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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)
)
Amendment of the Commission's) Docket 92-100
Rules to Establish New Personal) RM-7977
Personal Communications Services) pp-35
)

To: The Commission

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

PETITION FOR PARTIAL RECONSIDERATION

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SUMMARY

Dial Page, L.P. ("Dial Page") petitions the Commission for partial reconsideration of the portion of its Notice of Proposed Rulemaking and Tentative Decision, FCC 92-333 (August 14, 1992), tentatively denying Dial Page's request for a pioneer's preference for common carrier Acknowledgment Paging Service ("AP").

AP service is an enhanced paging service that allows a pager user to immediately acknowledge receipt of a page through a transmitter in the pager itself. Such a service ensures to both the sender of a page and the user of a pager that a page was received. In October of 1991, Dial Page filed a petition for rulemaking and a pioneer's preference request for its AP service. In addition, in support of AP's feasibility, Dial Page filed an experimental application which was granted in May of 1992.

The Commission tentatively denied Dial Page's request solely on the basis that Dial Page was one of several proponents of AP, and, therefore, had proposed nothing unique, and because Dial Page did not demonstrate the technical feasibility of its system through over-the-air tests.

As we will demonstrate herein, Dial Page was the first to propose an AP service, and thus is the innovator of AP. Moreover, through its ongoing tests since May of 1992, Dial Page has resolved technical barriers to implement its proposal through the design of a new receiver "Digiceiver" unique to AP. The Digiceiver can detect a low powered signal in a high noise environment. Such technology is fully supportive of the feasibility of Dial Page's proposal. Moreover, Dial Page

believes that the Digiceiver will have numerous commercial applications and will benefit those AMS proposals that require acknowledgment features as part of their proposals.

Dial Page has invested significant time and resources to develop its new proprietary Digiceiver to create a feasible cost effective AP service. Dial Page's efforts warrant grant of a preference under the Commission's pioneer preference rules.

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PETITION FOR PARTIAL RECONSIDERATION

Dial Page, L.P. ("Dial Page"), by its attorneys and pursuant to Section 1.106 of the Commission's Rules and Regulations, petitions for partial reconsideration of the portion of the Notice of Proposed Rule Making and Tentative Decision ("Decision"), FCC 92-333 (August 14, 1992) in which the Commission tentatively denied Dial Page's request for a pioneer's preference for common carrier Acknowledgement Paging Service ("AP").

I. Introduction.

1. In its Decision, the Commission tentatively denied Dial Page's pioneer preference request for AP service based solely on its finding that Dial Page was one of several proponents of AP, and therefore had proposed nothing unique, and because Dial Page had not demonstrated the technical feasibility of acknowledgment paging through over-the-air tests.

2. However, as will be shown below, Dial Page was the first to propose an AP service, and has designed new equipment to support the feasibility of its proposed service. Dial Page's efforts to develop proprietary technology through a series of

tests, including an over-the-air test, to create a feasible cost effective AP service, warrants grant of a preference under the Commission's pioneer preference rules or at least deferral of a decision on the request until Dial Page's tests are completed. Accordingly, Dial Page requests that the Commission reconsider its tentative denial of Dial Page's pioneer's preference request.

II. Background.

3. Dial Page petitioned the Commission on October 11, 1991, for an allocation of a portion of the reserve spectrum in the 930-931 MHz band for common carrier AP service. Dial Page's AP proposal would allow a pager user to immediately acknowledge receipt of a page by a transmitter within the pager itself. Such a service, ensures to both a sender and a user that a sent page is actually received. Thus, AP is an enhanced paging service that could significantly improve the reliability of traditional paging service, and the type of service that the Commission reserved the 930-931 MHz frequency band for in 1982.^{1/}

4. Dial Page simultaneously filed a request for a pioneer's preference for its AP proposal. In its request, inter alia, Dial Page set forth a detailed description of AP, and explained how AP enhances existing paging services by permitting a user to immediately acknowledge receipt of a page without the need to make a telephone call. Moreover, to demonstrate the

^{1/} The allocation Dial Page requests, was specifically reserved for advanced technology paging systems. See Policies and Procedures for One-way Paging Stations in the Domestic Public Land Mobile Radio Service, 89 F.C.C.2d 1337, 1341 (1982).

technical feasibility of its proposal, Dial Page filed an application for an experimental license for AP service, which was granted May 6, 1992.

5. On June 1, 1992, Dial Page supplemented its petition with marketing information including a study conducted by Arthur D. Little ("ADL") demonstrating a strong consumer demand for AP. The ADL market study indicated that four million current paging users, and an additional four million new paging users would subscribe to AP service. This study demonstrates a consumer interest comparable to current cellular and SMR units in service today. Thus, Dial Page documented a strong consumer demand and acceptance of its AP proposal.

6. In its supplement, Dial Page also presented a preliminary technical feasibility study refining its technical proposal and explaining its new development of the paging receiver "Digiceiver" needed to implement AP service.^{2/} Dial Page detailed its experimental program and the system test results and future test plans. This technological report formed the basis for its showing of the feasibility of the AP proposal.

7. In that showing, Dial Page discussed the critical problem facing implementation of AP service: development and

^{2/} Dial Page also supplemented its pioneer's preference request on June 1, 1992 to provide the Commission with its technical feasibility study. Accordingly, it is possible that the Commission simply did not know of the extensive work Dial Page had done prior to its decision. Because so many other AMS filings were made in June of 1992, and because of the procedural complexity of AMS, narrowband PCS, and wideband PCS involved in this proceeding, it would be understandable if Dial Page's technical report was overlooked.

implementation of a network of stations capable of receiving the low powered acknowledgment transmissions. Because the AP unit must use a very low powered transmitter, the technology deployed by the receiver network is critical. The AP receiver must be capable of receiving weak signals and demodulating them in the presence of narrow band and wide band interferences. After extensively investigating the commercial market for receivers that could be used to implement its proposal, Dial Page determined no such receiver existed. Based on its research, Dial Page developed its own Digiceiver^{3/}, a proprietary Digital Signal Processing Receiver uniquely suited for its AP system, as well as other systems. Indeed, Dial Page believes that the Digiceiver could be used by a number of the parties that filed AMS proposals including Pagenet, Pagemart, Metriplex and MobileCom. See infra ¶¶22 & 23. Not only does this equipment benefit AP, this product has direct application for any process requiring detection of weak digital signals. The technology can be used to improve the operating performance of RF data communications including alarm, automatic meter reading, telemetry and control, and credit card verification. The Dial Page Digiceiver will advance all processes requiring extremely precise detection of weak signals in noisy environments. Accordingly, Dial Page's showing of technical feasibility of its proposal, demonstrated that Dial Page had developed new state-of-the-art equipment that can benefit any service with the acknowledgement capability.

^{3/} Dial Page is in the process of patenting its Digiceiver.

8. Nevertheless, the Commission's August 14, 1992 Decision tentatively denied Dial Page's pioneer preference request.^{4/} In denying Dial Page's request, the Commission tentatively concluded that Dial Page's proposal was not innovative because other parties also proposed AP type service, and that Dial Page had not proven its feasibility, because Dial Page had not presented the results of an over the air test.

9. As we show below, Dial Page was the first to introduce Acknowledgment Paging. Thus, Dial Page believes its proposal is by definition new and innovative. Moreover, through a series of tests conducted since the May 6 grant, Dial Page has designed and developed new equipment that supports and demonstrates AP's feasibility. Dial Page has met the Commission's eligibility criteria for a grant of its preference request. Accordingly, the Commission should reconsider its tentative denial of Dial Page's pioneer's preference request.

^{4/} In addition to denying Dial Page's request, the Commission tentatively denied 12 other AMS requests. The Commission did grant a tentative pioneer's preference to Mtel. In denying the 12 AMS requests, the Commission found that most proponents did not meet the burden of demonstrating that their proposals were new, innovative or technically feasible. For example, the Commission tentatively concluded that Pagenet did not demonstrate that its proposal was new or innovative. In denying Freeman and Metriplex, the Commission tentatively concluded that both failed to demonstrate that their proposals were new, innovative and technically feasible. In denying Mobilecom and Echo Group, the Commission found that both had yet to demonstrate their proposal's feasibility through an experiment.

**III. Dial Page has met the Commission's
Pioneer Preference eligibility criteria.**

10. The Commission has stated that in applying the pioneer's preference rules it, first, examines the request pursuant to the eligibility criteria to determine (1) whether the applicant has demonstrated that its proposal is technologically innovative, and (2) whether the innovation reasonably will lead to establishment of a service not currently provided or will substantially enhance an existing service.^{5/} Second, the Commission evaluates the extent to which any experiments conducted by the proponent or other detailed technical submission demonstrate the proposal's viability.^{6/} Properly applied, the Commission's standards for evaluating pioneer's preferences require grant of a preference to Dial Page's AP proposal.

**A. Dial Page was the innovator of Acknowledgment
Paging and is thus entitled to a Pioneer's Preference.**

11. The Commission's conclusion that Dial Page's proposal is not technologically innovative because others in this proceeding proposed similar schemes for providing acknowledgment of paging messages is simply wrong. Dial Page was the first to propose AP.^{7/} As such, Dial Page is the proposal's innovator.

^{5/} See Request for Pioneer's Preference for Low-Earth Orbit Satellites, 7 FCC Rcd 1625, 1627 (1992) [hereinafter referred to as "Satellite Order"].

^{6/} Id.

^{7/} Dial Page is not claiming that other AMS filers are proposing AP systems. Rather, that the proposals of Mtel, Pagemart, Pagenet, Metriplex, and Mobilecomm, each include or integrate as part of their proposals, the AP concept.

(continued...)

12. Under Rule Section 1.402, a pioneer's preference request is appropriate where the applicant files a petition for rulemaking seeking an allocation of spectrum for either a new service or an enhancement or improvement of an existing service.^{8/} The Commission, in explaining the standard by which it determines whether a proposal is innovative, stated:

We will consider the development of an innovative proposal to mean that the petitioner ... has brought out the capabilities or possibilities of the technology or service or has brought them to a more advanced or effective state. Generally, we believe that an innovation could be an added functionality, a different use of the spectrum than previously available, or a change in the operating or technical characteristics of a service, any of which involve a substantial change from that which existed prior to the time the preference is requested. Further, technologies that yield efficiencies in spectrum use, speed or quality of information transfer, or spectrum sharing, or which significantly reduce costs to the public, will be given careful consideration.

See Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 6 FCC Rcd 3488, 3494 (1992)[hereinafter "Pioneer's Preference Order"].

^{7/}(...continued)

Indeed, these proposal can not work without an acknowledgment feature. Thus, AP can be seen as a necessary enhancement to other advanced paging systems.

^{8/} Rule Section 1.402(a) provides that

the applicant must demonstrate that it has developed the new service or technology, or has developed the capabilities or possibilities of the technology; e.g., that it ... has developed the capabilities or possibilities of the technology or service or has brought them to a more advanced or effective state.

13. Under the Commission's standard, whether a proposal is innovative is necessarily a question of whether anyone else already proposed such a service. Dial Page was the first to propose AP service to this Commission.^{9/} By being first, Dial Page obviously was the innovator of AP. Each of the proposals the Commission refers to that include an AP feature were filed long after Dial Page's October 11, 1991 petition for rulemaking proposing AP.^{10/} There is no doubt that AP was Dial Page's idea. Certainly no one proposed such a service before Dial Page. Thus, that others proposed an acknowledgment feature should not preclude a pioneer's preference to Dial Page.^{11/} Indeed, that other AMS proponents included an AP feature in their proposals

^{9/} Although the Commission has stated it may not just accord the first filer a preference because the first filer may not be the person who most deserves the preference, it stated that it would grant a preference to the developer of the innovation, or to those persons who have made a significant investment of effort in developing the innovation. Here, Dial Page is the first filer of the innovation and has significantly invested in the development of that innovation. Pioneer's Preference Order, 6 FCC Rcd 3494, n. 10.

^{10/} The AMS proposals that include an acknowledgment type feature include Mtel, Pagenet, Pagemart, Mobilecomm, and Metriplex. Each of these proposals were filed after Dial Page's October Petition. See MTEL Petition for Rulemaking, November 12, 1991; Pagenet Petition for Rulemaking, June 1, 1992; Pagemart Comment, June 1, 1992; Mobilecomm Request for Pioneer's Preference, June 1, 1992; and, Metriplex Request for Pioneer's Preference, June 1, 1992.

^{11/} While it is clear Dial Page was the first to propose acknowledgment paging, should the Commission find it difficult to distinguish between proposals, where appropriate the Commission has stated its intention to award preferences to each applicant that can meet the eligibility standard for being awarded a preference. Pioneer's Preference Order, 6 FCC Rcd at 3495.

clearly support the merit of Dial Page's proposal since it shows the value of that proposal. Because Dial Page was the first to propose the service, and because Dial Page has put substantial effort into developing its idea, Dial Page is entitled to a pioneer's preference.

14. Dial Page also meets the Commission's second eligibility criteria of whether the innovation reasonably will lead to the establishment of a service not currently provided or will substantially enhance an existing service. Dial Page's AP proposal does both. Dial Page's Acknowledgment Paging feature is not currently provided, and if licensed, will clearly enhance traditional paging service by adding an entirely new dimension to paging. AP will significantly improve the reliability of paging service. With the advent of nationwide paging, alphanumeric paging, and the possible allocation of spectrum for complex data transmission services, paging services now are important and becoming more so. Clearly the more important the message, the more crucial the reliability factor. AP provides a substantial measure of reliability. Although AP is not perhaps as exotic as the data delivery proposals of Mtel or Pagemart et. al., AP clearly is a necessary component of those proposals. AP is simply a natural extension of basic paging services and most importantly, unlike most of the AMS proposals -- AP works now and can be implemented now.

15. The Commission has only tentatively granted two pioneer preference requests. The first request was to Volunteers

in Technical Assistance ("VITA") for a license to operate a low-earth orbit ("LEO") satellite communications system to provide data communications. See Satellite Order, 7 FCC Rcd 1625 (1992). In tentatively granting VITA's request, the Commission found that VITA was clearly the first to both develop LEO data communications technology and to experiment with the operation of an actual LEO system to support data communications. Thus, the Commission found that VITA pioneered use of low orbit satellites for data communications. The second tentative grant was to Mtel in the subject decision. The Commission concluded that Mtel developed and demonstrated a significant improvement in bit transmission rates that would result in new service functionalities available to consumers. The Commission found that Mtel developed the technology necessary to implement its proposal, and thus provided a foundation for the feasibility of the proposal. Dial Page's proposal is similar to both VITA and Mtel. Like VITA and Mtel, Dial Page was the first to introduce AP service and to experiment with it. Moreover, as will be described below, Dial Page has developed new equipment to demonstrate the viability of its AP proposal. Thus, Dial Page, like Mtel, has provided a foundation to prove the feasibility of its proposal. Dial Page is thus entitled to grant of a pioneer's preference.

B. Dial Page has provided the foundation on which to judge AP's technical feasibility.

16. In denying Dial Page's pioneer's preference request, the Commission stated that because Dial Page did not conduct

over the air tests, it did not demonstrate the feasibility of its proposed system. The Commission's conclusion is mistaken. There is no specific requirement for over-the-air tests to prove feasibility.

17. Preliminarily, Rule Section 1.402 requires that an applicant accompany its preference request with either a demonstration of the technical feasibility of the new service or technology or an experimental license application, unless an experimental license application has previously been filed for that new service or technology. Moreover, in determining whether to award a preference, the Commission evaluates the extent to which any experiments conducted by the proponent or other detailed technical submission demonstrate the viability of its proposal.^{12/}

18. Dial Page understands the need for the Commission to require an applicant to demonstrate the feasibility of a proposal for a pioneer preference request. Because the award of a preference is so valuable, the Commission must require a substantial showing to justify grant of a preference. In its June 1, 1992 Supplement, Dial Page filed its preliminary tests results in an attempt to show its substantial progress in resolving the technological roadblocks to implementation of AP service.^{13/} Dial Page is filing simultaneously herewith the

^{12/} Satellite Order, 7 FCC Rcd at 1627.

^{13/} As explained in Dial Page's engineering statement in its supplement, Dial Page conducted tests and intended to
(continued...)

results of its quarterly progress report under its experimental authorization. In its report, Dial Page documents the recently conducted experiments that demonstrate Dial Page has overcome those roadblocks with the development of the AP Digiceiver. Thus, if the Commission believed Dial Page's preliminary test results were insufficient to demonstrate its proposal's feasibility, it now has sufficient grounds to reconsider its decision in light of the new information provided herein.

19. As the attached engineering statement of Mr. Andrew Degges explains, Dial Page has designed and developed a receiver that remedies the problems facing AP paging operating in the 930-931 MHz band where conventional receiving systems to be employed. Mr. Degges explains that with the frequency that AP would utilize, a conventional receiver system faces strong adjacent channel interference above and below the passband. The sources of that interference are existing paging transmitters on the 929-930 MHz and 931-932 MHz band. Moreover, Mr. Degges explains that conventional electrical wave filter technology fails to protect a receiver from adjacent channel interference from paging

13/ (...continued)

conduct additional tests by September of 1992. For example, Dial Page performed its first test to determine the ability of a low powered transmitter to be received within a certain milage separation. This test was a laboratory "over-the-air" test performed to provide a basis to compare the results of a conventional receiver to Dial Page's newly designed Digiceiver. Dial Page utilized battery-operated, low-power, portable RF transmitters and a Model/Transmitter unit connected to an antenna and personal computer, which was interfaced with the RF Modem. Dial Page also utilized a portable unit as a guide for locating the projected signal.

transmitters located closer than .1 miles from the receiver point. A conventional receiver system thus requires separate placement of receiving and transmitting equipment as a minimum criterion of system design. In addition, the receiver placement must be coordinated with all existing and future transmitters in the 929-932 MHz band, a very unrealistic task.^{14/} Since it is likely that adjacent channel licenses will be issued to competitive systems, coordination with AP receiver sites and adjacent transmitter sites may be impossible with conventional receivers. For example, a high power fill-in transmitter installed on an adjacent channel within .1 miles of an AP receiver would render that receiver inoperable and cause service disruption without notice.

20. Mr. Degges explains that AP requires the detection of a low level signal in a high interference environment. A conventional receiver, however, suffers from two forms of signal degradation; (1) the front end application stage of the receiver may be driven into saturation by out-band and in-band carriers; and, (2) the strong interfering signal may not be sufficiently attenuated by the filter stages and may appear as a spurious in-band signal in the discriminator output. The first form of signal degradation can be remedied through the use of an attenuator, a

^{14/} The need for coordination is to ensure that a new 900 MHz system design would not be licensed and result in severe interference to an existing system. Such coordination would unnecessarily burden either the Commission processes or the licensee by imposing the need to pay additional expenses for an independent frequency coordinator.

bandpass cavity ahead of the receiver front end and the application of a fast AGC control. The second form of signal degradation may be mitigated through the use of the dynamically recursive digital discriminator. Mr. Degges states that by exploiting augmentation and enhancements of the conventional receiver, Dial Page can overcome the .1 mile separation requirement for transmitters and receivers and avoid the massive task of transmitter-receiver coordination.

21. As set forth in the attached engineering statement, Dial Page conducted laboratory tests comparing a conventional receiver with the Digiceiver. The results of these tests undoubtedly demonstrate that the Digiceiver resulted in significant signal reception improvements. In its first test, Dial Page attempted to establish the quantitative advantage of Digiceiver augmented reception in the presence of normal strength narrow band interference. In the second test, Dial Page attempted to establish the quantitative advantage of Digiceiver augmented reception over a conventional receiver in the presence of strong interference and simulated distance. The results of tests one and two indicate that the Digiceiver provides a marginal increase in reliability for mild adjacent channel interference and a dramatic increase in reliability in the presence of strong adjacent channel interference. In a third test, Dial Page attempted to determine the quantitative advantage of the Digiceiver's affect on co-channel rather than adjacent channel interference. Dial Page determined that the Digiceiver

provides a dramatic increase in reliability in the presence of co-channel interference.

22. Dial Page's tests demonstrate that the Digiceiver enhances the reception of signals in the presence of high noise. As the attached graphic depiction of coverage demonstrates, Dial Page's Digiceiver can receive a signal 30dB weaker than a conventional receiver in a high noise environment while maintaining the same reliability of reception. With the use of the Digiceiver, Dial Page can provide reliable coverage to a significantly larger area with less receivers than that required with a conventional receiver. Accordingly, the Digiceiver would dramatically reduce the capital and operating costs while at the same time improving signal reception. Dial Page's Digiceiver is clearly a technological innovation that will result in wide applicability.^{15/}

23. The benefits of Dial Page's Digiceiver are numerous. The Digiceiver can work in conjunction with several of the other AMS proponent's systems that employ an AP feature. Specifically, Pagenet's, Pagemart's, Metriplex's and Mobilcom's proposals would be enhanced by the performance of Dial Page's Digiceiver since each of these systems require a low power acknowledgement system utilizing separate 25 KHz channels. Thus, Dial Page's newly developed Digiceiver clearly "yields efficiencies in spectrum use."^{16/}

^{15/} Dial Page has ordered equipment to conduct a field test, and thus expects to complete such a test in October. Dial Page believes that such tests will confirm its laboratory tests.

^{16/} Pioneer's Preference Order, 6 FCC Rcd at 3494.

VI. Conclusion.

24. Through Dial Page's market studies, it has documented a very broad public appeal for AP. Specifically, up to 8 million consumers are forecast to subscribe to AP service.^{17/} Clearly, those numbers alone speak for the public need for such a service. In addition, the fact that several other AMS proposals include an AP feature further supports the need for such a service.

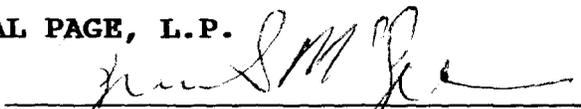
25. Dial Page has invested significant time and resources to develop its proprietary Digiceiver to make AP a viable low cost spectrum efficient service. AP is not some "futuristic" type of AMS paging service that may or may not work. AP is quite simply the logical next step in conventional paging services. Dial Page should not be penalized just because its proposal is less complicated than others. Thus, as the innovator of acknowledgement paging services, and the developer of new technology, Dial Page's proposal meets all of the Commission's criteria for an award of a preference. Accordingly, Dial Page's efforts in developing AP service warrant grant of a preference. In view of the foregoing, Dial Page respectfully requests that

^{17/} AP is widely accepted among consumers because it is perceived to be a low cost way to make existing paging services more valuable. Moreover, while innovative, AP does not utilize or attempt to utilize any unnecessary technological innovation that may not work. As Dial Page's profile study demonstrates, most users are medium income small business operators. These are the subscribers who are in need of more reliable communications services especially because they do not have large staffs. Those subscribers view AP service as a natural extension of paging service, and find that it is a service that "makes sense."

the Commission reconsider its tentative decision and grant Dial Page a pioneer's preference for its Acknowledgement Paging service.

Respectfully submitted,

DIAL PAGE, L.P.

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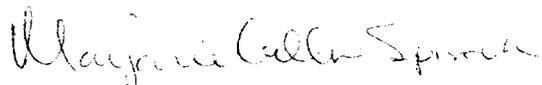
Re: Dial Page, L.P.
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File No. 2297-EX-PL-91

Dear Mr. Wright:

Transmitted herewith, in duplicate, on behalf of Dial Page, L.P., is the second progress report for the above-referenced experimental authorization.

Should you have any questions concerning this matter, please contact the undersigned.

Sincerely,



Gerald S. McGowan
Marjorie Giller Spivak

MGS:pcxt
Enclosure

System Enhancements Realized in the Application of the Dial Page Digiceiver to Acknowledgement Paging

Andrew Degges, Staff Project Engineer
Dial Page Corporate Engineering

Abstract:

Enhancements to be gained from the use of a DSP based receiver in an Acknowledgement Paging application are outlined. The augmentation of adjacent channel interference rejection and improved S/N ratio are detailed. The simplification of system design as a result of these enhancements is discussed.

Introduction:

The utilization of the Dial Page Digiceiver (Patent applied for) as the receiver of choice in an ACK-BACK Paging scheme is motivated by the Digiceiver's dramatically superior noise and interference specifications. The application of ACK-BACK Paging in the 930 MHz band presents some serious obstacles to a conventional receiving system.

An ACK-BACK Paging scheme consists of a standard simulcast transmission system (ERP = 100-3500 watts per simulcast transmitter) coupled with a receiver network. The pager is equipped with a low power transmitter (100-2000 miliwatts) to acknowledge that it has received a message when addressed by the paging system. The receiver sends the acknowledgement to the communications switch and advises the calling party that their message was received by the pager.

Conventional System:

In a conventional receiver system a narrow band communication receiver is utilized. This receiver typically has a sensitivity in the range of .5 microvolts and adjacent channel selectivity in the range of 80 - 85 DB.

At first glance these specifications seem adequate to the task of receiving the weak signal; particularly if sufficiently many receivers are deployed and networked. Unfortunately the receivers are subject to strong adjacent channel interference above and below their passband. The sources of the interference are existing paging transmitters on the 929 - 930 MHz and 931 - 932 MHz bands.

A well researched study of the pitfalls of using conventional receivers in this application was written by the Raymond C. Trott consulting engineering firm. This report, which was commissioned by Paging Network, Inc. (and included in their Pioneer's Preference filing) outlines the failure of conventional electrical wave filter technology to protect a receiver from adjacent channel interference from paging transmitters located closer than .1 miles from the receive point.

This is a serious handicap to system design as it mandates separate placement of receiving and transmitting equipment as a minimum criterion of system design. Moreover, this limitation requires coordination of receiver placement with all existing and planned transmitters in the 929 - 932 MHz bands. Since it is likely that adjacent channel licenses will be on competitive systems, coordinating acknowledgement receiver sites with adjacent transmitter sites may be impossible with conventional receivers. For example, a high power fill in transmitter installed

by a competitor operating an adjacent channel within .1 miles of an acknowledgement receiver would render that part of the receiver network inoperable and cause major service disruptions until an alternative receiver site is located. Such a task of coordination would be formidable.

The Trott firm has amassed empirical data to support these assertions in field trials they conducted in the Los Angeles area. We will not belabor the issue of the unfitness of the conventional receiver for this application, but will examine the fundamental reasons for its failure and ways they would be mitigated by employing the Dial Page DSP Digiceiver.

Receiver Design Fundamentals:

A conventional communications receiver consists of an analog signal processing chain composed of heterodyne mixers, amplifiers, and filters terminating in a limiter amplifier and a discriminator.(1) The end result of the signal processing chain is a 4 KHz bandlimited audio wave form.

In an high interference environment, in which we want to detect a low level signal, the receiver suffers due to the fact that if the interference is strong enough, two forms of signal degradation may occur:

- 1) The front end application stage of the receiver may be driven into saturation.
- 2) The strong interfering signal may not be sufficiently attenuated by the filter stages and may appear as a spurious in-band signal in the discriminator output.

The first form of signal degradation may be countered through the use of a bandpass cavity ahead of the receiver front end and the application of a fast AGC control.(1)

The second form of signal degradation may be mitigated through the use of the dynamically recursive digital discriminator described in (1). If we are interested in demodulating FSK data and only FSK data (i.e., no voice) then we may dispense with limiter-discriminator stage of the communications receiver and replace it with direct conversion stage coupled to a high speed analog/digital convertor.

By employing a parallel FIR DSP algorithm, it is possible to eliminate in-band interference from adjacent channels. In fact, it is possible to eliminate non-correlated co-channel interference as well. The bandwidth of the FIR filter is 20 Hz centered in the +/- 4200 KHz which is the FSK offset for binary 1/0.

By taking advantage of AM characteristics of FSK modulated FM we are able to enhance reception reliability by a factor of 30DB over a conventional limiter-discriminator demodulation scheme. The limitation of this method is that we can only demodulate FSK, it is not applicable to voice.

- (1) For a more detailed discussion of conventional receiver design, see the companion paper "A DYNAMICALLY RECURSIVE DIGITAL DISCRIMINATOR FOR THE DEMODULATION OF MONOTONIC BYPHASE FM RADIO SIGNALLING".

Conclusion:

By exploiting these augmentations and enhancements it should be possible to overcome the .1 mile separation requirement for transmitters and receivers and avoid the task of massive transmitter-receiver coordination. Our laboratory tests confirm these predictions. Our

upcoming real world tests will allow us to gauge the scope of reliability augmentation we can reasonably expect to achieve in real world terrain.

The benefits of this advance in communications technology would enhance the performance of PageNet's, Metriplex's and MobileCom systems.

All of these systems require a low power acknowledgement system utilizing separate 25 KHz channels.