

BEFORE THE
Federal Communications Commission
WASHINGTON, D. C.

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JUN - 1 1992

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of:)
)
Paging Network Inc.)
)
Request for a Pioneer's Preference)
For Pioneering the Ability for)
Spectrally Efficient, Cost Effective)
One-Way Mobile Voice Communications)
in the 930-931 Band)

Docket 92-100

To The Commission:

PETITION FOR PIONEER'S PREFERENCE

PAGING NETWORK, INC.

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Summary

Paging Network, Inc. ("PageNet"), the largest and fastest growing paging company in the United States, has developed a new voice paging service, VoiceNow, with unprecedented capabilities, and requests that the Commission award it a preference in the nationwide licensing thereof. PageNet has concurrently herewith filed a Petition for Rulemaking seeking the allocation of the 930-931 MHz band, in ten 25 KHz channel blocks to enable the provision of this and potentially other innovative paging services for which there is substantial untapped demand.

VoiceNow Services, which alert subscribers that a voice message has been received and store the message in the pager, for the first time, provide voice paging subscribers with the ability to listen to their voice pages when they want and eliminate the inconvenience of having to place a telephone call to receive messages as required by many currently existing voice messaging services. The service and its technical framework constitute either a new voice paging service, or at the least, a substantial enhancement over existing services.

The novel technical framework for PageNet's VoiceNow services cures the spectrum scarcity issues that have confronted voice paging providers to date, and enables the widespread provision of advanced voice paging on a spectrally efficient and cost effective basis. PageNet's system merges simulcast and frequency reuse concepts, resulting in efficient use of limited spectrum. Using two channels for signalling the pager that a message has been

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- Exhibit 1 The Market for Digital Voice Pagers With
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- Exhibit 2 Figure 2 from Comments of Motorola Inc. in
RM-7616
- Exhibit 3 Engineering Report of Moffet, Larson & Johnson,
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- Exhibit 4 AMS Signaling Sequence
- Exhibit 5 Report of Raymond C. Trott Consulting Engineers,
Inc.
- Exhibit 6 Letter to Ron Turner, PageNet from Bernhard Keiser,
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- Exhibit 7 Dynamic Frequency Reallocation
- Exhibit 8 Optimum Message Transmitter
- Exhibit 9 Letter to Ron Turner, PageNet from Scott Greenwell,
CNet
- Exhibit 10 Network Design

received, and eight channels for message delivery, all at 25 KHz of bandwidth, PageNet estimates that it can serve 22 times as many subscribers as can existing voice paging providers.

Both current and potential paging subscribers have demonstrated a substantial interest in VoiceNow services, and many indicated they would subscribe to the service. As expected, the VoiceNow Services capabilities, unavailable through existing services, found most appealing include the: (1) instantaneous transmission of a voice message directly to pager; (2) ability of the paging subscriber to listen to the message at his or her convenience (and store the message for repeat playback if desired); (3) ability to use the service as a screening device in determining whether to return a call; and (4) greater message capacity over existing voice storage systems.

PageNet has proposed a new and innovative voice paging service that can be provided in a spectrally and cost efficient manner to satisfy widespread demand, and has demonstrated the technical feasibility of its proposal. It has thus satisfied Commission Pioneer Preference criteria and should be awarded a preference.

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PETITION FOR PIONEER'S PREFERENCE

Paging Network, Inc., ("PageNet"), through its attorneys, hereby requests that the Commission grant it a dispositive pioneer's preference for its efforts in establishing ubiquitous spectrally efficient, one-way wireless voice communications services, referred to as "VoiceNowSM Services," on a cost effective basis. This request is made pursuant to Section 1.402 of the Commission's rules.^{1/}

^{1/} The Commission recently established rules under which it will grant pioneer's preferences in order to promote innovation, and assure those, like PageNet, that do make substantial contributions to the establishment of new technologies or new services in order that they will get to share in the fruits of their efforts. See Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 6 FCC Rcd 3488 (1991) ("Pioneer's Preference Order").

I. THE PROPER PARADIGM OF ANALYSIS
FOR GRANTS OF PIONEER PREFERENCES

As expressed in the Communications Act, the FCC's public interest mandate is to make available, so far as possible, to all the people of the United States a rapid, efficient, nationwide and worldwide radio communications service with adequate facilities at reasonable prices. 47 U.S.C. § 151. As with all its other actions, its grant of any pioneer's preference must be in furtherance of that public interest mandate. Thus, the Commission should keep foremost in mind the real world consequences of any such award and whether these consequences will serve or disserve the public interest.

In delineating the characteristics worthy of a preference award, the Commission has implicitly already recognized that a Pioneer's Preference is not merely a certificate that hangs on the wall of the recipient, but the withdrawal of frequencies from the general pool open to other potential users or services. As such, the Commission must carefully weigh not only the innovativeness but also the consequences of a specific proposal, including whether the proposed service will increase spectrum efficiency, add functionality and reduce cost. In other words, before the Commission agrees to award limited and valuable spectrum, whether through a pioneer's preference or a spectrum allocation, it must look at a continuum and determine exactly how the proposal serves the public. If there is no need or demand for a particular service, or no demand at the cost proposed, its innovativeness serves no purpose, and it offers the public no benefit.

It would be inappropriate, then, for the Commission to grant a pioneer's preference for innovation alone. An applicant for a pioneer's preference should demonstrate not only that it has "thought out the capabilities or possibilities of the technology or service, or has brought them to a more effective state," but also that there is an unmet need for the services proposed, and that it is feasible to offer these services at prices which will permit those the service is intended for to subscribe. This is particularly important when considering whether to grant a pioneer's preference for an Advanced Messaging Service. There is but 1 MHz of spectrum proposed to be allocated, compared, for example, to the 50 MHz of spectrum allocated for cellular service, itself an innovative service, when first introduced.

PageNet's VoiceNow Services satisfy these important public interest objectives. VoiceNow Services is an innovative new voice paging service, for which there is substantial pent up demand. As PageNet demonstrates, innovative spectrum conservation methods it has pioneered in voice paging permit it to increase by over 22 times the subscriber capacity per system, as compared to analog simulcast tone and voice systems. It has simultaneously reduced the per subscriber costs of voice paging by almost half compared to the costs of providing an equivalent service over analog networks. These stellar accomplishments demonstrate unqualifiedly that PageNet is entitled to a pioneer's preference for designing and establishing the technical feasibility of introducing VoiceNow Services on a spectrally efficient, cost-effective basis.

II. PAGENET IS AN INNOVATOR IN MARKETING AND TECHNOLOGICAL DEVELOPMENT OF PAGING SERVICES

Throughout its history, PageNet has been committed to innovation in the provision of paging services to the business and consumer market. Now a full ten years after its founding, PageNet is both the largest and fastest growing paging company in the United States. Its growth has come primarily from building new, innovative, state of the art paging systems through which it offers a full panoply of paging services at the lowest possible price. PageNet has always been committed to turning paging services into a commodity product, offering features which facilitate the use of pagers as a productivity tool for both businesses and individuals at a price each can afford.

Recognizing the promise of the 931 MHz frequencies allocated by the Commission in 1983, PageNet immediately applied for and was granted authorizations to offer paging services on those bands. PageNet's 900 MHz common carrier paging system in Tulsa, Oklahoma was the first of its kind operational in the country. Since then, PageNet has expanded its 900 MHz paging operations to serve, through its subsidiaries, subscribers in 24 states and the District of Columbia.

PageNet was also a pioneer of regional systems. PageNet built the first 900 MHz west coast paging network, providing users the opportunity, with one pager telephone number, to be paged anywhere in the Northern California area, the Los Angeles Metropolitan area, San Diego, Phoenix and Tucson, Arizona, and Las Vegas, Reno and Lake Tahoe, Nevada. PageNet offers similar

advances in the northeast corridor, offering customers the ability to have one telephone number anywhere throughout Washington, D.C., Maryland, Virginia, Philadelphia, New Jersey, New York, Connecticut, Rhode Island, and Boston -- all the way to the Maine border.

Like many others who recognize that a substantial segment of the potential pager user population prefers voice communications because of its ease of use and ability to convey large amounts of information, PageNet continues to offer primitive tone and voice paging services in some markets. Its offering of more advanced tone and voice capability is imminent. Yet, like all other paging carriers, it has been unable to offer these services on a spectrally efficient or cost effective basis to large numbers of subscribers. Particularly in the larger cities with severe capacity constraints, it simply is not spectrally efficient to offer voice paging services.

As an alternative to tone and voice services, PageNet has attempted to meet the consumers' desire to communicate by voice through voice messaging services. To that end, it offers low priced automated voice messaging and personalized automated answering services marketed under the names PageMail® or PageMailBoxSM.

Based on its in-depth internal exploration of potential services which could satisfy the demand for voice paging services offering high information content and ease of use, PageNet designed and refined its concept for VoiceNow Services. Simultaneously, it began exploration of the most technically

efficient, cost effective network through which to provide these services to the public. Using a team of engineering consultants, coupled with its own engineers, PageNet devised a highly advanced intelligent network through which to offer VoiceNow Services. It also conducted field tests and additional scientific research where necessary to resolve issues in the real world implementation of its proposed system. PageNet has conducted its testing in, and is designing its experimental system for Los Angeles, where it is licensed to provide service in both the 929 and 931 frequency bands. It is thus familiar with the geography, terrain, etc., and is able to conduct some tests without the need to obtain an experimental license.

It has also aggressively sought to obtain distribution channels to make VoiceNow and other paging services even more accessible to consumers. PageNet has now put in place the retail and reseller distribution channels which will facilitate the provision of its VoiceNow Service to the public. PageNet believes, in particular, that its current and projected retail distribution channels will expand consumer awareness of paging as a desirable communications tool, and provide both consumers and small businesses greater opportunities to conveniently purchase VoiceNow Services.

**III. THE INNOVATIONS IN VOICENOW SERVICES
PIONEERED BY PAGENET ARE ANALOGOUS TO THE
INNOVATION CELLULAR SERVICES BROUGHT TO
THE TWO-WAY MOBILE VOICE MARKET**

PageNet believes that the most important innovation, bar none, to paging services in the 90's is its own proposal to offer ubiquitous voice paging services, referred to as "VoiceNow Services" on a spectrally efficient, cost effective basis -- something never before possible. Like cellular, this proposal relies on a sophisticated network in order to provide simple, easy-to-use services to the public.

From the consumer's perspective, VoiceNow Services are elegant in their simplicity. With VoiceNow Services, the person placing the page will merely dial the pager's number, and leave a voice message. The voice page will be sent to the paging receiver. Then the pager will alert the user that a page has been received, allowing the user to listen immediately to the message or play it back at a time of the user's choosing. The voice quality generally will approximate that existing in cellular telephony today.

From an engineering perspective, the system supporting VoiceNow Services is extremely complex. A combination of simulcast paging, coupled with frequency reuse, dynamic frequency reallocation techniques and propagation modeling underlie the system design. PageNet also intends to apply digital modulation and voice compression techniques to optimize its use of the spectrum. However, the innovation propounded by PageNet is not merely in demonstrating the application of these technologies to

paging. It also lies in recognizing and meeting the practical real world challenges in the design and implementation of its digital system. The result of PageNet's proposed system is extraordinary increases in capacity.

The revolutionary engineering advances underlying PageNet's VoiceNow Services compare favorably to innovations that fostered the advent of cellular telephone services. Prior to the advent of cellular, the capacity constraints under which two-way mobile voice systems operated made service quality marginal at best -- voice quality was poor, and it was often difficult, and in many cases impossible, to obtain a free channel in order to complete calls. Even with the exorable degradation of service, there were waiting lists to subscribe to these services because there were no alternatives to two-way voice mobile service available.^{2/}

With the advent of cellular, all that has changed. Two-way mobile voice services, with quality often comparable to that of the landline network, are now available in virtually all of the major markets -- all the result of the innovative application of frequency reuse and other spectrum conservation techniques applied to two-way mobile voice services.

The status of voice paging services today compares to that of two-way mobile voice services prior to the advent of cellular. The availability of tone and voice paging services (comparatively primitive to the VoiceNow Services PageNet is proposing) has

^{2/} See An Inquiry Into the Use of the Bands 825-845 MHz for Cellular Communications Systems; and Amendment of Parts 2 and 22 of the Commission's Rules Relative to Cellular Communications Systems, 78 FCC 2d 984, 1009 (1980).

measurably declined given the spectrum constraints and system costs that paging carriers currently face in meeting the escalating demand for paging services.^{3/} Signal coverage is limited. Quality has also generally degraded substantially, especially in larger markets. And in some markets, such as Los Angeles, PageNet is not aware of any carriers which market voice paging services today.^{4/}

Despite the tremendous unmet business and personal demand for voice paging services, these services have necessarily been shoved aside to allow for these more spectrally efficient technologies. PageNet's own tone and voice subscribership has declined from approximately 7.5% of its total subscribers in 1987 to .2% today, as a direct result of its cutback on offering tone and voice service.^{5/}

The innovation in system design and implementation of VoiceNow Services pioneered by PageNet will allow PageNet and others to begin to meet the current and projected demand for voice paging services. Through PageNet's innovative marriage of simulcast and frequency reuse and spectrum management techniques, coupled with its knowledge and experience in receive system engineering, the potential capacity to serve voice paging users will increase by 2500 percent. Further, the per subscriber costs

^{3/} See EMCI Study, attached hereto as Attachment 1.

^{4/} Industry experts agree that, while voice paging services were "popular in the 1970s, it is now almost unobtainable in many cities, because it is more difficult and expensive for carriers to provide." Paging: The Whole Story, Mobile Office, November 1991 at 40.

of providing VoiceNow services are estimated to be approximately one half of the per subscriber costs of tone and voice services over a simulcast network, permitting the revolution in voice paging services to begin.

IV. SUBSTANTIAL DEMAND EXISTS FOR VOICE PAGING SUCH AS PAGENET'S VOICENOW SERVICES

PageNet has long believed that a substantial market for voice paging exists - a belief that was confirmed through its market study conducted as part of its consideration of VoiceNow services. See The Market for Digital Voice Pagers with Voice Storage Capabilities, prepared by Economic and Management Consultant International, Inc. ("EMCI Study"), attached as Exhibit 1 hereto. The study concludes that the decline in voice pager use in recent years is primarily attributable to lack of frequencies for traditional voice paging, not lack of demand, and that VoiceNow Services address a critical market need. Id. at 2.3.

VoiceNow Services were viewed by many market study participants as a preferred option over existing paging technology, and there was almost unanimous agreement among potential paging users that if in the market for a pager, they would select VoiceNow Services. Id. at 3.1.4. The VoiceNow Services features that participants found particularly appealing include: (1) the instantaneous transmission of a message to the paging user, giving him or her the choice of when and where to play the message without placing a telephone call to a central

5/ The decline also reflects PageNet's sale of two systems.

computer;^{6/} (2) the receipt of a message, rather than merely the telephone number of the person who had placed the page, thereby allowing the pager user to detect the urgency of the message and whether it requires a return call; (3) the capacity to store both longer and more messages than existing voice paging systems; (4) the ease of use for the individual both placing the voice page and receiving it; and, (5) the anticipated enhancement of voice quality and coverage as compared to existing systems. Id. at 3.1.4 and 3.24.

PageNet's VoiceNow Services for the first time provide a technically and economically feasible means to meet the substantial demands for these voice paging capabilities. PageNet notes that Motorola has very recently introduced a voice pager, known as a KeyNote pager, one model of which has modest storage capability. Motorola's innovation is very welcome as it begins to address consumer demand for message delivery and storage at the pager. It does, however, not solve the more onerous impediment to serving the market demand, that is, the lack of spectrally

^{6/} Voice mail service enables a caller to leave a recorded voice message that is stored in a computerized voice message retrieval center. When a message is left for the subscriber, the subscriber is alerted through a page, and can place a telephone call to retrieve the message(s) at any time. Despite its substantial advantages over previously existing voice communications, it still has drawbacks in that, as noted, the message is not delivered to the pager -- the paging user has to place a call to his or her voice mailbox to get the message. This method imposed productivity costs; the paging customer has to take time away from other tasks in order to place the call. It also imposes out-of-pocket costs; the calls to the paging mailbox may be local or long distance, and very often are placed from pay telephones.

efficient and cost effective means of providing voice paging services.^{7/}

V. PAGENET HAS DESIGNED A HIGH CAPACITY REAL WORLD SYSTEM TO SERVE UNMET DEMAND FOR VOICE PAGING SERVICES

In response to this need for voice communications, PageNet engineers analyzed the user requirements of functionality and, considering the joint requirement of spectral efficiency and minimal cost, designed and engineered a technically feasible, real-world system. See Final Engineering Report of Moffett, Larson & Johnson, Inc., prepared for PageNet, attached hereto as Exhibit 3. The AMS system proposed will provide Voice Now service as follows:

When a message is to be sent, the caller may pick up any phone and dial the user's personal phone number. A personal greeting is played, which has been previously recorded in the user's own voice, and a beep indicates that the caller may begin recording his message. Just like an answering machine, the caller speaks into the phone whatever message he would like to send to the user and then hangs up. Now the network signals the pager on a wide-area simulcast system similar to those in operation today.

^{7/} Motorola Inc. has also recognized the potential demand for voice paging services. It has predicted that if system capacity limitations can be solved, the number of voice pagers could increase from less than 2.5 million nationwide in 1990 to in excess of 18 million nationwide by the year 2000. See Comments of Motorola Inc., RM-7617, filed March 11, 1991 at Figure 2, attached hereto as Exhibit 2. PageNet's own experience indicates that even these estimates may be conservative.

(See Exhibit 4, "AMS Signalling Sequence") The pager sends an acknowledgment on a different channel which is delivered, through a network of receivers, to the network controller. Based upon information from those receivers, the controller selects the optimum base station site for delivery of the message. At the same time, it dynamically selects from eight possible message frequencies the optimum channel. It sends a command over the simulcast system informing the pager of that frequency assignment, then, utilizing digital modulation and compression techniques, broadcasts the voice message over a single transmitter best able to reach that pager. Meanwhile, that message frequency may be utilized by other stations in the same metropolitan area to transmit different voice messages. The pager may request retransmission if errors are detected in the message; otherwise, the user is alerted to the presence of a message. He is then free to listen to the message at his discretion.

VI. SYSTEM DESIGN

A. PageNet Will Employ A Simulcast System To Signal and Control Pagers

The simulcast portion of PageNet's VoiceNow Services system, using one 25 kHz channel, will operate much like PageNet's 900 MHz systems do today. Multiple transmitters, collectively providing coverage over the entire service area, will transmit signals to paging units on a common frequency, in a simulcast mode of operation. With VoiceNow Services, however, the simulcast system

will transmit only the pager's address to indicate that a message is awaiting transmission. Exhibit 3 at 2,7,8.

Critically important to PageNet's ability to serve the large numbers of users, and thus its overall system design, is the maximization of pages which can be sent over its simulcast channel. PageNet has thus designed its system to utilize the ERMES signalling protocol to transmit at 6250 bits per second. This increase in throughput will permit PageNet to double the number of subscribers served on a simulcast channel from the 160,000 served on its conventional systems today to approximately 330,000 subscribers.^{8/}

This simulcast channel forms the signalling and control foundation for the system, and is readily achievable through the combination of PageNet's extensive 900 MHz simulcast experience in the U.S. with the already-developed ERMES high speed signalling protocol.

B. PageNet's Unique System Design Facilitates Network Signaling Between The Pager And Receiver Sites

The companion to the wide-area simulcast transmitter network is the ACK receiver network. A response from the pager is used to determine its location for message delivery. This network also provides the means for pagers to request retransmission of incomplete messages, and ultimately provide positive confirmation

^{8/} PageNet has used a busy hour call rate of 0.2 in determining the approximate number of subscribers the simulcast signalling channel will likely accommodate.

of message delivery as well. In order to receive the acknowledgment from the pager, multiple receivers are required throughout the coverage area. Data from the receivers is forwarded to the Network Controller for processing.

In concept, the use of low power paging devices communicating with receive sites is relatively simple; in the real world, receipt of the signal from the pager is quite difficult. The difficulty stems from the relatively low power of the pager as compared to the relatively high power (up to 3500 watts E.R.P.) of the existing paging transmitters on the adjacent 929 and 931 MHz bands.

The disparity in power presents two separate and distinct problems in the design of receive stations for VoiceNow Services at 930 MHz. In designing its proposed system, PageNet has had to overcome the fact that the receivers would be desensitized by the strong signals emitted by paging transmitters in the 930 band, as well as adjacent bands, and compensate for the noise produced by these paging transmitters on receive frequencies. A third problem is the potential for intermodulation interference resulting from combinations of paging transmitters in the adjacent bands. See Report of Raymond C. Trott Consulting Engineers, attached hereto as Exhibit 5.

PageNet has been able to overcome each of these potentially prohibitive problems, in part through conducting test measurements in Los Angeles to determine real world conditions in an urban environment. Id. Through PageNet's testing, and empirical evaluation, it has found a simple but innovative solution. It has

determined that it can adequately compensate by utilizing sites for the receivers which have no collocated 900 MHz transmitters. Id. Furthermore, awareness of nearby transmitters in the band is essential to the successful design of the receive system. Id. Illustration 1 in Exhibit 3 demonstrates the system layout which PageNet has found necessary to assure talk back by the low powered pagers to the ACK receivers.

C. PageNet's Messaging System Deploys Frequency Reuse Concepts As Well As Digital Modulation Techniques In Order To Optimize Usage of Capacity On Messaging Channels

Voice paging utilizes substantially more capacity per message than does, for example, digital display paging. As discussed infra at Section IV, the decline in the availability of voice paging services, particularly in metropolitan areas, is a direct, albeit unfortunate, result of the congestion and resulting lack of capacity to handle voice messages. PageNet has developed techniques utilizing frequency reuse concepts to achieve spectral efficiencies which will, once again, permit it and others to fulfill the unmet demand for voice paging services. See Exhibit 3 at 2, Map 2.

1. Frequency Reuse

In a city like Los Angeles, already suffering under severe capacity constraints even for digital display services, which require very small amounts of bandwidth, PageNet envisions a four

cell reuse plan.^{9/} 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.^{10/} 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.

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

^{10/} 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.