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Before the
FEDERAL COMMUNICATIONS COMMISSION
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In the Matter Of:	)	
	)	
PAGEMART, INC.	)	
	)	ET Docket No. 92-100
Request for a Pioneer's Preference	)	PP-40
Regarding its Petition for Rulemaking	)	
to Allocate 800 kHz in the 930-931 MHz Band	)	
and to Establish Rules and Policies for a New	)	
Nationwide & Local Personal Information	)	
Messaging Service	)	

FORMAL OPPOSITION AND REPLY COMMENTS OF MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION

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TABLE OF CONTENTS

SUMMARY i

I. PAGEMART HAS FAILED TO DEMONSTRATE TECHNICAL FEASIBILITY . 2

II. PAGEMART'S PIMS SERVICE OFFERS NO INNOVATIONS WARRANTING A PIONEER'S PREFERENCE 7

A. "Radiolocationing" Is An Inherent Requirement of Cell-Based Frequency Re-Use Systems That Does Not Qualify As An Innovation 8

B. PageMart's Cell-Based Re-Use Plan Employing An "Adaptive Architecture" Is Not Innovative 9

C. PageMart's Open Protocols and Device Independence Are Not Innovative 15

III. THE PURPORTED "PUBLIC BENEFITS" OF PIMS ARE ILLUSORY 16

A. PIMS Is Spectrally Inefficient 16

B. PageMart's Identified "Consumer Benefits" Are Counterintuitive And Unsupported 18

IV. CONCLUSION 19

EXHIBIT A: MPR Comments on the Physical Layer Aspects of the "Petition for Rulemaking" . . . . . TAB A

EXHIBIT B: MPR Comments on the Link Layer Aspects of the "Petition for Rulemaking" . . . . . TAB B

SUMMARY

The Pioneer Preference rules require the submission of a technical feasibility demonstration or initial experimental test results establishing that a new service can be implemented as proposed. PageMart has done neither. Its sole submission prior to the Commission's cut off deadline for such filings was simply a 28 page description of how its Personal Information Messaging Service conceptually might work. This failure to provide required information, standing alone, requires dismissal of the PageMart request.

PageMart's omissions are particularly glaring given the numerous technical questions associated with its PIMS proposal. As documented below, Mtel retained the engineering consulting firm of MPR Teletech Ltd to evaluate the PIMS service as described by PageMart. MPR found that the proposed service raises serious unresolved technical issues ranging from the lack of basic information essential to even a rudimentary analysis of any proposed service to the failure to corroborate the feasibility of PIMS basic technological design.

MPR found at least eleven serious major technical problems unaddressed by PageMart. For example, PageMart proposes a four cell re-use system radically departing from industry standards without any attempt to demonstrate its feasibility. Similarly, PageMart claims the capability to deliver 4,800 baud simulcasting without any documentation to back up its representations. These issue and omissions are detailed in the appended MPR report and highlighted below.

Aside from the foregoing fatal deficiencies, PageMart has failed to identify any true innovations arising from its developmental efforts. Its request cites features of PIMS which

either involve variations of existing industry technology or do not rise to the level of a significant advance warranting Pioneer Preference status. Finally, the purported benefits of PIMS are exaggerated and potentially illusory.

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FORMAL OPPOSITION AND REPLY COMMENTS OF MOBILE TELECOMMUNICATION TECHNOLOGIES CORPORATION

Mobile Telecommunications Technologies Corporation ("Mtel"), by its attorneys, herewith submits it opposition and reply comments to the above captioned Pioneer Preference Request Filed by PageMart, Inc. ("PageMart").[1] As detailed below, its request has failed to meet even the most minimal obligations of any party seeking a Pioneer Preference. PageMart has not submitted any technical feasibility demonstration or any initial experimental test result to confirm that its Personal Information Messaging Service ("PIMS") can be

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[1] *See PageMart, Inc. Request for a Pioneer's Preference Regarding its Petition for Rulemaking to Allocate 800 kHz in the 930-931 MHz Band and to Establish Rules and Policies for a New Nationwide & Local Personal Information Messaging Service*, ET Docket No. 92-100, PP-40 (filed February 28, 1992) ["*PageMart Pioneer Preference Request*"]. *See also PageMart, Inc. Petition for Rulemaking to Allocate 800 kHz in the 930-931 MHz Band and to Establish Rules and Policies for a New Nationwide & Local Personal Information Messaging Service*, ET Docket 92-100, RM-7980 (filed February 28, 1992) ["*PageMart Petition*"]; *Comments of PageMart, Inc.*, ET Docket 92-100, RM-7976 *et al.* (filed June 1, 1992) ["*PageMart Comments*"].

implemented as proposed.[2] Nor has PageMart identified any significant innovations attributable to its developmental efforts within the meaning of the Pioneer Preference policies. Accordingly, PageMart's request should be summarily dismissed for failure to comply with Commission rules.

I. PAGEMART HAS FAILED TO DEMONSTRATE TECHNICAL FEASIBILITY

PageMart has elected not to file a technical feasibility demonstration or initial experimental results. Consequently, the total technical record of PageMart's PIMS proposal is an appendix included with its petition for rulemaking that leaves unanswered a number of fundamental questions on the basic theory of PIMS.[3] Importantly, the problems raised by Mtel are more than simple feasibility issues, but rather serious informational omissions that are requisite to any rational discussion on the technical viability of the service.

In effect, PageMart has simply postulated that cell-based re-use technology can be applied to two-way messaging services and briefly described a system that assumes, with no rational basis, a four-cell re-use pattern. Despite the paucity of information included on PageMart's system, Mtel requested MPR Teletech, Ltd. ("MPR") to examine critically the PageMart PIMS proposal.[4] MPR's findings are included in two attachments, Exhibit A,

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[2] The cut-off deadline for the filing of initial experimental reports or technical feasibility demonstrations has now passed. *See* Deadline To File Pioneer's Preference Requests 900 MHz Narrowband Data and Paging Service (ET Docket No. 92-100), *Public Notice*, Mimeo 22922 (April 30, 1992).

[3] *PageMart Petition* at Appendix A.

[4] MPR has research and development roots extending over 80 years through its predecessor, GTE Lenkurt Electric (Canada) Ltd. MPR's extensive experience covers a broad range of technologies and services, including: (1) microwave radio, satellite, emergency, aeronautical, and infrared communications; (2) network management, supervisory and signalling, and imaging systems; (3) systems integration; and (4) manufacturing. MPR has recently been engaged in performing in-depth studies on the performance of wireless technologies for

detailing the physical layer deficiencies of PIMS, and Exhibit B, detailing the link layer problems with PIMS. These findings, as summarized below, indicate that PageMart's efforts barely provide an adequate description of the system, and certainly do not constitute a technical feasibility demonstration.

- ***The Ability To Use a Four Cell Re-Use Plan.*** It is generally well understood that using a smaller number of cells per cell group increases capacity. However, the standard cell grouping used in the mobile communications industry is seven because the reduction to four cell re-use results in severe co-channel interference problems. Despite that the industry as a whole has not succeeded in going below a seven-cell re-use plan, PageMart proposes to do so. However, PageMart has not included any information in its filing regarding the suitability of a four cell re-use pattern for messaging applications, where channels are "re-used" at a distance of 3.46 cell radii,[5] and a mobile being served by one cell could be closer than one cell diameter from a mobile being served by a different cell on the same frequency. In other words, a 100 mW mobile at the edge of a cell service area (1 cell radius from the intended receiver) could be attempting to communicate with its base station while a high power base station is transmitting on the same frequency only 2.46 cell radii away from the mobile unit. PageMart's analysis utterly fails to prove that it can maintain reliable communications with a carrier-to-interferer ("C/I") protection ratio of only 12.93 dB.[6]

- ***4800 Baud Simulcast.*** PageMart's "polling channel" operates as a 4,800 baud MSA-wide simulcast. In light of the extensive documentary record compiled in this proceeding indicating that 3,000 baud is a practical limitation on simulcast systems, PageMart's unsubstantiated claim to be able to simulcast at 4,800 baud on its "polling channel" is speculative at best, and certainly not simple, proven technology. Moreover, although PageMart faults Mtel incorrectly for failing to discuss interzone interference,[7] PageMart itself does not deal in any way with the potential for interference on the polling channel between MSAs. Since, unlike in Mtel's NWN

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its parent, BC Tel, including cellular CDMA, cellular TDMA, CT-2+, and other new mobile data technologies.

[5] For a cluster of N cells in a re-use pattern, the "re-use" distance D is generally given by $D = (\sqrt{3} * \sqrt{N})$. *See* J.D. Parsons & J.G. Gardiner, *Mobile Communication Systems* (Halsted Press 1989), p. 249.

[6] *MPR Comments on the Physical Layer Aspects of the "Petition for Rulemaking"* at 4-9 (Attached as Exhibit A).

[7] Mtel's system provides for a number of feasible means for limiting interzone interference. *See Mtel Reply*, ET Docket 92-100, PP-37 (filed June 16, 1992).

system, the polling channel in different MSAs will not be synchronized, inter-MSA interference on the polling channel could be attended with severe capacity penalties.

- ***Base Station Transmitter Power And Proposed Cell Radii.*** PageMart has omitted any reference to the size of the cells it intends to use or the power to be used by its base station transmitters (although it specifies a maximum of 3,500 Watts). Without these crucial numbers, PageMart has failed to demonstrate that adequate service can be provided to mobiles within the nominal service area of the base transmitter. Mtel's calculations, in fact, indicate the contrary -- a 100 mW mobile has an on the street coverage distance of 1.15 miles (reduced to 0.33 miles if the service will support in-building use), whereas a 500 Watt base transmitter has a coverage radius of 10.54 miles (again, reduced to 4.29 miles if the service will support in-building use).[8] Since PageMart only proposes to use twice as many "fill-in" receivers as base stations (it would, however, appear to require approximately 169 dedicated receiver sites per base station for full coverage), mobiles cannot operate throughout the full coverage area of a cell base station without losing acknowledgements critical to PIMS ARQ protocol.[9]

- ***Cell Hand-Off.*** PageMart has indicated that it intends to support transmission of facsimile pages of 60,000 bytes.[10] Given that it will take over 172 seconds to transmit a single facsimile page under PageMart's stated assumptions about the efficiency of its system,[11] it is likely that cell-to-cell hand-off will be required for mobile applications. PageMart has failed to demonstrate that such hand-off might work or could be successfully implemented.

- ***Cell Channel Assignments.*** In its technical appendix, PageMart states that "the message may be assigned to one of eight different data channels for the nationwide licensees,"[12] and that "a nationwide provider could use algorithms that permit all 8

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[8] Exhibit A at 11-14.

[9] *Id.* This number is greatly in excess of the "twice as many" receivers PageMart implies it can use. *PageMart Petition* at A4-A5 n.3. Additionally, it is unclear whether the "fill-in" receivers will only be used for the "return link" as opposed to the return "data channels." *Id.* Apparently, the "return link" is the dedicated mobile to base channel, and differentiated from the bi-directional "data channels." *See, e.g.*, Legend on Exhibit XIII, *PageMart Petition* at A14-A15.

[10] One of PageMart's criteria is "transmission of lengthy complex text, graphic and facsimile files." *PageMart Comments* at 3. PageMart later states a single facsimile page is roughly 60,000 bytes. *PageMart Comments* at 49; *see also* Errata dated June 15, 1992.

[11] ((60,000 bytes) x (8 bits/byte))/((4800 bits/sec) X (0.58 POCSAG efficiency)) = 172.8 sec. *See PageMart Petition* at A22, *see also* Errata dated on June 15, 1991.

[12] *PageMart Petition* at A16.

data channels to broadcast in one out of each 4-cell reuse group, with all others inactive."[13] If a single cell is using all eight channels -- at any point in time -- not only are the remaining cells in the cell grouping precluded from using the channel, the adjacent cells in *up to three adjacent* cell groups cannot use *any* channels. PageMart has failed to prove how the system can manage dynamic frequency assignments when the basis of cell-based frequency re-use is that orthogonal channel divisions must be maintained.[14] Although these orthogonal cell assignments can be made in time (*i.e.*, each cell in a four cell group uses all eight frequencies for 1/4 of a cycle, with all cell groups in a market synchronized), after one cycle, the efficiency of such a system is exactly the same as dividing the channels by frequency (*i.e.*, giving each cell 2 channels or 1/4 of the available channels).

- ***Base Receiver Desensitization.*** Assuming that each base station has two "data channels," each of which can be employed as either transmit or receive channels, a "polling channel" and a "return link," the issue of whether transmitting channels will desensitize co-located receiving channels is a serious concern. Unless PageMart intends to use a channelization scheme that it has not identified in its petition for rulemaking, and for which other technical issues would certainly arise, a base station could have frequency separation of *at most* 175 kHz center to center for a transmitter and co-located receiver. Even using high quality telemetry receivers with a selectivity of 70 dB and a spurious rejection of 70 dB, a transmitter will act as a destructive adjacent (or next adjacent) channel interferer up to 0.526 miles away, thus, among other things, interfering with the base station itself.[15] PageMart has failed to prove, under these conditions, that significant receiver desense will not occur.

- ***Capacity Limitations.*** PageMart is unclear as to whether it intends to ACK or NAK an entire message, or every 2-5 POCSAG batches.[16] If PageMart ACKs only the whole message, a 500,000 bit facsimile page transmitted over a low power mobile channel at 4,800 bit/sec will only generate a single acknowledgement. Under these conditions, it is highly probable that numerous retransmission requests will be generated -- all using the simulcast polling channel. Since the polling channel is also responsible for transmitting "radiolocation" pages (potentially numerous times), and is only operating at an effective bit rate of 2784 bits/sec, the capacity of the polling channel is severely circumscribed. In a similar manner, it can be shown that

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[13] *PageMart Petition* at A20.

[14] The cellular radio telecommunications service, for example, does not use this means of "optimizing cell throughput." *PageMart Petition* at A20.

[15] Exhibit A at 21-22.

[16] *PageMart Petition* at A17. An ACK is an acknowledgement that the message was received without errors. A NAK is an acknowledgement that the message was received with errors and should be retransmitted.

"ACKing" every 5 batches will limit the polling channel to 12,000 subscribers per MSA ("ACKing" every 2 batches will limit the channel capacity to 4,800 subscribers).[17]

- ***Base Station Complexity.*** PageMart has postulated a system that requires a large number of base stations, each equipped with a radio capable of transmitting simultaneously on 3 of 9 channels (the "polling channel" and 2 of 8 bi-directional "data channels") and simultaneously receiving on 3 of 9 channels (the "return link" and 2 of 8 bi-directional "data channels"). In addition, PageMart must utilize expensive high quality telemetry receivers with high selectivity and high spurious rejection due to co-location with transmitters.

- ***The Cost and Battery Life of PIMS Mobiles.*** Although PageMart castigated Mtel, quite wrongly, for failing to identify the cost and battery life of NWN portables,[18] PageMart has neglected to provide any information on PIMS mobiles. According to the technical appendix, a PIMS mobile must be able to receive on 9 channels (continually monitoring the "polling channel"), transmit on 9 channels, contain 128 kilobytes of memory, operate on all channels at 4800 bits/second, have a high selectivity on receive channels, have a 0 msec transmitter turn-on time, and have a battery independent of the application device.[19] PageMart has failed to show such devices are feasible. Further, it is likely that such mobiles will violate two of PageMart's "criteria" for an allocation in the band -- PIMS mobiles would not be "small, lightweight, and low-priced" nor "low-powered with low battery drain."[20] Absent a technical feasibility demonstration to the contrary, which PageMart has not supplied, the technical requirements above compels the conclusion that PIMS mobiles will be expensive, bulky, and power consumptive, if realizable at all.

- ***In-Building Frequency Re-Use Plans.*** PageMart does not discuss the internal propagation issues arising in their in-building services. PageMart asserts that internal walls and floors will halt propagation, without referencing any data or providing transmit power levels. From the minimal information provided, PageMart has failed to demonstrate that a three-dimensional frequency re-use pattern would not be required, nor how one could be implemented under their spectrum constraints. Thus

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[17] *MPR Comments on the Data Link Layer Aspects of the "Petition for Rulemaking"* at 4-6 (Attached as Exhibit B).

[18] *PageMart Comments* at 60. Mtel has provided an exhibit demonstrating the feasibility of NWN portables that will be small, inexpensive, and long battery life. *Mtel Technical Feasibility Demonstration* at Exhibit C.

[19] *PageMart Petition* at Appendix A.

[20] *PageMart Comments* at 8-9.

PageMart's assertions on in-building applications can only be considered conjecture at best.

- ***Integration of In-Building and Outdoor PIMS.*** PageMart fails to provide any information on whether in-building systems can be integrated with the out-of-building uses without causing interference. PageMart states, for example, that in-building units will be connected to 10 W transmitters, which could interfere with a mobile up to 4.55 miles away.[21]

Although PageMart asserts that it is "clear that . . . MTel does not understand frequency re-use,"[22] PageMart apparently reaches this conclusion because they themselves do not understand the application of this technology. The informational omissions listed above go to the basic ability of the PIMS theory to be put into practice. PageMart has failed to describe its system, and provided less than "mere speculation" that PIMS will work.

II. PAGEMART'S PIMS SERVICE OFFERS NO INNOVATIONS WARRANTING A PIONEER'S PREFERENCE

PageMart has cited a total of five alleged innovations to justify awarding a pioneer's preference for PIMS: (1) radiolocationing; (2) cell-based frequency re-use; (3) adaptive architecture; (4) open protocols; and (5) device independence.[23] As discussed below, "radiolocationing" is a necessary component of any cell-based re-use scheme and the particular method PageMart utilizes to accomplish "radiolocationing" is not only simplistic, but also subject to potentially fatal technical flaws. In addition, PageMart's "adaptive

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[21] In this regard, PageMart mistakenly assumed Mtel was utilizing 7 Watt transmitters (Mtel portables will use 2 Watts or less; 7 Watts was proposed as a maximum mobile power limitation in the proposed rules) and claimed that potential health problems will result -- an absurd allegation when PageMart intends to utilize 10 Watt transmitters. *PageMart Comments* at 61.

[22] *PageMart Comments* at 66.

[23] *PageMart Pioneer Preference Request* at 9-11.

architecture" appears to lack meaningful substance since cell-based architectures place significant constraints on system deployment. PageMart's third purported innovation, the application of well-known cell based re-use schemes to messaging, is highly derivative of existing Mobitex systems, suffers from severe technical problems, and is probably not viable, much less appropriate or efficient. PageMart's last two "innovations" are features included in Mtel's NWN system four months prior to PageMart's filing. PageMart's purported innovations are briefly discussed below.

A. "Radiolocationing" Is An Inherent Requirement of Cell-Based Frequency Re-Use Systems That Does Not Qualify As An Innovation

PageMart's "radiolocation" scheme, even if it works as theorized, is merely the use of a page on a 25 kHz outbound simulcast channel followed by an acknowledgement on a separate 25 kHz return channel. In this regard, PIMS requires 50 kHz -- the entire spectrum requested by Mtel to provide NWN -- for signaling alone. And, PageMart's scheme would appear to suffer serious technical problems resulting from differences between inbound and outbound coverage areas.[24] Further, PageMart's radiolocation scheme is only useful if the data transfer is initiated while the subscriber is still within the serving area of the cell the subscriber identified on the return link; if the delay is more than seconds, the likelihood that

[24] As discussed before, with a mobile transmit distance of 0.33 miles and a base transmit distance of 4.29 miles, 169 "fill-in" receivers will be required for each base station. Under these conditions, there is a significant possibility of "dead zones" and noncontiguous coverage leading to missed ARQ messages and needless retransmits.

the user may have moved out of range increases substantially.[25] In any event, PageMart's method of identifying the location of the subscriber mobile to a particular cell is hardly innovative; it is required to take advantage of a cell-based re-use scheme, and it is the most obvious and easiest method for doing so.[26]

B. PageMart's Cell-Based Re-Use Plan Employing An "Adaptive Architecture" Is Not Innovative

PageMart's alleged innovation appears to consist of applying well known cell-based frequency re-use technology to messaging using an "adaptive architecture." PageMart describes its adaptive architecture as allowing "utiliz[ation] of cells in any re-use pattern that is efficient . . . and at a size ideally configured relative to the projected message demand in the locality."[27] This purportedly permits "messages to be delivered, in any real-time combination of cells necessary for optimal system efficiency," with "flexible system deployment keyed to the growth of subscriber demand."[28] As discussed below, it is unclear as to how these factors will be achieved with a cell-based re-use scheme, or why this is innovative.

First, the application of well known cellular technology to a messaging environment is hardly innovative. PageMart itself states that "PIMS is a technologically advanced

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[25] This information is not provided in PageMart's technical appendix, nor the size of the serving cell's area.

[26] Indeed, this method has been used by both Motorola and Ericsson in their packet radio networks.

[27] *PageMart Pioneer Preference Request* at 10.

[28] *Id.*

combination of radiolocation, frequency reuse and state-of-the-art communications technologies."[29] Clearly the application of "state-of-the-art" cell-based frequency re-use is not an "innovation beyond existing communications technology."[30] Far from being the "original developer or proponent of the innovation at issue,"[31] PageMart has done no more than suggest that it might be feasible to apply a cell-based re-use scheme to messaging -- a radio scheme in use in numerous applications -- without any developmental effort. PageMart's much touted experimental authorizations have yielded no experimental reports,[32] and since the cut-off date has passed for filing "initial experimental results" or a technical feasibility demonstration in support of a pioneer's preference, will not yield any in time to be considered in this proceeding. Finally, the system appears completely derivative of existing Mobitex packet data networks, except that Mobitex is viable because is has between 10 and 30 channel pairs available in addition to a control pair.[33]

Second, PageMart's purportedly innovative "adaptive architecture" places enormous constraints on the sizing of PIMS cells, in sharp contrast to its statement that its adaptive architecture allows "utiliz[ation] of cells in any re-use pattern that is efficient . . . and at a size ideally configured relative to the projected message demand in the locality." Because

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[29] *PageMart Petition* at i.

[30] *See PageMart Pioneer Preference* at 7 (citing *Request for Pioneer's Preference in Proceeding to Allocate Spectrum for Fixed and Mobile Satellite Services for Low-Earth Orbit Satellites* at ¶ 17-18, FCC 92-91 (February 11, 1992) ["*VITA Order*"]).

[31] *See PageMart Pioneer Preference Request* at 15-16 n.23 (citing *VITA Order* at ¶ 2).

[32] *See, e.g., PageMart Pioneer Preference Request* at i, 13, 14.

[33] Exhibit A at 22-24. Mobitex terminals, due to their complexity, are also significantly more expensive (~$1,500) than what PageMart appears to be proposing.

the "data channel" base receivers are all co-located with the base transmitters, a PIMS cell can be no larger than the reliable service area of the 100 mW transmitter in the mobile unit. In any event, it is inconceivable that PIMS cells could be "large geographic cells similar to conventional paging transmitters."[34] There are also practical limitations on the minimum size of cells, since PIMS makes no provision for hand-off between cells (or, for that matter, the resultant signaling traffic that would be required on the "polling channel" and "return link" to manage hand-offs).[35]

Third, PageMart's purported ability to reconfigure frequency assignments in real time appears to be premised on a misunderstanding about the design of cell-based systems. As previously noted, a cell-based re-use scheme does not *a priori* permit any division of the frequencies within a given cell group. Cell-based frequency re-use is used to guarantee a minimum separation between cells in different cell groups using the same frequency. In a four-cell re-use plan, each cell in a cell group is adjacent to cells from at least two or three other cell groups. This interrelation between the cells dictates the principle that is the basis of cell re-use schemes -- that orthogonal divisions between adjacent cells must be made and the capacity evenly divided among the cells to re-use frequencies effectively. For example, as shown in figure 1, assigning all eight channels to cell A1 means that no frequencies can be

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[34] *PageMart Pioneer Preference Request* at 10.

[35] In contrast, a system like NWN, which relies on simulcast and has an independent receiver network, can employ transmitters serving areas of any size. To maintain full use of the channel, high powered transmitters will be employed to establish larger serving areas where appropriate. Lower powered transmitters with smaller service areas may also be utilized, especially in high density areas and as necessary near zone boundaries. If multiple receivers pick up the same inbound message as could occur as a portable unit travels from the edge of one receiver's reception area into that of another receiver, the intelligence built into the NWN system will note the duplicate messages and select the one to be forwarded to the recipient. In this manner, NWN will achieve what PIMS cannot -- full channel capacity use throughout all served areas.

used in cells A2, A3, A4, B4, E2, F2, F3, F4, or H3 if a re-use distance of 3.46 is to be maintained. Thus, for practical purposes, the 8 frequencies cannot be used again except at cells B1, C1, E1, and F1, illustrating the principle that the frequency divisions for a cell group will dictate the use of the frequencies throughout the system.[36]

While it is theoretically possible to optimize the levels of interference for a non-repeating cell-based system, PageMart has failed to demonstrate that its network is capable of such dynamic reassignments. Mtel is not aware of any cell-based systems, for example, that can be reconfigured on a semi-static basis to match predictable shifts in traffic density (*e.g.*, rush hour waves). Attempting to engage in fully dynamic channel reassignments is within a class of "NP-complete" problems -- such as the "knapsack" problem -- where there are no closed solutions and the number of "cut-and-try" candidates quickly expands to become unmanageable.

As a final matter, the cited "flexibility" of the cell-based architecture is inherently fallacious. Unlike the NWN system, additional transmitters cannot simply be "dropped" into an existing system. To accommodate new cells in a cell-based frequency re-use scheme requires completely reconfiguring the power levels of adjacent cells and developing a new

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[36] A channel "borrowing" scheme has been proposed for cellular whereby a cell in a cell group experiencing particularly heavy loading uses a channel originally designated for use by another cell. Under this plan, however, the channel is not only borrowed from the adjacent cell within the borrower's cell group, but also from all adjacent cell groups (see Figure 2). Thus, the channel is removed from service in at least 3 cells to provide additional capacity for 1 cell, resulting in a net system capacity decrease. This "borrowing" is not routine in cellular radio telecommunications systems because capacity surges rarely occur in a single cell in situations where cell loading does not commensurately increase in adjacent cells and cell groups.

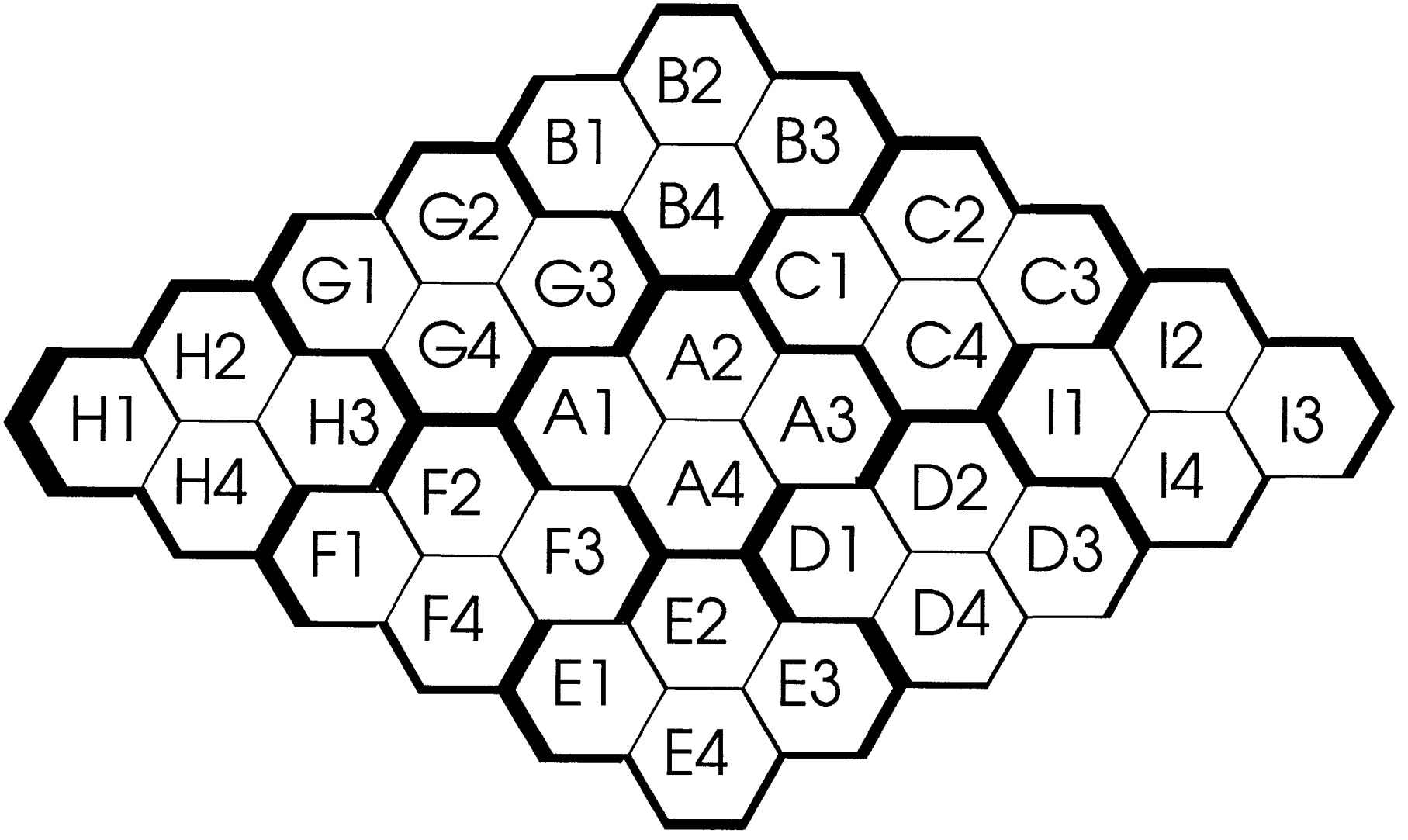

Figure 1: Four Cell Frequency Re-use

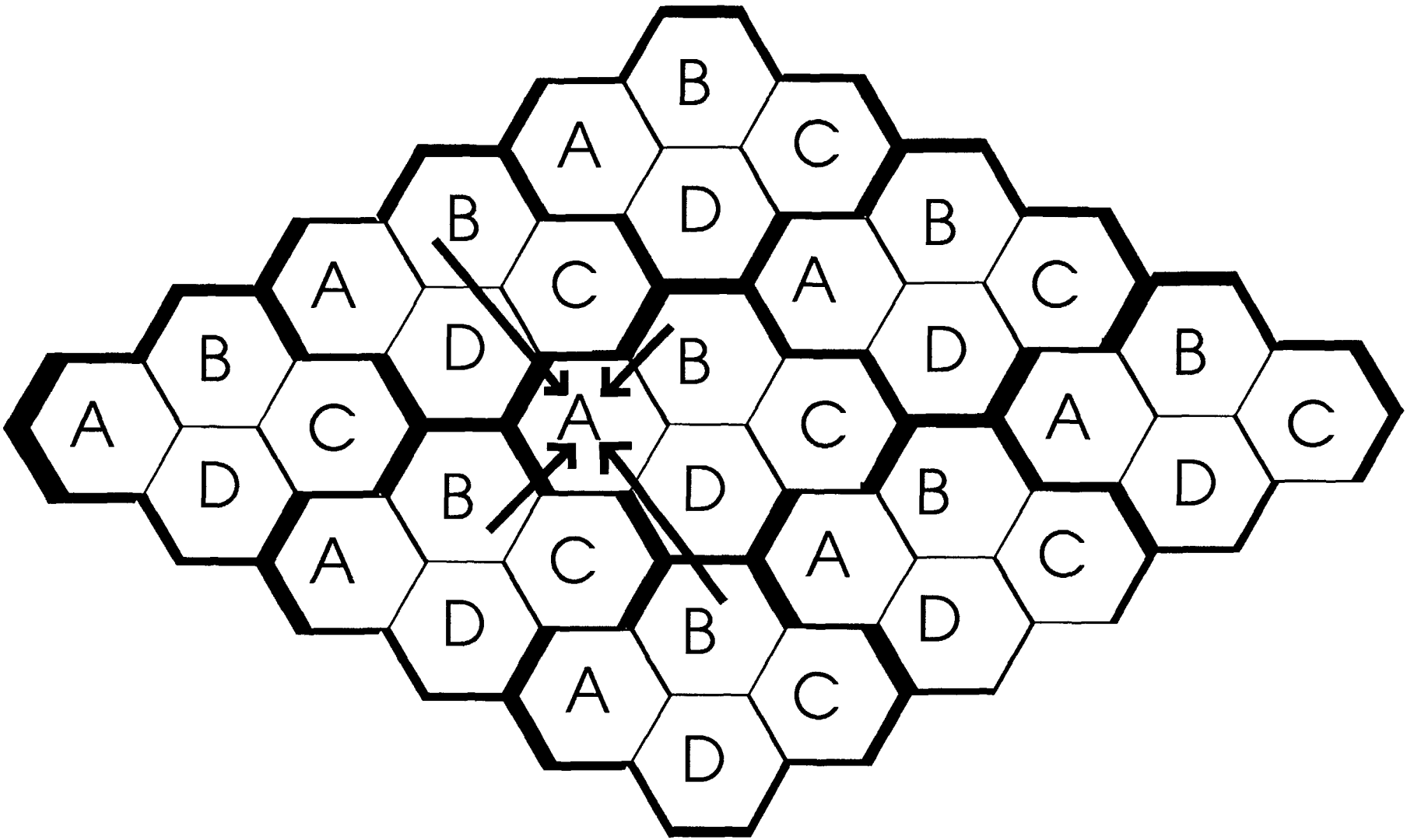

Figure 2: Cell Borrowing Requires Precluding Use of the Channel in 4 Cell Groups

frequency distribution plan. In other words, dropping a new cell into a 4 cell re-use scheme will create a ripple effect throughout the system requiring extensive modifications.

PageMart also believes that its in-office system reflects architectural flexibility. Unfortunately, however, PageMart's in-office architecture does not appear nearly as "flexible" as the alternatives, including, for example, a backbone fiber optic Ethernet LAN connected to individual computers on a wireless basis using infra-red, spread spectrum, or Part 15 devices, and interconnected to a public switched packet network. Such a configuration would offer greater flexibility, greater speed, and much lower cost.[37]

C. PageMart's Open Protocols and Device Independence Are Not Innovative

PageMart's last cited innovations, "open protocols" and "device independence" also should not qualify as advances warranting pioneer's preferences. In fact, Mtel proposed both the use of an open architecture and RF links to be coupled with laptop and palmtop computers (the substance of both of these "innovations") in its NWN filing four months earlier, without attempting to base a pioneer's preference on these features.[38] Under these circumstances, if these are "innovations," PageMart cannot be considered the "original developer or proponent of the innovation at issue."[39]

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[37] Although the initial deployment costs would be borne by the user, the user would not face the interminable recurring $0.10/kilobyte charges that would occur in PIMS. *PageMart Petition* at 37.

[38] In its comments, PageMart noted that "conventional paging systems can also interface with a wide variety of service and communications networks through commercially available gateways." *PageMart Comments* at 53.

[39] *See PageMart Pioneer Preference Request* at 14-15 n.23 (citing *VITA Order* at ¶ 11).

III. THE PURPORTED "PUBLIC BENEFITS" OF PIMS ARE ILLUSORY

A. PIMS Is Spectrally Inefficient

PageMart's PIMS system, upon inspection, is actually composed of two distinct services, an outdoor service and an in-building service. The cell-based architecture of PIMS, however, is an inappropriate means of satisfying the targeted markets' needs. In the case of the "outdoor" service, the cell-based architecture requires large amounts of dedicated spectrum, the large majority of which will lie fallow in most markets because the infrastructure costs of serving anything but the most dense areas is too high. In the case of the "in-building" market, to the extent that such demand exists at all, it can be satisfied by less expensive and faster systems that do not require new allocations of spectrum.

As Mtel discussed in its original petition for rulemaking, cell-based architectures are not the single best answer for all radio communications needs because they require orthogonal divisions of capacity. For services requiring "circuits" (whether physical or virtual), such as voice or real-time data applications, cell-based systems offer some advantages and the spectrum necessary to offer the service is well justified. For store-and-forward messaging, on the other hand, the spectrum investment is far too great, and simulcast re-use systems like NWN offer much greater rewards. For example, if it were possible to create a 1.5 mile radius PIMS cell,[40] it would require over 16 cells to cover the same geographic area as a high power simulcast transmitter with a 6 mile range. This increased system complexity is reflected in the cost of the infrastructure, and must ultimately

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[40] PIMS would not appear to be able to support such great cell sizes due to the limitations on the transmit power of mobiles.

be reflected in the cost of the service -- thus limiting its availability to the general public. Furthermore, if the traffic demands of the area can be satisfied by a single NWN transmitter as part of a larger zone,[41] the PIMS architecture dictates using five times as much spectrum to serve the same needs. In sum, PageMart's proposed architecture costs more and requires dedication of more spectrum, which may only be justified in the largest metropolitan areas in the U.S. As such, it neither costs less than NWN nor extends the reach of mobile wireless messaging to a broader range of customers.

The in-building service provided by PIMS is not an efficient use of valuable mobile spectrum, even though it accounts for the largest part of PageMart's offering. In fact, in deriving its capacity estimates, almost 84% of the cited capacity available from PIMS comes from "building cells" and "office cells."[42] In the 3 pages of the Petition for Rulemaking relating to demand for PIMS, however, PageMart nowhere justifies any consumer need for its proposed "in-building" services.[43] As Mtel discussed before, there are faster, less expensive means of satisfying any in-building needs that exist without dedicating additional 930-931 MHz spectrum.

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[41] If the capacity demand of the area is too great for a single zone, NWN could, of course, create additional zones to provide more capacity. A zone would, however, typically involve many transmitters.

[42] 400 "office cells" and 40 "building cells" with an effective channel capacity of 231.5 channels, versus 40 "geographic cells" with an effective channel capacity of 44.8 channels. *PageMart Petition* at A23.

[43] *PageMart Petition* at 10-12.

B. PageMart's Identified "Consumer Benefits" Are Counterintuitive And Unsupported

PageMart's list of PIMS's public benefits includes low battery usage due to low power transmit and radiolocation, multiple cell architecture leading to no "dead zones," and cost benefits.[44] PageMart's system description, however, does not support the existence of such benefits. First, PageMart, after chiding Mtel -- quite wrongly -- for creating portables that consume too much power and cost too much, has designed a system that requires far more complex, costly, and power consumptive mobiles than NWN. PIMS mobiles must continually scan a polling channel, be capable of transmitting on 9 different channels (at bit rates of 4800 bits/sec), contain 128 kilobytes of memory, and have a radio capable of receiving transmissions on 9 separate frequencies. In addition, with a bit rate of 4800 bits/sec, the mobiles will potentially require adaptive equalizers and signal processing chips significantly increasing the size, complexity, power consumption, and expense of the units.

In addition, the ability of a cell-based system to overcome "dead zones," PageMart's second "public benefit," is severely circumscribed. A "dead zone" is an area where, due to local terrain considerations, no service is available although service around the area is provided. Unlike simulcast systems, which can "drop in" transmitters at any point, cell-based systems cannot provide coverage to a "dead zone" without recoordinating frequency

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[44] PageMart also cites its "open protocols" as a public benefit. Mtel's response on this issue is contained in Section II.C.

usage throughout the system. Thus, multiple cell architectures generally cannot cure "dead zones" with any flexibility at all.[45]

Finally, any PIMS cost benefits are completely speculative. PageMart has not identified the cost of its cell-based architecture, nor the costs of the mobile units, both of which appear to be rather expensive. PageMart nevertheless makes the assertion that it will be able to provide service at $0.10 per kilobyte of traffic transferred. As an initial matter, this number appears rather costly for in-office applications, which could be provided without recurring charges at all. Mtel submits that without some form of substantiation, PageMart's projected costs are no more than supposition.

IV. CONCLUSION

For the foregoing reasons, Mtel believes that PageMart's Request for a Pioneer's Preference is fatally flawed. PageMart has failed to provide information critical to assessing whether its system is technically or commercially viable, and cannot now cure these deficiencies. And, the informational omissions are severe, going to the basis of applying the proposed four-cell re-use plan to a messaging environment. Furthermore, PageMart's purported innovations are demonstrably contrary to the information it has provided, and the public benefits of PIMS are illusory. Because PageMart has failed to provide a technical

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[45] Dead zones, for example, are a problem in the cellular radio telecommunications service. *See Amendment of Part 22 of the Commission's Rules to Provide for the Filing and Processing of Applications for Unserved Areas in the Cellular Service and to Modify Other Cellular Rules*, 6 FCC Rcd 6185, 6198 (1991).

feasibility demonstration and meet the other requirements for grant of a pioneer's preference, PageMart's request should be promptly dismissed.

Respectfully submitted,

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Dated: June 16, 1992

CERTIFICATE OF SERVICE

I, Kim Riddick, hereby affirm that on this 16th day of June, 1992, I have caused copies of the foregoing "Formal Opposition and Reply Comments of Mobile Telecommunication Technologies Corporation" to be delivered, First Class Mail, postage pre-paid, to the following, except where service by hand is indicated:

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