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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules to Establish New Personal Communications Services	)	GEN. Docket No. 90-314 ET Docket No. 92-100
	)	
In the Request of	)	
	)	
Freeman Engineering Associates, Inc.	)	PP-79
	)	
For Award of a Pioneer's Preference in the 930-931 MHz Band to Provide Two-Way Data and Advanced Paging Services	)	

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To: The Commission

Petition for Reconsideration

Freeman Engineering Associates, Inc. ("Freeman"), by ts attorneys and pursuant to Section 1.106 of the Rules and Section 405 of the Communications Act of 1934, as amended, hereby requests reconsideration of the Commission's decision, in its First Report and Order (GEN Docket No. 90-314, ET Docket No. 92-100), FCC 93-329, released July 23, 1993 ("R&O"), denying Freeman's request for a pioneer's preference for the provision of 900 MHz band Personal Communications Services ("PCS"). In support hereof, the following is shown:

Freeman's Filings And Dr. Berlin's Comments

1. On June 1, 1992, Freeman timely-filed with the Commission its "Request for Pioneer's Preference" ("Request") in ET Docket No. 92-100 for the provision of two-way data and advanced paging

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services in the 930-931 MHz band within the New Orleans and Baton Rouge, Louisiana markets.

2. By Notice of Proposed Rule Making and Tentative Decision, FCC 92-333, released August 14, 1992 ("Tentative Decision"), the Commission tentatively concluded to deny the Request.[1] Freeman responded to the Tentative Decision in two ways. First, on October 5, 1992, Freeman filed a "Petition for Reconsideration" ("Petition") of the Commission's action.[2] Second, pursuant to Paragraph No. 169 of the Tentative Decision, Freeman filed with the Commission on November 9, 1992 its "Comments and Supplemental Information of Freeman Engineering Associates, Inc." ("Comments") which fully responded to the Commission's criticisms.

3. Freeman's November 9, 1992 Comments were extensively supported both by the 35-page "Engineering Statement of Arthur K. Peters, P.E.," and by the 72-page market study report, entitled

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[1] The Commission's discussion of Freeman's Request was set forth at Paragraph No.154 of the Tentative Decision. There the Commission incorrectly characterized Freeman's Request as setting forth "a general proposal to provide a number of paging-type services using 'advanced modulation techniques' and 'some current technology and some technology yet to be applied.'" The Commission set forth only one reason for its tentative decision to deny Freeman's Request, i.e., that Freeman did "not explain the technical basis for its proposal with greater specificity." This single finding constituted the sole basis for the Commission's tentative conclusion that Freeman "failed to meet its burden of demonstrating that its proposal is new, innovative, and technically feasible and therefore that its request should be denied."

[2] Petitions for reconsideration were filed by Freeman and five other pioneer's preference requestors. In the R&O, the Commission addressed all six petitions by stating that "[b]ecause these tentative decisions [denying pioneer's preference requests] were not final, ..., the petitions are not accepted but are treated as comments and are fully considered herein." R&O, footnote 65.

"Demand for the Advanced Paging Services Proposed By Freeman Engineering Associates," prepared by TRANSCOMM, Inc. Mr. Peter's Engineering Statement provided further information to demonstrate that Freeman's proposal is new, innovative and technically feasible; provided a more detailed description of Freeman's proposal, including its feasibility and the new and innovative features and concepts which distinguish it from existing, conventional systems; and showed that Freeman's proposal is at least as innovative and feasible as the proposal advanced by Mobile Telecommunications Technologies Corporation ("Mtel"), which the Commission had tentatively concluded merited a pioneer's preference. The TRANSCOMM market studies demonstrated the existence of public demand for the services proposed in Freeman's Request.

4. Also on November 9, 1992, Dr. Charles I. Berlin, the Director of the Kresge Hearing Research Laboratory of the South ("the Kresge Laboratory"), filed comments in support of Freeman's Request.[3] The Kresge Laboratory has a worldwide reputation as an institution on the cutting edge of new technology for medicine and for the hearing impaired.[4] As Dr. Berlin's comments demonstrate, Freeman's innovations, as embodied in its Request, are uniquely

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[3] The Kresge Laboratory (which is affiliated with the Louisiana State University Medical School in New Orleans, Louisiana) honored W. Harrell Freeman, the President of Freeman, as the recipient of the 1992 KAM Award for his contribution to the research efforts of the Kresge Laboratory. Dr. Berlin's comments, at Paragraph No. 7.

[4] Dr. Berlin's comments, at Paragraph No. 2.

suited to meeting communications needs of the hearing impaired at a lower cost to the deaf subscriber than afforded by landline telephone and cellular systems.[5]

The Commission's Denial Of Freeman's Request

5. The R&O evidences no indication that the Commission even considered the arguments advanced, and showings made, by Freeman in its Petition and Comments, or even considered the supporting comments filed by Dr. Berlin. It is axiomatic that an administrative agency must consider all material facts and issues presented in the record. Getty v. FSLIC, 805 F.2d 1050 (D.C. Cir. 1986); Brae Corporation v. United States, 740 F.2d 1023 (D.C. Cir. 1984); Motor and Equipment Manufacturers Association v. EPA, 627 F.2d 1095 (D.C. Cir. 1979); Greater Boston Television Corporation v. FCC, 444 F.2d 841 (D.C. Cir. 1970). The Commission's failure to do so constitutes clear error.

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[5] As noted by Dr. Berlin at Paragraph No. 8 of his comments, Freeman's Request embodies "a packet type arrangement for [telecommunications devices for the deaf ("TDD")] which conserves frequency resource. By combining the dispatch type arrangement with the TDD enhancement that Freeman's proposal allows, the TDD calls will be interleaved on the channel rather than requiring spectrum to be set aside during the entire duration of the call. One of the problems with using TDD with conversational cellular is that the holding times for the calls are much longer than for the spoken call. For example, on conventional telephones and cellular, the deaf person must keep a telephone call active until he has completed the message exchange. With this dispatch (packet) arrangement described in [Freeman's Request], the TDD device only need transmit when the message is ready. The switching equipment provided by [Freeman] will sort out the messages and get them to the appropriate calling party. This will allow for spectrum conservation and at the same time meet the needs of the deaf community which heretofore has had significant problem in operating TDD devices in a wireless environment, due to cost of airtime."

6. The R&O's discussion of Freeman's Request is set forth at Paragraph Nos. 112-114 of the R&O. There, the Commission characterized Freeman's Request as setting forth "a general proposal to provide E-mail, tone plus voice, tone only, digital readout, and alphanumeric simulcast paging services;" stated that Freeman had requested "a series of 150 kHz channels, using advanced modulation techniques for its simulcast broadcasts;" had requested "a 56 kHz return channel for mobiles and a series of 56 kHz channels for base station communications;" and "proposes the use of multiple satellite receivers to receive the return communications from portables." In denying Freeman's Request, the Commission incorrectly concluded that the "proposal requires a substantial amount of spectrum that is inconsistent with the Rules adopted herein," and that the "proposal indicates the use of 150 baud simulcast equipment, which is slow and not spectrum efficient."

The Commission's Criticisms Of Freeman's Request Are Not Well Taken

7. As a review of Freeman's June 1, 1992 Request, November 9, 1992 Comments and the attached supplemental "Engineering Statement of Arthur K. Peters, P.E." (Attachment A) hereto will disclose, the Commission's stated reasons for denying Freeman's Request are incorrect and are not supported by the record. First, the Freeman proposal does not require "a substantial amount of spectrum that is inconsistent with the Rules adopted" in the R&O. As noted in the Request, the Freeman proposal contemplates a

licensee using a single 150 kHz channel for base-to-mobile simulcast transmissions, a single 56 kHz channel for base station communications, and a single 56 kHz return channel for mobile-to-base communications.

8. The use of the 150 kHz channel, as proposed by Freeman, is not inconsistent with the Rules adopted in the R&O. The Commission's 900 MHz band PCS Rules, as adopted in the R&O, expressly permit the "aggregation of channels in any of the paired or unpaired channel groups (e.g., up to 150 kHz paired with 150 kHz) to accommodate the wider bandwidth services," and, as a result, expressly permit "a single licensee to hold licenses for up to three 50 kHz channels, paired or unpaired (i.e., no more than 150 kHz paired with 150 kHz)." R&O, Paragraph Nos. 21 and 34; Section 99.405(b) of the Rules.[6] Thus, Freeman's proposed use of a 150 kHz channel is fully consistent with the Rules adopted.

9. The flexibility of Freeman's proposed system is typified by the adaptability of the originally-proposed 56 kHz channel. The 56 kHz channel was proposed by Freeman in its Request, which was filed some two and one-half months prior to the Commission's August 14, 1992 release of the Tentative Decision, where the Commission first proposed (as one of three alternatives under active consideration) the use of 50 kHz channel bandwidths for 900 MHz

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[6] Section 99.405(b) of the Rules (adopted in the R&O) provides that "[a] single licensee is permitted to hold licenses for up to three 50 kHz channels, paired or unpaired. This limit is based on the total spectrum in the licensee's nationwide, regional, and local licenses at any geographic point."

band PCS. Tentative Decision, Paragraph Nos. 51 and 52.[7] In response to the Commission's proposal, Freeman changed the 56 kHz aspect of its proposal to employ the use of a 50 kHz channel (Attachment A hereto, pg. 1) which conformed the Request to the most conservative of the three channelization plans proposed by the Commission. This is reflected at page 4 of Mr. Peters' Engineering Statement, filed November 9, 1992, which noted that Freeman's original 56 kHz proposal "could be changed to 50 kHz to permit more uniform allocations," and that, under Freeman's proposal as so revised, "a single channel allocation would consist of a 150 kHz wide forward channel and a 50 kHz wide reverse channel." The R&O fails to acknowledge that Freeman's Request sets forth a proposal that will allow it to use 50 kHz channels.

10. At this juncture, it should be emphasized that considerations of administrative due process permit Freeman, at a minimum, to modify any aspect of its proposal in response to the rulemaking proposals advanced in the Tentative Decision so as to avoid a finding that any aspect of the proposal "is inconsistent with the Rules adopted" in the R&O. Under the Administrative Procedure Act, a party to an agency proceeding is entitled to

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[7] As its "first alternative," the Commission proposed a 50 kHz channel bandwidth at Paragraph No. 51 of the Tentative Decision. As its "second alternative," the Commission proposed "to divide the 901-902 MHz and 940-941 MHz frequency bands into four paired blocks of 250 kHz each (500 kHz per pair), and to divide the 930-931 MHz band into four 250 kHz blocks" Tentative Decision, Paragraph No. 52. The Commission stated that a "third alternative would be to divide the 901-902 MHz and 940-941 MHz frequency bands into two paired blocks of 500 kHz each (1 MHz per pair), and to assign 930-931 MHz as a single 1 MHz block" Tentative Decision, Paragraph No. 52.

actual and timely notice of the standards that such party is required to meet to obtain favorable relief from the agency. 5 USC §552(a). "Actual and timely notice" means that the agency must be precise, timely and informative with respect to its requirements. United States v. Anaconda Co., 445 F. Supp. 486 (D.D.C. 1977). As stated by the Court in Northern California Power Agency v. Morton, 396 F. Supp. 1187, 1191 (D.D.C. 1975) aff'd. 539 F.2d 243 (D.C. Cir. 1976):

> Where "timely" notice . . . is required, the statute cannot be satisfied by actual notice of the Department's improvised decisions as each new problem arises. What is contemplated is a reasonably complete code of procedures set out in advance by which actions can be guided, and strategies planned. (emphasis added).

Any failure by the Commission to permit Freeman to modify its Request in response to the Commission's rulemaking proposal would constitute a clear violation of the Administrative Procedure Act.

11. Similarly incorrect is the R&O's finding that Freeman's proposed system will employ 150 baud simulcast equipment. In point of fact, the system will employ a much faster transmission rate, and the reference to 150 baud equipment at page 8 of the Request was intended to indicate that existing simulcast equipment could be modified to achieve the higher transmission rate needed. As a review of page 2 of Mr. Peters' attached Engineering Statement will disclose, the Comments filed on November 9, 1992 (at page 18 of the Engineering Statement) clearly showed a transmission rate of 9600 bits per second on each of the 32 subchannels, or 9.6 kilobits per second per subchannel. As the attached Engineering Statement

likewise discloses at page 2, this transmission rate is technically feasible since the equipment will be capable of operating with a transmission rate of 19.2 kilobits per second.

12. Thus, the Commission's criticisms of Freeman's proposal are incorrect and unsupported by the record in this case.

Freeman's Proposal Is At Least As Innovative As Mtel's Proposal

13. In the R&O, the Commission granted Mtel a pioneer's preference for a Nationwide 50 kHz unpaired channel. According to the Commission, Mtel was awarded a pioneer's preference for having developed and tested "Multi-Carrier Modulation" technology capable of transmitting a 24 kilobits per second simulcast signal in a single 50 kHz channel, and designed a system capable of providing a variety of new 2-way services in a single 50 kHz channel.

14. As reflected in Mr. Peters' attached Engineering Statement, Freeman's proposal is at least as new and innovative as Mtel's proposal. The 22 system features identified by Mtel as justifications for the award of a pioneer's preference are quite plainly matched by the proposed Freeman system in virtually every category by equivalent or superior features. Thus, if Mtel is entitled to a pioneer's preference, so is Freeman. The failure to award Freeman a pioneer's preference in these circumstances constitutes arbitrary and capricious action.

WHEREFORE, Freeman requests that the R&O be set aside insofar as it denied Freeman's Request, and that Freeman be awarded a pioneer's preference.

Respectfully submitted,

Freeman Engineering Associates, Inc.

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Dated: August 23, 1993

FREEMAN ENGINEERING ASSOCIATES, INC.

ENGINEERING STATEMENT OF ARTHUR K. PETERS, P.E.

The firm of Arthur K. Peters, Consulting Engineers, has been retained by Freeman Engineering Associates, Inc. (Freeman), to review and comment on the statements made in the FCC's recent First Report and Order in the matter of Amendment of Commission's Rules to Establish New Narrowband Personal Communications Services, General Docket No. 90-314, ET Docket No. 92-100 (Order).

INTRODUCTION

The FCC released its Order on July 23, 1993 (adopted June 24, 1993), mimeo FCC 93-329. In the Order at page 44, paragraphs 112-114, it appears that the FCC has mistakenly used the wrong Freeman information. There are no references in the Order to the factors contained in Freeman's technical report submitted as Comments and Supplemental Information on November 9, 1992. The technical portion of this report is attached herein as Appendix B. For convenience, paragraphs 112-114 of the Commission's Order are reproduced as Appendix A.

COMMENTS CONCERNING COMMISSION REVIEW OF FREEMAN'S PROPOSAL

The Freeman proposal requested a single 150 kHz forward channel and a single 56 kHz reverse channel (which it modified to be a 50 kHz reverse channel). The Commission's Order provided a mechanism for obtaining precisely the bandwidth requested in the Freeman proposal. However, in characterizing the Freeman proposal, the Order indicates that Freeman "requires" a series of 150 kHz channels. In paragraph 114 (see Appendix A) the Commission found that Freeman's proposal "requires a substantial amount of spectrum that is inconsistent with the Rules adopted herein. Additionally, Freeman's proposal indicates the use of 150 baud simulcast equipment which is slow and not spectrum efficient or innovative." Had the Commission reviewed Freeman's technical proposal more closely, it would have determined that the Freeman proposal was the most frequency-efficient system in the entire proceeding before it, including that of Mtel to which it granted a Pioneer's Preference. For example, the Freeman system requires a 150 kHz forward channel which will enable the system to serve eight-million tone only subscribers or 98,630 voice subscribers assuming 15 second voice messages or eight-million alpha-numeric subscribers assuming a 60-character message.

Since the time Freeman submitted its technical showing in November, 1992, the manufacturer of the receiver has successfully produced a receiver with a subcarrier system using a 5-volt, 10 ma. digital signal processor (DSP). They are currently examining the DSP's reduced power consumption and operational characteristics at 3.3 volts. At present, a 19.2 kbps data rate has been found to be stable in an actual fading channel. Freeman's proposal requires half that data rate, or, 9.6 kbps. See page 18 of Appendix B.

In the Order, Mtel was granted a Pioneer's Preference on the basis of a number of characteristics of its proposed system. However, several of Mtel's claims were used throughout the Order as justification for awarding the Preference. Presented below is a list of those system features identified by Mtel, in its January 8, 1993 Reply, as being advantageous to its system with a comparison of Freeman system features.

Subject	Mtel	Freeman
Speed per 50 kHz of bandwidth	24 kbps	96 kbps
Maximum speed	24 kbps	288 kbps
Two-way functionality:		
Automatic acknowledgement	Yes	Yes
Return Receipt	Yes	Yes
Two-way digital data	Yes	Yes[1]
Nationwide Coverage Capability	Yes	Yes/No[2]
Simultaneous transmitter capability	Yes	Yes
Application Independence	Yes	Yes
Adaptable Functionality:		
Error detection	Yes	Yes
Error correction	Yes	Yes
Encryption	Yes	Yes
Prioritization	Yes	Yes
Billing options	Yes	Yes
Message variable bandwidth[5]	No	Yes
Adaptive data protocol[5]	No	Yes
Simulcast Zoning	Yes	Yes
Multiple Receiver Load Balancing	Yes	No
Dynamic Scheduling	Yes	Yes
Contention Priority Ordered Demand Assignment of Resources	Yes	Not required[3]
Adaptive Registration	Yes	Yes[4]
Voice Capability as adjunct to digital data[5]	No	Yes
Graceful, seamless system expansion capability	Yes	Yes

Table 1. Major Feature Comparison

[1]Asymmetrical with greater capacity in the forward direction
[2]Can be used as local, regional and/or nationwide
[3]Can be utilized if found necessary in peculiar circumstances
[4]On request of system. Will not affect Freeman's capacity.
[5]Not an Mtel claim

A quick review of the features which won Mtel its Pioneer Preference is quite plainly matched in virtually every category (except a few which may not be of any real value) with equivalent or superior features of the Freeman system.

MAJOR SYSTEM DIFFERENCES

The Freeman system does not propose symmetrical land and mobile data rates. Freeman anticipates that there is enough demand for advanced messaging services (without high capacity reverse capabilities) that a lower capacity, narrower bandwidth reverse channel is all that is necessary. Wide-band PCS and current cellular services are available for high-volume, symmetrical data applications. In its technical explanation in Appendix B it was indicated that CDMA techniques were to be investigated for use with the reverse channel. Since the reverse channel will be substantially comprised of very low power mobile (pager) units, the deployment of an appropriate number of remote receivers will be used so that low power units will be near system receivers at any time. Techniques for controlling the use of the receivers to effect the required throughput were discussed. When using mobile units of the variety that can originate substantial amounts of data, higher power units may be available. The CDMA techniques proposed by Freeman in Appendix B has the flexibility to be adapted depending upon the mix of high power and low power mobile units which would be served in its system. Several techniques exist which have been proven in the fading channel environment such as ALOHA and others. Any of these systems could be employed in the reverse channel depending upon the complexity of the required reverse channel communications. Freeman anticipates wide acceptance of its proposed system needing only limited reverse channel communications. A Pioneers Preference should not be denied on the basis of Reverse Channel Configuration because it does not technically hinder the Freeman proposal. That is, the Freeman system retains the same capacity with or without a reverse channel. The reverse channel is used mainly to enhance service offerings.

FREEMAN DESERVES A PIONEER PREFERENCE

For several of the reasons shown in Table 1, Freeman is deserving of a Pioneer Preference. For example, its channel efficiency alone makes it deserving. Moreover, simulcast equalization techniques proposed by Freeman will enable this high capacity system to be deployed using relatively standard simultaneous transmission methods in wide use today. In a manner somewhat akin to digital television compression, the system equalizes only the spectrum necessary to

ensure low error rates in the presence of strong co-channel signals. Even if the fully implemented system efficiency is reduced by a retry factor of 2-to-1, the Freeman system is still the most efficient proposed by any entity in this Proceeding. Moreover, the Freeman system has the ability to change its data protocol and vary its data bandwidth in accordance with user requirements. A user could be assigned multiple subchannels to enable a high-speed service which could include video or any other digital service. Obviously, customers who require such services would also require the utilization of more sophisticated and higher priced receiver equipment. But, at least the Freeman system has the capability to utilize this variable bandwidth on a customer-by-customer basis. No other applicant proposed these features which will assure the Freeman system a smooth and orderly transition to future technology and techniques.

Arthur K. Peters, P.E.

August 12, 1993

APPENDIX A

(Excerpt from Commission's First Report and Order
General Docket 90-314, FCC 93-329, pages 44-45)

112. Freeman Engineering Associates, Inc. (PP-79). Freeman submitted a general proposal to provide E-Mail, tone plus voice, tone only, digital readout, and alphanumeric simulcast paging service.[88] Freeman requests a series of 150 kHz channels, using advanced modulation techniques for its simulcast broadcasts. Additionally, Freeman requests a 56 kHz return channel for mobiles and a series of 56 kHz channels for base station communications. Freeman also proposes the use of multiple satellite receivers to receive the return communications from portables.

113. In the Tentative Decision, we proposed to deny Freeman's preference request because Freeman had not demonstrated the feasibility of its technology nor development of the capabilities or possibilities of a specific PCS technology or service. in comments to the Tentative Decision, Freeman states that its request sets forth a considerably more detailed explanation of the technical basis for its proposal than the Commission's tentative denial suggests. Specifically, Freeman contends that its proposal: a) allows the integration of multiple modes of operation on a single paging channel; b) envisions an extension of a local area network or public data network to transmit messages or data to portable computers; c) requires a series of 150 kHz channels using advanced modulation; d) requires digitization of the voice message to the pager; e) permits the text messaging service to be integrated in the same bit stream with conventional digital readout and tone alert services; f) permits a 56 kHz reverse channel to be used for mobile and fixed units to allow for response to incoming calls by the paging subscriber; g) permits the 56 kHz reverse channel to be synchronized with fixed station transmitting equipment; h) allows multiple satellite receivers to be used; and i) permits the 56 kHz channels to be used for transmissions from the base stations to the subscriber equipment to allow for the use of packet switching technology in conjunction with the paging system for wireless input of paging calls.

114. We find that Freeman's proposal requires a substantial amount of spectrum that is inconsistent with the rules adopted herein. Additionally, Freeman's proposal indicates the use of 150 baud simulcast equipment, which is slow and not spectrum efficient or innovative. Accordingly, we deny Freeman's pioneer's preference request.

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[88] See Freeman Request at 4.

APPENDIX B

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FREEMAN ENGINEERING ASSOCIATES, INC.

ENGINEERING STATEMENT OF ARTHUR K. PETERS, P.E.

The firm of Arthur K. Peters, Consulting Engineers, has been retained by Freeman Engineering Associates, Inc. (Freeman), to provide a more detailed explanation of the paging system set forth in Freeman's Request for a Pioneer's Preference previously filed with the FCC. The FCC rejected Freeman's application on the basis of insufficient technical information. This report provides in detail all of the features and services summarized in Freeman's original request and describes how Freeman's system meets or exceeds the Commission criteria for awarding such a preference.

INTRODUCTION

In its application, Freeman proposed advanced paging services utilizing base to pager channels of 150 KHz and response (pager to base) channels of 56 KHz. On these channels, Freeman referred to services which included voice transmissions, data transmissions, voice mail messaging, special services for the deaf, message delivery information, systems distributed over large geographical areas, retransmission of messages that were incorrectly received and efficient use of the spectrum for paging and text messaging. The details presented here show that Freeman's system meets or exceeds all expectations listed in Freeman's Request.

It will be shown that Freeman's system is extremely efficient compared with current paging practices for all types of paging including voice, tone only, numeric and alpha numeric. Because of the relatively low speed of voice transmissions resulting from individual message time lengths, paging system operators have all but abandoned voice messaging in spite of the fact that voice messaging is still the most efficient way to convey large amounts of data to a pager from any telephone with no special devices required.

Freeman's system will utilize existing technology in a new and innovative application. Pagers for this service will cost about the same as current pagers but utilize very different, already existing, more modern technology to realize the enormous efficiencies described. Transmitters and equalizing techniques required for this system are derived from present equipment with few or no required modifications. Manufacturers and suppliers have been contacted and it has been determined that all of the equipment required for this enterprise could be in service within a year's time at costs comparable to current existing paging system components.

The word "pagers" in this document refers to any digital device which receives data over the system. This can be in the form of a printer, a telecommunications device for the deaf (TDD), facsimile device or any other digital device which generally employs a predominately unidirectional data path. We have termed the main 150 KHz channel the forward direction and the 56 KHz response channel the reverse direction. The reverse channel will be typically used for message control, short responses and automatic verification of delivery of a paging message.

OVERALL SYSTEM DESCRIPTION

FCC Rules Changes Required to Implement the Proposed System

The system proposed here is not licensable under current FCC Rules. The Commission is currently looking toward allocation of advanced paging channels in GEN Docket 90-314, ET Docket No. 92-100 as described in the NPRM released August 14, 1992. In that document, the Commission requests comments concerning advanced paging services in the 901-902, 930-931 and 940-941 MHz services. At Paragraphs 48-52 the Commission has listed several alternative allocation structures for these frequencies. Freeman proposes that provision be made for highly spectrum efficient systems such as described here. Additionally, it should be recognized that multi-transmitter simultaneous transmission systems require special and very precise distribution of signals over wide areas. In conventional paging systems, simple radio links are used for distribution of signals over large geographic areas. Similar arrangements would be required for simultaneous, wide-area wideband systems, such as the one proposed here. Therefore, some means for radio distribution would be beneficial. However, interstation distribution can be accomplished using conventional microwave techniques in other frequency bands.

Frequencies and Bandwidths

Freeman seeks allocation of 150 KHz bandwidth for forward channels and 56 KHz bandwidth for reverse channels. It should be noted that if it is more convenient, the 56 KHz value could be changed to 50 KHz to permit more uniform allocations. In this case, a single channel allocation would consist of a 150 KHz wide forward channel and a 50 KHz wide reverse channel.

Of the three 1 MHz bands under FCC consideration, it would be most desirable to place the 150 KHz transmission channel or channels adjacent to other high power paging transmission bands. The Freeman system utilizes effective radiated power outputs similar to those currently authorized in the 931 MHz band. Thus, it would be reasonable to assign these wideband channels in the 930-931 MHz band.

The reverse response channels should be allocated in a band which is not immediately adjacent to high power transmission bands. This requirement exists because the response channels will typically have very low power transmissions of very short duration.

The system proposed here will function properly with any channel allocation adopted by the FCC having similar bandwidths.

Since the proposed system costs are not much different from existing systems, it is not difficult to justify utilizing this system for smaller areas which will permit access to other compatible systems. Because of the enormous capacity achieved in this system, larger population centers will likely use this system first

while rural areas will institute the service as needs arise. There are no technological or cost factors involved in this proposed system which would restrict the system's use in rural areas.

System Description and Operation

The Freeman system consists of a forward and reverse channel. The forward channel is comprised of a system of 32 subchannels which are modulated on a standard FM transmitter in a wideband mode. Each of these subchannels carries data at a rate of 9600 bits per second (bps). The first subchannel (Channel 1) is a synchronous channel to which all pagers will be tuned when idle. Pagers will synchronize themselves to the data on Channel 1 using techniques that are well established in the paging industry, namely those employed in POCSAG synchronization.[1] The normal POCSAG battery saving techniques are employed in this proposed system and provisions are available for different battery saving techniques due to slight format changes in the coding structure. The code formats and protocols are addressed later in this presentation.

It is anticipated that pagers will utilize digital signal processing technology (DSP) which are specialized computer hardware devices which enable large volumes of computations. Using DSPs, the pager technology will be highly simplified and made more versatile and much "smarter" than ever before.

In an idle condition pagers will be tuned to Channel 1 decoding the synchronous bit stream which consists of paging addresses. When a pager

[1] Unlike POCSAG, since the system utilizes only one signalling protocol, the preamble signal will rarely be used except immediately after system interruptions.

detects its address it decodes the channel number contained in the address codeword. Codes and bit allocations within the protocol are described in the Code Format and Protocol section. There are several currently assigned actions a pager may take based upon information contained in its address codeword. There is also spare capacity in the protocol to make future assignments as the system evolves. Currently, the system can address over two million pagers with expansion potential to over eight million on this single 150 KHz channel.

The system operates as a calling channel/working channel conventional radio system. When the pager detects its address in the synchronous bit stream, a message channel number of zero indicates that there is no pending message at which time the pager simply alerts the user and resumes its decoding of Channel 1. If the message channel number equals one, then the system is requesting that the pager transpond its identification on the response channel. This message may be sent by the system for any number of reasons but generally it will be to locate the pager and/or determine if the pager is within the system area and receiving decodable signals. If the message channel number is greater than one, the pager will then move to one of the other 31 subchannels and acquire bit and word sync on the new channel. Once the message is received, if there are no errors, the pager responds on the reverse channel with its address and the message channel number.

Pager responses will generally be automatic and issued upon receipt of a message with no errors. If the message is not received or if the pager has received an error, the pager may send an indication back to the system to resubmit or retransmit the message. In a preponderance of paging cases, a calling party will

receive an immediate response. In fact, Freeman anticipates converting the pager responses, in many cases, to synthesized voice responses such as "Message received". In some cases, a selection of responses is possible, depending upon the message sent to the pager. In these cases, the user will select a response from two or more buttons placed on the pager. Responses such as yes, no, defer, delay are all possible and interpretable at the user's discretion without specific system involvement. More complex responses and responses requiring multiple words can also be relayed back to the system over the reverse channel.

Pagers equipped for voice transmissions will be able to store five 15-second voice messages to be recalled at will. Voice messages are digitally encoded by the system and sent at greater than a real time rate. This compressed format will provide a high-quality voice message with a small amount of compression. It will permit a 15-second message to be transmitted to a pager in 10.95 seconds including subchannel acquisition time.

Persons with hearing disabilities will receive unique benefit from the Freeman system. When deaf persons are paged on conventional paging systems, they may have significant problems responding. The proposed system allows the person to respond by pressing a button which will immediately be communicated back to the calling party. The response can be converted to a voice response, returned via E-mail or sent as a character string if the calling party placed the call via a TDD.

Benefits can also accrue to persons with other types of disabilities. There are no system technical limitations to receiving emergency origination messages from pagers on the response channel. For example, as is currently provided in other services, medical emergencies can be annunciated by originating a special

message from a small pager. The chief advantage to using the Freeman system is that a large infrastructure will be in place and underwritten by large numbers of diverse users.

System expansions such as using messages with alternative code formats are potentially available by defining one of the reserved message type words. In the future, even combinations of message formats including higher speed data simultaneously utilizing two or more subchannels are possible with software changes in the system. For example, a message type (either Type 3 or Type 4) can be defined to permit commands and instructions to occur in the messages themselves. Once the pager intercepts its address and transfers to a subchannel for message processing, the message word can contain further instructions for the pager to also acquire one or more additional subchannels for simultaneous transmission or to completely change its codeword structure. Procedures like this will be possible for future equipment without affecting the compatibility or usability of existing equipment. Thus, the proposed system is fully expandable without obsolesence.

While discussing the features one has a tendency to remain with familiar objects used in paging systems. However, in this case the pager should acquire no fixed definition and can literally be a computer terminal, voice messaging system, facsimile terminal and a host of other types of devices. The system will automatically send appropriate messages to the appropriate devices in the expected formats. Should a format change be required, one of the codewords would define an extended messaging service in which formatting is performed on