherently recognized in strict cash bidding. Therefore, the Commission should revise its proposal contained in Paragraph 42 of the Notice to maximize consumer and public welfare benefits as well as cash generated for the Treasury by adopting the following proposals. If the Commission chooses not to specifically dedicate spectrum to the PLMS service, there should be an auction-bidding credit provided to bidders who would propose to use the spectrum in a manner that would benefit the public safety and render assistance to tax supported public service institutions such as police and fire departments.

MicroTrax™ proposes that qualifying organizations receive an auction bidding credit similar in scope to what was provided to small business in the PCS auctions. The Commission at that time recognized that there was public value and an abiding overriding public interest in assuring that some firms and uses gained access to the spectrum – firms and uses that, but for the special consideration, would not likely be realized. Thus, the Commission has previously recognized and acted on the principle we assert here – that the presence of externalities warrants extraordinary auction provisions. Thus, we are proposing not a new principle -- when arguing

firefighters who died in 1999, a little over 20% died because they were caught or trapped inside
Footnote Continues on next page

for spectrum bidding credits for firms proposing use of spectrum with probable, large externalities – but rather for a modest extension of an existing one.

V. NATIONWIDE ALLOCATION

MicroTrax™ strongly believes that a nationwide allocation at 1670-1675 MHz (as well as the other spectrum in this docket) is best suited to maximizing public welfare and service efficiencies. Each of the three service proponents mentioned in the Notice at Paragraph 40 have called for a nationwide allocation. At least two of those services, MicroTrax™ and AeroAstro, are designed to provide mobile service on a nationwide basis. With respect to the PLMS, as previously stated, it is designed, among other things, to provide assistance in tracking people and property often taken from the cities in which they reside. City limits, metropolitan statistical areas, state lines, or other larger geographical separations within the country geographically bind none of these services. Given that most, if not all, of the parties interested in 1670-1675 MHz are seeking a nationwide allocation, it may well be that without such an assurance, the likely bidder population will actually decrease, leaving the Commission with fewer, rather than more, parties who are interested in the band.

Although it is clear from the foregoing that nationwide bidding is appropriate, we would urge, if for some reason the Commission disagrees, to at least provide for combinatorial (package) bidding in designing the auction by which these licenses are to be awarded. A scheme for such bidding at 1.4 GHz is described above at Section III.E. From the very outset of its implementation of Section 307(j) of the Communications Act to award licenses through competitive bidding, the Commission has recognized the advantages of combinatorial bidding in situations such as this where license values are interdependent and where the value of individual

burning buildings. Of those, over 20% died of asphyxiation.

licenses is likely to be greater as a package than in isolation.¹⁶ The Commission has further noted the appropriateness of package methods when an entrepreneurial business plan requires licenses in a large number of markets.¹⁷ Quite recently, the Commission noted the efficiency of combinatorial bidding would be best suited where only a few licenses were to be available.¹⁸

Conversely, the reasons for rejecting combinatorial bidding in the past are inapplicable in the present context. Thus, questions regarding Congressional authorization have been removed by Section 309(j)(3) of the Communications Act; indeed, the Balanced Budget Act of 1997 *directs* the Commission to use this design in order to speed auction processes where, as here, it will foster the development and rapid deployment of new technologies and services for the public, especially those residing in rural areas.¹⁹ As this proceeding is still at an early stage in which an auction design has not yet been tentatively proposed, prior Commission concerns over disturbing parties' expectations will not become a factor.²⁰ Indeed, in preparing for the recent 747-762 and 777-792 MHz auction, the Commission noted the strengthening trend favoring combinatorial bidding approaches as both feasible and efficient where sufficient time exists to implement a proper package bidding auction design.²¹ As was the case there, here the proponents have noted the necessary objective of developing large (if not nationwide) service

¹⁶ See Implementation of Section 309J of the Communications Act Competitive Bidding, 8 FCC Rcd 7635 (1993) at Paragraph 57.

¹⁷ See Allocation of Spectrum Below 5 GHz Transferred From Federal Government Use, 11 FCC Rcd 624 (1995) at Paragraph 90.

¹⁸ See Nextel Communications, Inc.'s Petition for Expedited Action to Modify the Auction Design for Auction No. 35, the C and F block - Re-Auction, 2000 FCC Lexis 6628 December 14, 2000 at Paragraph 13.

¹⁹ See Section 309(j)(3)(A) of the Communications Act of 1934, as amended.

²⁰ See, e.g., Amendment of the Commission's Rules Regarding Installment Payment Financing for Personal Communications Services Licensees, FCC 01-017 (January 18, 2001) at Paragraph 17.

areas. NPRM at Paragraphs 25-29. Therefore, while nationwide bidding is clearly preferable, a combinatorial auction approach would seem to be the only feasible alternative for realizing the public interest objectives of the proponents herein.

VI. SERVICE AND TECHNICAL RULES

As noted above, MicroTrax™ believes that power and adjacent band interference limits need to be adopted in the 1670-1675 MHz band. These standards are embodied in the proposed attached rule, General Technical Requirements 90.1204. MicroTrax™ believes that adoption of these requirements will properly protect radio astronomy operations in the adjacent band as the Commission requested.

The Commission also requested comments on other service rules for operation in the band. As previously mentioned, MicroTrax™ strongly believes that of all the potential uses, PLMS is the most urgent and demanding. Accordingly, it would suggest the following rules for operation:

- **Small enough to be body worn or hidden in small personal assets. PLMS** service providers should demonstrate that a substantial portion of the services they provide are for portable applications; i.e. something that can be worn by a person, rather than used in a vehicular, mobile application. Services primarily oriented to vehicular applications do not adequately serve the needs of many segments of the public. MicroTrax™ believes that low cost, personal safety and security services are desperately needed for children, the aged, the infirmed and the non-affluent for which vehicular application becomes a limiting factor. Other bands, such as the LMS bands, have been allocated to services primarily oriented to vehicular

²¹ See Public Notice – Auction of Licenses in the 747-762 and 777-792 MHz Bands
Footnote Continues on next page

use. These other bands allow relatively high transmit power from the mobile (e.g. 30 Watts for LMS) which makes them quite useful in the vehicular context, but virtually unavailable to personal, portable services. PLMS devices must be sufficiently low in power usage that they may be safely “body worn” yet store sufficient power for long-term usefulness. Adopting such a service restriction would encourage the development of new and innovative personal use services. It might also encourage broader use of public mass transit due to the increased availability of portable personal safety and security services that are not tied to private vehicular use.

- **Can be located both indoors and outdoors without materially affecting performance.** Without this capability, the utility of any personal service is severely hampered. Therefore, the FCC must be careful to select frequencies that make this objective achievable.

- **Can provide location accuracy** better than the Commission’s Enhanced 911 accuracy requirement. *MicroTrax™ believes that the minimum standard should be an order of magnitude better than E911 Phase II.* This minimum standard is achievable and necessary to provide a truly useful service.²²

- **Service must be offered Nationwide.** To qualify as nationwide, the service must achieve coverage for 25 metropolitan areas with a combined population of 150 million people

Scheduled for September 6, 2000, DA-001486 (released July 3, 2000) at page 8.

²² The FCC Third Opinion Report and Order on E911 Phase II changed the accuracy requirement from 125 meters RMS to:

- 1) For network-based technologies:
 - 100 meters for 67 percent of calls,
 - 300 meters for 95 percent of calls;
- 2) For handset-based technologies:
 - 50 meters for 67 percent of calls,

Footnote Continues on next page

within 5 years. The service must be offered nationwide because stolen or lost assets are often quickly transported away from the owner or the owner may be on the move. In either case, a local-only service would be of limited value and could wastefully use spectrum otherwise required for a viable nationwide service. Moreover, a nationwide service is necessary for the protection of small children or pets, whose kidnappers frequently transport them hundreds of miles from the site of abduction. Similarly, the use of devices in the Personal Location and Monitoring Service for offender monitoring would require nationwide application to be effective in locating offenders who have violated their travel restrictions.

- **The service should be limited to terrestrial based systems or uplink only satellite systems.** Terrestrial systems offer the greatest potential for providing low cost service within the reach of users for individual applications capable of working while deep within buildings or when hidden in assets or body worn. Mixing terrestrial and downlink, space-based applications would pose a potential for destructive interference while losing the location ubiquity available with terrestrial services. A terrestrial system allows for low power applications with scalable receive sites capable of providing nearly limitless locates per day. Moreover, adequate spectrum has already been allocated for satellite radiolocation type services. In this case, a terrestrial limitation will actually foster innovation and competition. While MicroTrax™ believes that a terrestrial system maximizes the PLMS potential, it would not prohibit satellite systems, such as AeroAstro's SENS system, which would use the PLMS spectrum only for the up-link portion of its service.

150 meters for 95 percent of calls.

- **Transmission of voice must be prohibited.** There has already been a multitude of bands and resulting communications services made available for voice. The contemporary user has The Cellular Telephone Service, Personal Communications Service (PCS), Business Radio, Specialized Mobile Radio Service (SMRS) and many others to choose from for this purpose. The availability of spectrum for those services has already spawned a host of innovative services capable of providing voice communications. Restricting voice in these limited size bands would foster similar innovation in a location and tracking service.

- **Transmission of data must be restricted** to that associated with monitoring the location, security, or safety of the person or property associated with the device. Similarly, this restriction would foster innovation and development for a badly needed, but overlooked service. Other spectrum bands, such as LMDS and MMDS, have been allocated for video and data services. Paging and some satellite systems have been designated for data distribution. This restriction would allow the development and implementation of spectrum for new and innovative location and tracking services.

Furthermore, to realize the full potential of the intended Personal Location and Monitoring Service, MicroTrax™ believes that a qualified provider must offer all three of the following capabilities to qualify for the service:

- **Locally commanded locator-tracker:** At least one type of mobile unit must be able to be activated or controlled locally by the user.

- **Remotely commanded locator-tracker:** At least one type of mobile unit must be able to be activated or controlled remotely by a user trying to locate the person or property being monitored.

- **Embedded Location and Tracking:** The capability to integrate personal location and monitoring technology into other applications, such as cellular telephones, PCS devices and pagers.

MicroTrax™ proposes service rules attached to the appendix to implement this proposal.

VII. CONCLUSION

MicroTraxTM believes strongly that the time has come for the Commission to adopt a Personal Location And Monitoring Service. PLMS would serve the public interest in hundreds of ways already identified and hundreds more only being imagined today. To meet its goals, PLMS requires an exclusive 5 MHz band. 1670-1675 MHz is ideally suited for this purpose. Unencumbered by substantial government relocation costs, 1670-1675 MHz can provide a cost-effective solution to the personal location and monitoring needs of average citizens for everyday non-business purposes and contains the potential to substantially enhance the quality of their lives. There are substantial economic externalities in PLMS that must be recognized by the Commission and dealt in the spectrum allocation process.

Should the Commission decline to adopt a PLMS with rules such as those appended to these comments and allocate 1670-1675 MHz to that service, MicroTraxTM strongly urges it to consider the spectrum proposal contained in these comments for the 1.4 GHz band. The MicroTraxTM 1.4 GHz proposal advances previously declared purposes of the Commission and respected telecommunications economists more fully than the plan proposed in the Notice.

Finally, it is important that a PLMS on this allocation be made on a nationwide basis. It simply makes no sense to provide for a PLMS that is not highly mobile across our nation.

MicroTraxTM also strongly endorses service and technical rules to maximize the service efficiency and utility of PLMS to average citizens.

Respectfully submitted,

MICROTRAXTM

By:  _____

Gregg P. Skall
Counsel for MicroTrax™

Pepper & Corazzini, L.L.P.
1776 K Street, N.W.
Suite 200
Washington, D.C. 20006
(202) 296-0600

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PROPOSED RULES

PART 90

SUBPART - Y

PERSONAL LOCATION AND MONITORING SERVICE (PLMS)

90.1201 **SCOPE**

This subpart sets out the regulations for the Personal Location and Monitoring Service (PLMS).

90.1202 **DEFINITIONS**

(a) **Average Transmit Power.** The average power obtained by multiplying the Peak Transmit Power by the fraction of time that the transmitter is on during any continuous 60-second interval.

(b) **Embedded User Device:** A mobile PLMS User Device capable of being integrated with other devices or applications, such as cellular telephones, PCS devices and pagers.

(c) **Emission bandwidth.** For purposes of this subpart, the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(d) **Locally Commanded User Device:** A mobile PLMS User Device that is capable of initiating the location and monitoring function in response to a stimulus created within the immediate vicinity of the user device, or capable of activating or controlling itself.

(e) **Peak Transmit Power.** The peak power output of a transmitter as measured over an interval of time equal to the frame rate or transmission burst of the transmitter under all conditions of modulation. Usually this parameter is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. If a direct connection cannot be achieved, alternative techniques acceptable to the Commission may be used. Peak Transmit Power must be measured using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity,

etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

(f) **Personal Location and Monitoring Service (PLMS).** The use of non-voice signaling methods to locate or monitor any legal entity, person or property. PLMS systems may transmit and receive only non-voice transmissions and instructional information related to such units.

(g) **Personal Location and Monitoring Service User Device (PLMS User Device)** [Unlicensed]. Mobile or portable intentional radiators operating in the frequency bands _____ MHz that provide a wide array of mobile location and tracking communication services as defined by the provisions of this Subpart Y.

(h) **Portable Application.** PLMS Service offered through a PLMS User Device that can be worn by a person and hidden from plain view, rather than used in a vehicular, mobile application.

(i) **Remotely Commanded User Device:** A PLMS User Device capable of being activated or controlled by commands received from a person or entity away from the PLMS User Device trying to locate or monitor a person or property in the immediate vicinity of the PLMS User Device.

90.1203 **EQUIPMENT AUTHORIZATION REQUIREMENT**

(a) PLMS devices operating under this subpart shall be verified under the provisions of Subpart J of Part 2 of this chapter before marketing.

90.1204 **GENERAL TECHNICAL REQUIREMENTS**

(a) The ___ - ___ MHz band is limited to use by PLMS service providers and devices under the requirements of this Part.

(b) Average Transmit Power of a transmitter operating pursuant to this subpart shall not exceed 0.25 watts.

(c) Adjacent Channel Limit

i. Out of band emissions in any 1 MHz bandwidth must be attenuated below P by $55+10\log(P)$ dB where (P) is the Peak Transmit Power in Watts of the transmitter inside the authorized bandwidth.

ii. The resolution bandwidth of the instrumentation used to measure the emission power must be 100 kHz, except that a minimum spectrum analyzer resolution bandwidth of 300 Hz must be used for measurement center frequencies within 1 MHz of the edge of the authorized sub-band. If a video filter is used, its bandwidth shall not be less than the resolution bandwidth. Emission power shall be measured in peak values.

(d) A PLMS device must comply with IEEE C95.1-1991, (ANSI/IEEE C95.1-1992), “Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.” Measurement methods are specified in IEEE C95.3-1991, “Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave.” Copies of these standards are available from the IEEE Standards Board, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331. Telephone 1-800-678-4333. All equipment shall be considered to operate in an “uncontrolled” environment. The application for certification must contain a statement confirming compliance with IEEE C95.1-1991. Technical information showing the basis for this statement must be submitted to the Commission upon request. The ANSI/IEEE standard uses the term “radiated power” as meaning the input power to the antenna.

90.1205 PLMS Device Requirements

PLMS Devices may be operated only as part of a PLMS system that complies with the following characteristics:

(a) **Size:** PLMS services providers must demonstrate that a substantial portion of the services they provide are for Portable Applications in which the PLMS User Devices are small enough to be body worn or hidden in small personal assets.

(b) **Location:** PLMS services providers must demonstrate the ability to locate User Devices that are located indoors or outdoors without materially affecting performance.

(c) **Accuracy:** PLMS User Devices must provide location accuracy that complies with the Enhanced 911 accuracy requirement of 125 meters or less using a Root Mean Square (RMS) methodology, as provided at Section 20.18 (e) of Part 20 of the Commission’s Rules.

(d) **Nationwide Service:** The service must achieve coverage for 25 metropolitan areas with a combined population of 150 million people within 5 years of the date service is first initiated. PLMS service providers must notify the Commission of their Service initiation date.

(e) **Voice:** Transmission of voice within the PLMS service is prohibited.

(f) **Data:** Transmission of data within the PLMS service is restricted to that associated with monitoring the person or property associated with the device.

90.1201 PLMS System Device Requirements

PLMS User Devices may be offered for use to the public only with a PLMS system that offers each of the following types of PLMS User Devices:

- (a) Locally Commanded User Device
- (b) Remotely Commanded User Device
- (c) Embedded User Device