

cell reuse plan.<sup>9/</sup> Each cell is assigned two of the eight message channels. Thus, throughout the system, no two adjacent cells would experience destructive co-channel interference.

Because in a real world system traffic density will be uneven over a given geographic area, PageNet has designed its experimental system to accommodate cell sites which may vary in diameter from 10 to 20 miles. In its initial Los Angeles system, for example, PageNet expects significantly higher traffic densities in downtown Los Angeles than it does in Pasadena, and thus contemplates the use of comparatively smaller cells in Los Angeles to satisfy the potential demand.<sup>10/</sup> In the future, the messaging system will accommodate the addition of cells where necessary to serve large areas of increased demand.

In a cellular configuration, the system capacity can be determined by multiplying the number of cells times the pager capacity in each cell. Given that the capacity of each cell is 19,200 subscribers (Exhibit 3 at 18), a typical 15 cell system could serve 288,000 VoiceNow pagers, a 20-fold increase over the number of subscribers which can be served on ten channels with existing analog simulcast systems.

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<sup>9/</sup> As described more fully below, the deployment of dynamic frequency allocation techniques is made possible by increasing intelligence in the RF network.

<sup>10/</sup> In determining areas of high potential demand within Los Angeles, PageNet has used as a barometer areas in which PageNet is experiencing higher usage of digital display pagers today. PageNet's marketing analysis, conducted in part by EMCI, Inc. confirmed PageNet's own conclusions that numerous current users of digital display pagers will migrate to VoiceNow Services when they become available.

## 2. Digital Modulation And Speech Coding

In order to minimize the degree of channel occupancy per voice message, and thus optimize potential capacity, PageNet has also studied digital modulation and speech coding techniques to find those which provide the greater throughput. Pagers operate in a fading environment, characterized by operations under moving conditions, often indoors. See Exhibit 3 at 14. The digital modulation utilized must take this environment into account. PageNet's engineers have consulted with experts in the digital modulation field, and have concluded that digital modulation using 16-QAM is likely feasible. See Letter from Bernard Keiser, Keiser Engineering, Inc. to Ron Turner, PageNet, Exhibit 6 at 1.<sup>11/</sup>

PageNet has also explored various voice compression techniques to further maximize spectrum efficiency. It has determined to utilize LPC at 2400 b/s initially. Exhibit 3 at 14. This bit rate minimizes channel occupancy and storage requirements while still achieving the high degree of intelligibility and speech recognition PageNet perceives as necessary to meet user requirements. Using this bit rate will also facilitate the transmission of data over the system, thus permitting E-mail or other data transmission services to be offered on a secondary basis. Exhibit 6 at 1.

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<sup>11/</sup> Based on its current research, PageNet does not believe it feasible to operate at 64-QAM, despite the advances in faster transmission. The use of 16-QAM allows an overall bit rate of 80 kb/s at 20 kBd, which some experts in the field believe in turn allow 33 simultaneous channels in each 25 kHz of bandwidth. PageNet has utilized conservative estimates of 10 channels.

The net result of this combination of digital modulation and voice compression is the multiplication of the speed of message transmission by 10-20 times, while improving the voice quality.

D. A Cornerstone of VoiceNow Services Is Its Intelligent Network Capable of Implementing Dynamic Frequency Reallocation, Message Channel Selection, and Predictive Propagation Techniques

PageNet's design of an intelligent paging network provides for substantial improvements over existing network capability. Through its intelligent network, typified by the network controller capabilities PageNet plans to deploy, PageNet will achieve increases in capacity, quality and flexibility.

1. Dynamic Frequency Reallocation

PageNet expects to be able to maximize its capacity through the use of dynamic frequency allocation techniques. The use of these techniques will allow PageNet to reallocate frequencies to cells with increased demand in order to increase capacity. The utilization of the adjacent cell's frequencies will be dynamic, that is, utilized in instances of need rather than permanently. See Exhibit 7 for pictorial of dynamic frequency reallocation. See also Exhibit 3 at 17. These techniques take advantage of the fact that demand is not typically uniform over a given geographic area and permit the use of frequencies which are otherwise underutilized. The dynamic reallocation of frequencies among cell sites thus allows PageNet to maximize utilization of all channels assigned to various cells. It also allows it more easily to handle sporadic demand peaks of comparatively short duration without having to build out additional sites.

## 2. Predictive Propagation Techniques

A great deal of intelligence will be incorporated into the Network Controller to determine the optimum message transmitter. See e.g., Exhibit 8, (demonstrating that closest transmitter not always optimum transmitter). Starting with a database including digitized terrain, buildings, and vegetation, each message transmitter's coverage area would be predicted. (See e.g., CNet Letter to Ron Turner, at Exhibit 9) This database will then be modified based on field measurements and actual user's experience. The end result will be an increasingly accurate lookup table to indicate the one optimum message transmitter site for any location in the system's coverage area.

Information obtained from the ACK receiver system will be compared to the predictive propagation table for each message to a pager. The message would be forwarded to that one ideal server. Potential problems in simply selecting the closest transmitter are thus minimized. Exhibit 3 at 12-13.

## 3. Pager Location Techniques

Each ACK receiver will forward all received data to the Network Controller, accompanied by a measure of the signal strength. Thus, for each acknowledgment transmission from a pager, the network will have data from one or more receivers with varying signal strengths. The Network Controller will use this information to estimate the location of the pager as follows: Digitized terrain and obstacle information for the coverage area of each receiver can be used to estimate the distance from that receiver as a function of the received signal strength. The

combination of this information from whatever number of receivers report the acknowledgment will be used to determine the location of the pager. That information is then referenced to another table of Message Transmitter coverage predictions. See Exhibit 9.

E. Pagers Can Be Readily Designed To Accommodate VoiceNow Services.

A new pager product is required to provide this service. VoiceNow pagers need to be capable of transmitting back to nearby receivers upon receipt of their address. They must be capable of operation on multiple frequencies. The pager must receive and decode a digitized, compressed voice message rather than analog. PageNet believes, too, that increases in storage capacity beyond those currently available are necessary to meet consumer requirements.<sup>12/</sup>

PageNet has received assurances from a major paging equipment manufacturer that much of the functionality which PageNet has requested can easily be produced. Pagers can be designed to transmit at 2 watts, in short packets of approximately 200 ms in duration. The comparatively high current necessary to transmit at 2 watts is provided by a dual disparate battery combination. This added functionality will be incorporated easily, adding only approximately one cubic inch to the size of state of the art digital display and voice pagers on the market today.

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<sup>12/</sup> It is PageNet's understanding that Motorola's KeyNote Pager currently has 32 seconds of storage capacity.

Pagers capable of operation on multiple frequencies are currently available. The capability for those pagers to change frequency under control of the network can be readily achieved.

Technology already exists which permits the receipt by the pager of digital signals. The vast majority of pagers sold today decode and store digital data. The addition of circuitry which decodes 16-QAM and LPC is not currently available, but is certainly feasible with the application of VLSI technology. See Exhibit 6. Lastly, additional memory can also be easily added without any measurable increase in the size of the pager.<sup>13/</sup>

VII. THE VOICENOW SYSTEM IS COMPRISED OF NUMEROUS INNOVATIONS AIMED AT PROVIDING A HIGH VOICE QUALITY, HIGH CAPACITY SERVICE

The one-way voice communication required by consumers cannot possibly be provided using existing technology or spectrum. PageNet realized this, and sought to find a way to bring this new service to the public. It was recognized that significant breakthroughs were needed to solve serious problems of spectrum consumption and high costs to the end user. To get to this point with the first prototype experimental system design complete, the

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<sup>13/</sup> Cost estimates from manufacturers indicate that the functionality which PageNet has requested will initially add approximately \$100 to the unit costs. PageNet has taken these added costs into account in calculating, per month, the costs of providing these services. Even with the increased pager costs, PageNet has determined that VoiceNow Services cost approximately 50% less per subscriber than existing tone and voice services offered over a conventional simulcast system.

following technical innovations have been synergistically combined to make the provision of VoiceNow service possible:

- \* Frequency reuse
- \* Dynamic reallocation
- \* Receiver Locating
- \* Predictive Propagation
- \* Compressed Digital Voice Transmission

1. Frequency Reuse

Until now, the standard paging system utilized a simulcast configuration for message transmission. For short messages, this is an efficient means of operation. For longer messages, the spectrum required and the infrastructure costs are prohibitive. PageNet's application of frequency reuse to paging makes possible low-cost, spectrally-efficient delivery of one-way messages. This has not been attempted on paging systems until now, but it is the only way Advanced Messaging Services can be provided without wasteful spectrum consumption.

2. Dynamic Reallocation

While frequency reuse brings tremendous increases in spectral efficiency, traditional frequency reuse can be enhanced even more in the case of paging. PageNet's experience and understanding of heavily loaded metropolitan paging channels caused its engineers to consider variations possible when frequency reuse is applied to a store-and-forward system such as paging. Knowing that the distribution of message traffic is random, the capability to borrow capacity among cells to meet those brief, uneven peaks of

traffic has the potential to add considerable capacity to an AMS system. The dynamic reallocation is based on every transmitter installed with full frequency agility across a licensee's channels. The Network Controller will assign, real-time, a frequency to the transmitter. The Network Controller may choose to deviate from the traditional, static frequency reuse plan and permit one especially busy cell to use additional channels.

### 3. Receiver Locating

The network of receivers proposed to deliver acknowledgments back to the controller will provide the information to a sophisticated computer program and database designed by PageNet to determine the location of the pager. Rather than just look at signal strength to estimate a pager's location, PageNet proposes to use digitized information about the area around each receiver, including vegetation and man-made obstacles, to make a real-world prediction of the distance from the receiver to the pager. Calculations based on the signal reaching more than one receiver will result in a far more accurate estimate of the pager's location than any other means possible.

### 4. Predictive Propagation

The use of digitized terrain, vegetation, and obstacle information will be especially valuable in selection of the optimum message transmitter. PageNet, through the combination of its extensive real-world experience in 900 MHz paging propagation and current state-of-the-art computer modeling, has included in its system design a Predictive Propagation system. Based on all of the above known factors, a look-up table will reside in the

network controller referencing locations in the system to a particular messaging transmitter. Knowing the approximate location of the pager based on its acknowledgment, the table would be used, for each message, to select the optimum transmitter site. This extensive network intelligence is a PageNet innovation resulting from its extensive experience with 900 MHz urban propagation. Consideration of such factors are essential to the success of AMS.

#### 5. Digital Voice Compression

Current analog transmission of voice pages is both an inefficient use of the spectrum and a very costly way to provide this service. PageNet's application of 16-QAM digital modulation and Linear Predictive Coding to paging is a novel solution to the challenge. Paging is unique in mobile communications, being based on a store-and-forward system. Constraints of design on systems providing interactive voice communications do not apply. This combination of modulation and encoding scheme are uniquely suited to voice paging. Both voice quality and speed of transmission are improved significantly over existing service. PageNet is the first company to recognize the need for one-way personal voice communications and research the appropriate technology to provide this service.

VIII. PAGNET IS ENTITLED TO A PIONEER'S PREFERENCE FOR CONCEIVING, AND DESIGNING A SYSTEM, OVER WHICH TO PROVIDE SPECTRALLY EFFICIENT VOICENOW SERVICES

A. Analytical Framework

The Commission has carefully crafted criteria to measure the sufficiency of pioneer preference requests. In delineating the characteristics worthy of a preference, the Commission has already committed to weighing not only the innovations of a proposal, per se, but also the consequences of a specific proposal, including whether the proposed service will increase spectrum efficiency, add functionality and reduce costs of providing the service.

The Commission has recognized that it would be inappropriate to grant a preference for innovation, for innovation's sake. The criteria it set forth, taken in sum, reflect the proper balance. See Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 6 FCC Rcd 3488 (1991), amended on reconsideration, memorandum Opinion and Order, FCC 92-57 (released February 26, 1992). This balance requires that an applicant for a pioneer's preference demonstrate not only that it has proposed a new, technically feasible service or substantially enhanced an existing one, but also that a demand exists for the service proposed, and that it is feasible to offer the proposed service at prices consumers are willing to pay. This is particularly important in considering whether to grant a pioneer's preference for Advanced Messaging Services ("AMS"), given the very limited amount of spectrum under consideration.

The Commission has also recognized that innovation in the technical design of new or existing services, which constitute,

inter alia; 1) a different use of the spectrum than previously contemplated; 2) a change in the operational or technical characteristics of a service; 3) efficiencies in spectrum use; 4) increased speeds of transmission; 5) increased quality of transmission; or 6) result in substantial reductions in the costs of the services, may individually warrant grant of a dispositive preference. PageNet's VoiceNow services meet each of these criteria.

B. VoiceNow Services Represent Either A New Voice Paging Service Or A Substantial Enhancement Over Existing Voice Paging Services

Just as cellular was considered a new service, not an enhancement of an existing one, PageNet views VoiceNow Services as totally new and different from the comparatively primitive tone and voice services and voice storage services. PageNet's VoiceNow Services eliminate the impediment which has caused the decline in subscription to tone and voice and other first generation voice paging services, e.g., the spectral inefficiencies associated with simulcast, analog delivery of those messages.<sup>14/</sup>

PageNet's VoiceNow Services must be considered a new service as the capabilities it offers have never before been available. For the first time, one-way voice paging services will be

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<sup>14/</sup> Without these spectral efficiencies which will allow the costs of VoiceNow Services to be spread over a proportionately larger number of subscribers than with existing tone and voice services, PageNet doubts, in fact, that VoiceNow™ Services could ever be offered -- it simply could not be economically feasible. See discussion of cost effectiveness, Section VIII. G.

available to millions of subscribers, eliminating the spectrum scarcity issues that have thwarted the growth of voice paging to date.

C. VoiceNow Services Constitute a Different Use of Spectrum Than Previously Contemplated For Voice Messaging Services

The ubiquitous and instantaneous service that PageNet proposes constitutes a different use of spectrum than previously contemplated for voice messaging, and on that basis, too, it is qualified to receive a pioneer's preference. AMS has always been thought of as involving the transmission of alpha or numeric data, graphics and the like. It was not envisioned that the AMS for which there is the most demand would be voice messaging. However, PageNet's investigation confirms that this is the case. Voice paging services are high in information content, while satisfying consumer demands for a one-way voice service which is easy to use. Voice paging thus represents a different use of the spectrum than was previously contemplated, but by far the highest and best use to which the Commission could grant the allocation.

D. VoiceNow Services Constitute a Change in the Operational and Technical Characteristics of Voice Messaging Services

As discussed, the VoiceNow Services combined use of simulcast paging and frequency reuse constitutes a significant, innovative change in the manner voice paging has traditionally been provided -- a change that transforms the service into one that meets

previously unsatisfied market demand. PageNet's system will utilize a one channel simulcast system to communicate with the pager, sending notice that a voice message has been received. The voice messages themselves will be transmitted over frequencies configured in a four cell reuse pattern.

E. The Deployment of Frequency Reuse, Dynamic Frequency Reallocation, and Other Spectrum Conservation Measures by VoiceNow Services Result in Phenomenal Advances in Spectrum Use

As previously explained, PageNet's system design for VoiceNow Services merges simulcast and frequency reuse concepts as well as dynamic frequency reallocation methodologies. This system design innovatively permits a different use of the spectrum that was previously available, e.g., it will foster the broadscale provision of one-way voice paging services to a mass market -- something not possible with existing simulcast tone and voice paging systems given the inefficiencies of transmitting each message over the entire service area. PageNet estimates that its utilization of simulcast and frequency reuse concepts to their maximum advantage will permit it to handle over 25,000 voice pagers per channel on a typical system, as compared to its ability to serve 1200 tone and voice pagers on today's simulcast channel.

Tone and voice services as well as new "state of the art" voice storage paging services are available in a few smaller markets over simulcast channels, using analog signalling techniques. Therefore every voice page is sent throughout the paging carrier's service territory, eating up large amounts of

capacity. These services are spectrally very inefficient, permitting very few pages of this sort as compared, for example, to digital display pages utilizing the same amount of capacity.

VoiceNow Services also represent a change in the operating and technical characteristics of existing analog voice services, introducing significant spectrum efficiencies not even approached in the system design of analog voice services offered today.

As noted, PageNet has also designed the system to employ voice compression techniques. This synergistic combination of voice compression techniques and PageNet's system design, utilizing both simulcast and frequency reuse to their maximum advantage, will serve more than 20 times the number of pagers possible with today's technology.

F. Other Criteria are Also Satisfied

Other criteria considered by the Commission, such as improvement in transmission speeds and improvements in the quality of information transmitted are also met by VoiceNow Services. The digital compression techniques PageNet has incorporated into its system have never before been deployed in a paging environment; these compression techniques should compress a 15 second voice message to less than two seconds. The speed of transmission will therefore be greatly enhanced. Application of these digital compression techniques to paging is among PageNet's most significant innovations contained in its proposal, and is also a

key ingredient in the dramatic increases in capacity PageNet projects.

It also has demonstrated improvements in the quality of delivered messages. PageNet's system is designed with pagers sufficiently intelligent to recognize when a message delivered to it has errors, and to request retransmission of those messages.

G. PageNet's VoiceNow Services Will Significantly Reduce The Costs of Providing One-Way Voice Services To The Public, While Simultaneously Increasing Their Usefulness

The Commission has recognized that an innovation which results in the introduction of technologies which substantially reduce the costs of service to the public may warrant a pioneer's preference.<sup>15/</sup> Clearly, PageNet's VoiceNow Services satisfy that criteria. As described above, VoiceNow Services provide added functionality over existing tone and voice, voice storage, and voice mail and messaging services. The quality and geographic scope of these services are vastly improved. Despite these enhancements which transform voice paging into a service for which there is potentially explosive demand, PageNet believes it can be offered at prices which are comparable to or less than those less sophisticated, first generation voice services offered today.

To illustrate its point, PageNet has performed a comparison of the costs of providing a hypothetical, mature tone and voice

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<sup>15/</sup> As noted, supra, if the cost reductions are for a service for which there is no public need, and thus no demand, the grant of a pioneer's preference would be inappropriate even if the costs were reduced to zero.

system and the costs of providing a mature VoiceNow system. PageNet assumed that each system would have fifteen transmitter sites, with the appropriate transmitters and receivers necessary to offer each service. In conducting its analysis, it considered capital costs, operating costs, including repair salaries, site rent, telephone infrastructure and interconnection costs, and other direct and indirect costs, as well as pager and system depreciation. It also included in its analysis of VoiceNow costs the increased cost of the VoiceNow pager with the capabilities set forth in Section VI. E, assumed to be in the \$100 range.

Its subscriber forecasts were based on the comparative capacities of an analog simulcast system and VoiceNow Services, with a message length of 15 seconds. The proposed message length was initially derived from PageNet's historical average of call length for its own voice mail service, and confirmed by participants of focus groups as appropriate.

PageNet's analysis showed that, if VoiceNow Services were offered over a conventional simulcast paging system, rates to the consumer, inclusive of both service and pager rental, would be in the \$30.00 range. A competitor's provision of Voice paging service in Arizona proves the conservative, accurate nature of PageNet's estimates. PacTel has recently introduced voice paging services in Arizona with voice storage capabilities provided through the use of Motorola's Keynote™ pagers. These pagers typically have 32 seconds of storage capacity. PageNet believes this service offered to consumers for approximately \$27.95/month.

VoiceNow Services, on the other hand, will cost consumers in the neighborhood of \$15.00 - \$18.00 per month. Simply put, VoiceNow Services are vastly superior to all other existing voice paging services, and because of PageNet's innovative system design, will be available to consumers at almost half of what voice storage paging services are available for today. This breakthrough itself entitles PageNet to a pioneer's preference to expeditiously offer VoiceNow Services.

#### IX. PAGENET IS ENTITLED TO A NATIONWIDE PREFERENCE

As the innovator in designing spectrally efficient, ubiquitous voice paging services, whose expanded capabilities will be available to consumers at prices that in some markets are almost half of what consumers pay now, PageNet is entitled to a nationwide preference. The Commission has indicated some hesitancy in granting nationwide preferences, stating that applicants would have a heavy burden in justifying same. But in this instance, there is no question that some licenses should be awarded on a nationwide basis, and that PageNet should be awarded one for its exemplary pioneering efforts.

It is essential that paging carriers be licensed on a nationwide basis to maximize the potential benefits to the public of these exciting new technologies. The needs of the public vary over a continuum from local service through wide-area and regional coverage to complete nationwide paging. Throughout PageNet's history, its customers have demanded greater coverage and greater

functionality with each passing year. It is anticipated that this trend will continue and the pager population will shift increasingly toward the high end of the coverage/functionality curve.

In its infancy, the industry served customers with local paging coverage. Today, the minimum requirement demanded by customers is wide-area coverage of a metropolitan area. Furthermore, a significant portion of PageNet users also subscribe to regional service as an option. Its nationwide service has also been well-received. In order for this continuum of service to be provided to the public in the most cost-effective manner, it must be carried over a common infrastructure. In much the same way as our nation's telephone network seamlessly connects calls between any two telephones, utilizing whatever facilities are appropriate, paging is most efficiently provided through the networking of various wide-area metropolitan systems. Local users demand solid coverage and intense transmitter density in urban areas, while regional users insist upon the broadest possible geographical coverage. Nationwide subscribers require coverage in all of the U.S. major cities. A seamless nationwide paging network will serve all three requirements, and users in each category will benefit from the infrastructure installed to serve the others. More importantly, the provision of service to the widest possible variety of users will spread costs over a greater number of pagers and minimize the cost of the service to the end user.

Upon grant of a license, PageNet is prepared to immediately begin design and construction of systems nationwide.<sup>16/</sup>

#### CONCLUSION

PageNet has demonstrated that it is an innovator in the design of spectrally efficient voice services. Its design, based on frequency reuse and other spectrally efficient methodologies applied to voice paging for the first time, is ingenious. The spectral efficiencies the design yields will make it possible for carriers to offer voice paging services in virtually every market, large or small. Moreover, increases in efficiencies make it possible for these services to be offered at up to half what lesser quality services are offered at today. For its innovation

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<sup>16/</sup> In its Petition For Rulemaking, filed simultaneously herewith, PageNet has proposed that all nationwide licensees, including those granted pioneer's preferences, be required to demonstrate the financial ability to construct 300 transmitter sites in 50 cities within the first year of the license grant.

in making this possible, PageNet deserves a pioneer's preference  
for a nationwide license to offer VoiceNow Services.

Respectfully submitted,  
PAGING NETWORK, INC.

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Dated: June 1, 1992

**EXHIBIT 1**

**THE MARKET FOR DIGITAL  
VOICE PAGERS WITH VOICE  
STORAGE CAPABILITIES**

**Prepared by:  
Economic and Management Consultants International, Inc.**

**EMCI**

*Telecommunications Consultants*

A Malarkey-Taylor Company

## **The Market for Digital Voice Pagers With Voice Storage Capabilities**

**Prepared for:**

**PageNet**

**by:**

**Economic and Management Consultants International, Inc. (EMCI)**

**May, 1992**

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# 1. Executive Summary

Economic and Management Consultants International, Inc. (EMCI) was retained by PageNet to evaluate the market potential for a new generation of voice pager service. This new service represents several important improvements over previous technologies widely available:

- more efficient use of the radio spectrum leading to greater subscriber capacity;
- voice storage capability within the pager; and
- better clarity of voice transmission.

In order to determine the potential market for this product, EMCI evaluated trends within the paging industry, and conducted a series of focus groups. Four focus groups were conducted, two among paging users and two among non-users to determine communication needs, potential acceptance of the product, and likely acceptance at key pricing points. While the results of these focus groups are not statistically projectable, they are indicative of general behavioral trends among the specific segments tested.

EMCI's analysis reveals the following:

- The decline in voice pager use in the U.S. in recent years is due primarily to lack of frequency for traditional voice pagers, not lack of demand.
- The product concept addresses a critical need within the communications marketplace: voice communication messaging that is easy to use.
- Focus groups indicated a high degree of interest and excitement for this new product.
  - Non-paging consumers with awareness of and interest in mobile communications almost unanimously preferred this voice pager service to existing digital display services, even at a higher cost of service. A high degree of subscription interest exists among these potential users.
  - Among existing paging users, those using voice mail in conjunction with their pagers expressed unanimous interest in the product and showed little sensitivity to price within the range tested. Acceptance was more moderate among non-voice mail pager users.

Based on this analysis, EMCI has determined that a broad and immediate market exists for this service:

- A substantial share of future users would select this technology over existing digital display services, perhaps replacing digital display services as the dominant pager type where the new voice service was available.
- Existing paging subscribers using voice mail services would be highly penetrated in a short period of time.
- A significant portion of existing digital display users would convert over time. This segment would be penetrated somewhat more slowly as investment in existing pagers is amortized and service contracts expire.

EMCI has thus concluded that the proposed digital voice pager with voice storage capabilities would better serve a significant portion of the existing base of paging subscribers, and would draw a large number of new subscribers to mobile communications services.

EMCI also concludes that the digital voice pager with voice storage capabilities would:

- increase efficiency,
- improve productivity,
- increase user safety, and
- provide better emergency response capabilities.

Many users and non-users expressed that the ability to receive a voice message instantaneously and that conveys the complete message would save them time and help them do their jobs better or manage their family life better. Users also expressed concern for their own public safety, as well as for the safety of those calling them. Women users said that, in many instances, they will not stop late at night at a payphone to call the caller back, but will instead wait until they are at home. Focus group participants also said that the proposed voice pager would allow them to respond to family emergencies better as they can instantaneously hear the message and the urgency of the caller.

Both users and non-users expressed a primary advantage of the pager, receiving a complete message, not just a phone number. For both personal and business use, not