INTEL CONSULTANTS LTD.

Radio paging study for the Dept. of Communications.

RADIO PAGING STUDY

FOR

THE DEPARTMENT OF COMMUNICATIONS

OTTAWA

PART I

SUMMARY & RECOMMENDATIONS

(VOLUME 1 OF 3)

InTel Consultants Ltd
56 Sparks Street
Ottawa
K1P 5A9
Canada

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PART I - SUMMARY & RECOMMENDATIONS

1.0 - Summary

1.1 - Introduction

Since many of the comments relative to both the private and public paging sectors cover similar topics, this summary treats both sections of the study together. Most of the discussion centers on public paging, remarks relating to private paging only are suitably notated.

As defined by the terms of reference and financial limitations of the study contract, the coverage of the whole sector was necessarily limited. The true dimensions of the market and its evolutionary dynamics became clear during, and as a result of, the work of the study. While a deeper and wider treatment would undoubtedly be beneficial, the present study had brought out the major characteristics and evolutionary trends of the sector.

The balance of this section of the report summarizes the operations and findings of the survey. In the course of this process, recommendations and suggestions naturally emerge as the context develops. These are summarized in the final section of this part of the report.

Part II gives all analytical detail relating to the survey work carried out.

The data presentation in Part III of this report provides detailed listings of all identifiable paging licensees, together with pertinent licensing data, quantitative statistical information where provided and a summary of the manner in which respondents from each region replied to the questionnaires. A tabular listing of the manner in which each pager population is distributed amongst each type of regional grouping is also included for reporting systems.

In brief, this study has researched the overall status of the paging industry as it presently exists in Canada, and provides a detailed record of all data upon which the study has been based.

The report identifies the main areas for policy development, with recommendations and suggestions; it identifies sector areas where further study is indicated to assist in the finalisation of policy option. In general, the study has acquired and arranged the sector data, observed and assembled the evolutionary trends, and derived the consequent conclusions on which policy development can be based.

1.2 - Conduct of Survey

Questionnaires were mailed to a total of approximately 500 addressees in the private, regulated and unregulated paging areas. The private listing covered all provinces, while those for the regulated and unregulated operators excluded the central region. The breakdown is approximately as follows for the paging areas concerned:

Paging Area	Est. Total Operator Population	Questionnaires Issued	Useful Replies Rec'd	% of Operator Population
Private	550+	202	123	22% (approx.)
Regulated	10	15	7**	50%
Unregulated	106*	272	47	45%

Note: (*) The figure of 106 includes the central region.

Note: (**) Two of the 7 regulated carriers returning questionnaires provide no public paging.

Unregulated operator mailing lists were drawn from two sources. Firstly, by researching yellow page advertisements etc, and secondly by researching license printouts of purported paging operators. Prior to the time when license data became available, a listing of 225-250 addressees had been prepared; subsequent examination of license information made it possible to correct some addresses, and to add a few others which has been missed in the original list.

The issue of private paging questionnaires was based on a random sample of approximately 200 addressees taken from a total of approximately 550 private license printouts. The initial questionnaire issue was followed up 3-4 weeks later in all cases where replies had not been received. The initial mailing resulted in a 35-40% response; the second mailing has since increased this to 60%. In the case of the public paging systems, all identifiable operators received questionnaire material; as in the private situation, follow up letters together with additional questionnaire material was sent 3-4 weeks after the initial mailing.

The large number of questionnaires issued in the case of unregulated operators was due to the difficulty experienced in identifying competitive paging operations. Typically, a license issued to a private individual may be associated with more than one business name, thus within the composite list used for mailing purposes, the name of the licensee appeared as well as those of the businesses he operated. Also, in many instances, addressees drawn from the license files were returned marked "not in the paging business" because the printouts included some operators whose businesses were confined to MRS operations only. In the final analysis, the total unregulated operator count was reduced to 106 for all the regions; useful replies were received from just under half the estimated operator count within the survey region.

Field survey was concentrated on those areas which were most productive from the viewpoint of study requirements. Visits and contacts have been directed largely towards manufacturers, suppliers and the more important paging operators.

Although sustained attempts were made to reach smaller operators, they did not prove notably successful, and the time expended did not justify the results obtained. There are two basic reasons: Firstly, the smaller operator generally has one or more other business interests and not only is it difficult to locate him, but it is difficult to arrange a meeting. While it is true that some are reluctant to discuss their business with outsiders, this does not imply that the smaller operators in the competitive sector are uncooperative. Of the total of 47 useful replies received from the unregulated systems, approximately 80% of them were from smaller installations.

The fact is that larger operators are more readily accessed since the size of their business operations demands that responsible management personnel be available at all times. Furthermore they appear to be in tune with the purposes and objectives of the survey and are prepared to assist to the extent that time will allow.

Private system survey information is largely limited to that obtained from DOC license printouts, manufacturers and questionnaire material. Public paging information was derived from DOC license printouts, advertisements in telephone directories,

and interviews with operators, manufacturers and suppliers in the Quebec and Ontario regions as well as from questionnaire material.

1.3 - Paging License Information

There is no reliable method of identifying paging licensees other than through DOC licensing information itself. If the relevant data cannot be readily and totally accessed, then there can never be an accurate accounting of the licensee position at any given time.

From the researcher's point of view, license printout data provided for this study suffered from two basic shortcomings, firstly a lack of completeness and secondly, no means of identifying frequencies used for paging purposes on printouts listing a number of frequencies authorized for various purposes. Furthermore, other than resorting to the original license applications per se, there appears to be no means of identifying public or private operators who are authorized to use MRS frequencies on a secondary basis for paging purposes.

Although it was not always possible to identify specific frequencies used by public operators for paging purposes, the names and addresses were useful for mailing purposes. Subsequently however, an appreciable number of the returns indicated that the addressees concerned were not in the paging business. Thus it was evident that many systems included amongst the licensee printouts were MRS operators only.

The Montreal and Toronto regional offices were able to provide a list of frequencies used by public operators in the Ontario and Quebec regions, and these were used to determine which licensees amongst those not responding to questionnaires were probably paging operators. Similar information was not available from B. C. and the sort was largely based on previous reports concerning paging activity in the area.

An obvious prerequisite to accurate and complete information on paging licensees is therefore the housekeeping necessary to make all relevant records readily available and identifiable.

Specifically it is recommended that it be possible to obtain printouts which positively identify:

a) All paging operations, per se.
b) Whether paging is licensed on a primary or secondary basis
c) Frequencies used for paging.
d) Link frequencies involved where employed specifically for paging operations
e) Relevant application dates.

1.4 - Frequency Usage - Public Paging Sector

The major concern today is the growing scarcity of frequencies available to meet the needs of various radio services. At the present rate of consumption, the regional office in Toronto anticipates that all frequencies available for mobile, and paging services other than those which are able to share common assignments, will be exhausted in the 1978 1979 period. While the situation is understood to be getting worse in Montreal, it is not yet as acute as in the Toronto area.

It is therefore apparent that existing licensing policies will have to be modified if spectrum availability is not to vanish altogether. Although the present situation is rather akin to closing the gate after the animal has fled, it is necessary to review present paging practices to determine what the options are for optimizing frequency usage.

1.4.1 - Voice Paging Implications

In both the competitive and the private sectors, a major problem lies in the extensive use made of "Voice" type pagers. For all practical purposes air time is controlled entirely by message disciplines; few systems are capable of handling a voice type page in ten seconds or less. The duration frequently being in the order of 15-20 seconds or longer. Hence regardless of whether or not signalling speeds inherent in the system are measured in terms of milliseconds, capacity is almost entirely controlled by message length. Typically a ten second voice page can occupy the terminal 50 times longer than a "Tone" page.

Thus "Voice" paging places severe restrictions on the number of subscribers any one RF channel can handle; from a frequency point of view, it is the most inefficient paging practice in use today and should be eliminated.

1.4.2 - Congestion in Metro Areas

The major frequency problems exist in large centers where the demand for various types of radio service is high. In the competitive paging sector, the problem is complicated by an anticipated annual growth rate in the order of 25-30% per year and the need to maintain service to present paging subscribers. Although most major systems incorporate signalling methods which are theoretically capable of handling tens of thousands of "Tone" pagers on a single RF channel, their potential capacities are severely inhibited by the high proportion of voice pagers in service, and to some extent by older pagers using the slower coding arrangements.

Larger operators are fully aware of the limitations imposed on their system capabilities by voice paging. The present squeeze for frequencies in congested areas has led them to the obvious conclusion that their best interests would be served by converting the public to the more efficient "Tone" type of service. However the paging public has developed poor habits, and re orientation is not going to happen overnight; a more efficient substitute for "Voice" paging is needed for subscribers who feel the need for some form of message service.

At present, operators await the advent of the pager equipped with a digital display as the voice unit replacement. Many messages in use today have standard formats which could be substituted by simple

numeric codes, which would substantially reduce air time requirements. It is understood that present efforts to develop such units vary from a single L.E.D. capable of displaying digits from 0-9, to a more sophisticated design capable of storing and displaying (in serial form) multi word messages. Pager designs of this type are probably still at least a couple of years away, hence cannot be expected to bring any immediate relief to the paging market.

1.4.3 - Frequency Sharing

While the larger operators have the capacity to make more efficient use of their assignments, smaller systems don't. Thus several frequencies could be tied up in busy areas to serve a traffic total which could be accommodated on a single RF channel, or portion thereof. Such situations could be avoided if smaller operators were grouped together on a single system. As unpalatable as this concept may be to the smaller operator, it is the only method of making efficient use of the available spectrum.

Sharing a common frequency within a common coverage area in public paging applications is neither economic nor optimally efficient from a spectrum point of view unless terminal and transmitter installation/s are shared as well. A representation from RCC sources has already been made to the Department with this concept in mind. Simply stated the proposal is that high capacity paging installations should be established in larger centers by RCC operators who are not themselves engaged in renting pagers to the public.

Blocks of pager codes would be rented to individual entrepreneurs who would sell the service to the public and provide the necessary units; code blocks could also be rented to bulk users who might otherwise require a private installation with broad coverage capabilities. Thus the unnecessary waste of frequencies which could result from multiple assignments to small systems would be avoided. Shared

installations of this type would be required to maintain a high grade of service within their coverage regions, and would be required to arrange exchange coverage agreements with similar systems in neighbouring or other areas.

Such a scheme could not be successfuly applied if frequencies continue to be issued to embryonic paging operations commencing business in areas where these cooperative installations are authorized. While the concept may be difficult to apply in situations where a number of small systems already exist, the basic idea, or some modification of it, could be an effective means of controlling the situation in the future.

Public carriers in some regions favour the idea of independent entrepreneurs renting pager units for use in conjunction with their "Swap" systems. In such instances however, the independent would be competing in the sale of units to the public with the company supplying paging service to their clients. Little is known about such operations other than the fact that certain carriers favour them.

Frequency conservation is a matter of prime concern, and the potential for using shared installations as "Catch-Alls" for smaller paging operations in congested areas merits further consideration. Such operations in busy areas could provide the Department with a means of gracefully denying individual frequency assignments without denying smaller

entrepreneurs the right to operate a paging service, or the private system operator the right to citywide coverage. Furthermore, the public would benefit from the superior grade of service such systems could provide, and paging activities in larger centers would be more readily monitored and controlled.

Finally it should be noted that in a sample representing just under a third of the estimated unregulated pager operators in Canada, 71% favoured sharing of facilities with other operators in metropolitan areas.

1.4.4 - Secondary Paging Licensing of MRS Frequencies

Limited information was gathered about RCCMRS operators who are authorised to employ MRS frequencies on a secondary basis for paging purposes. This was due to the fact that there was no apparent means of readily extracting the relevant licensees from existing computer records. Those which came to light were incidental to the questionnaire issue.

Such systems are typically operated through community repeaters to which all subscribers have wire line or radio access, no operational staff is required. The prime function and the primary revenue source from these installations are mobile radio service operations; thus paging is secondary to the main purpose of the facility and incidental to the MRS activity.

Paging is thus a parasitic operation which in the case of "Tone" systems using sub-audible signalling frequencies, can make simultaneous use of the radio channel with the mobile radio services. If "Voice" paging is employed, then the MRS installation loses the air time necessary to transmit messages. The paging adjunct to existing mobile radio operations, in most instances therefore, serves to make more efficient use of frequencies already assigned for purposes other than paging.

The lack of factual data makes it difficult to determine how widespread this type of paging practice is. It is believed however that Canadian MRS systems with paging adjuncts would only be a

small fraction of 1% of the total MRS population. Since this type of operation is not particularly significant from a frequency point of view, it is recommended that the practice be allowed to continue. Tone type paging should however be encouraged.

1.4.5 - Link Frequencies

During the course of interviews, one operator indicated that he considered the use of VHF and UHF frequencies for link purposes is wasteful. He suggested the possibility of being permitted to use microwave for such purposes and indicated a willingness to release existing link frequencies in return for microwave assignments.

Two large operators in the Toronto region indicated that they had researched the possibility of using wireline links, and both indicated that apart from the fact that the telephone company could not meet their technical requirements, the charges involved were extremely high; one operator indicated that the wireline costs made microwave a viable proposition. It was also stated that the telephone company would not permit more than one drop point from a rented pair, thus unnecessarily increasing the lines required and the associated costs. Understandably, operators strongly object to having a vital portion of their system dependent on the serviceability of a competitor's facility.

No research relating to the use of radio links for controlling paging transmitters was accomplished during the course of this survey; hence it is not known what the significance may be in terms of frequency channels used for these purposes.

It is nonetheless an important area which requires further study from the viewpoint of the overall spectral efficiency of existing paging systems. It is therefore recommended that this area be reviewed, and that an independent evaluation be made of the technical problems and costs involved in using wire line links for paging transmitter control in situations where phasing problems are a factor to be considered.

1.4.6 - Public Carriers

The homogeneity of the public carrier system makes it simpler to handle from a frequency point of view. "Swap" installations employ "Tone" type pagers and high speed switching techniques with terminals centrally located within their network. Optimum channel loading can therefore be realized, and a single frequency can be employed throughout the carrier's operational area. From the viewpoint of spectral efficiency, the systems are state-of-the-art and for the moment, are of far less concern than systems in the competitive sector.

1.4.7 - Competitive Operator Attitude to Frequency Problems

What are operators doing about the frequency problem, and what does their attitude appear to be?

The general impression received has been that operators in the competitive sector, while expecting the problems in congested areas to be partly resolved by technological advances in the pager units and partly resolved by the department, are not inactive. They recognize the ultimate implications of the frequency difficulties, and certainly in the case of larger operations, are planning on the demise of voice paging. Furthermore many systems have been or are in the course of being made as efficient as the current state-of-the-art will permit, thus ensuring that optimum system loading will be possible when current voice paging in its present form can be retired in favour of more efficient operating techniques.

Coupled with present efforts to enlarge system capacity is the feeling that, from the spectral viewpoint, the superior efficiency of paging over other radio applications is in itself justification for drawing added frequencies from other services.

In brief, operators in larger centers appear to be adopting policies, and taking such action as seems appropriate to the situation. Their requests for frequencies are not being made without considering the effectiveness of their present operational activities. However, their progress toward ultimate

channel capacity capabilities is slowed by the implications of the changeover process itself.

1.5 - Frequency Usage - Private Sector

1.5.1 - General

It is estimated that approximately 20,000 pagers are in current use by private system operators across the country, and that 90% of these are of the "Tone + Voice" type. The probability is that 80% of some 550 private installations are manually operated. Nearly one third of all private paging operations are associated with hospitals or related medical services, while the second largest users are motel and hotel operators who account for about 12% of the total system population.

Private system installations can be broadly classed into two main types:

1 - Those which share common frequencies with similar systems in the same general area, and
2 - Those which operate on unique frequency assignments to permit broader coverage than is possible with 1) above.

Systems sharing common frequencies depend on receiver proximity to the terminal equipment, and discrete signalling codes to avoid potential interference from their systems in the same area.

Existing systems came into being primarily for economic reasons; in many cases these installations cost about 50% less than equivalent services obtained

through public operators. In many instances, the requirement for instant system access, confidentiality, special area coverage, etc., dictated the need for an independent installation.

Private system facilities are frequently rented from the telephone company, equipment manufacturer or agent thus avoiding maintenance complications. When Telco systems are provided, system access through telephone facilities may be readily arranged. Systems vary in size from small local area in-plant installations with one or more pagers to citywide systems serving 300-400 or more units.

1.5.2 - Frequency Considerations

Private system installations with extended coverage requirements in a given region require unique frequency assignments. Hence though fewer in number in the larger centers, they make the greatest demands on the avaialble spectrum. For instance, available data indicates there are 28 private systems in the Vancouver area, 15 of these share a total of 3 frequencies between them, while the remaining 13 are presently absorbing individual assignments. Obviously the latter group give more cause for concern.

Two further considerations are of significant importance, particularly as they may relate to private installations with unique frequency allocations:

1) - The greatest majority of private systems employ operational methods which are the least efficient from the viewpoint of spectral efficiency, e.g. manual control, and voice type paging.
2) - The average system loading possible in terms of pagers served and paging traffic handled is low even for manually operated systems, averaging about 35 pager units per installation.

The significance of these factors becomes more apparent when dealt with in terms of a specific example. Statistical data reported by 32 systems in the

Quebec region reported serving a total of 900 pagers at the rate of 2400 calls per day. If these installations served the same coverage area, the total pager complement and their associated traffic would only partially load a single RF channel, even assuming that all units were of the "Voice" type; sufficient capacity could be left to serve an additional 2500 or more "Tone" pagers in a well disciplined state-of-the-art public installation.

In the private sector therefore, the most significant frequency savings would result if all private paging installations were obliged to share their operational frequencies with others in the area, and restrict coverage capabilities to small localized areas only. Where more extended coverage requirements exist, private system operators should be required to obtain the service by subscribing to the facilities of public or shared citywide installations capable of making efficient use of the spectrum.

Frequency conservation within groups of private systems operating on a shared frequency basis is not an immediate problem. However, in time, the number of such systems may grow to the point where they do absorb a significant number of assignments in the overall picture. The advent of such a possibility would be delayed by encouraging broader use of LOOP systems.

At present there are quite a number in use. However the costs of the LOOP itself are a deterrent to its wider application, particularly where installations

must be effected in existing buildings. Nevertheless there are many situations where LOOP costs would be nominal, and in such situations applicants should be encouraged to make use of them.

It is recommemded that the private paging area be given further study with a view to determining more definitively the reason why some systems require broader coverage, and what the implications are for integrating these paging needs with public or shared citywide installations capable of making more efficient and effective use of the spectrum.

1.6 - Implications for Future Channel Use

The average annual pager growth expected by reporting operations in the competitive sector is 28%. The general feeling of optimism for the future which prevails throughout the paging industry appears to be based on two factors.

Firstly, potential paging applications have barely been touched. At present the public is only partially aware of the nature of the paging industry and even less aware of what benefits may accrue from it not only in their business lives, but in their domestic activities as well.

Secondly, the paging industry anticipates dramatic reductions in pager costs which will make the service economic to a much broader sector of the Canadian public. Many anticipate that the pager population will grow to equal that of the telephone within the next ten to fifteen years.

To accommodate this growth and keep costs down, paging of the future will almost wholly be of the "Tone" type. The Bell Canada "Swap" installation is presently capable of handling up to about 100,000 "Tone" pagers per RF channel, and other "Swap" systems are probably of comparable capacity. Many of the larger competitive installations presently in existence will have capacities in the order of 50,000 units or more when voice paging and the slower signalling codes are phased out. Thus in the

case of some competitive facilities, present pager capacities should be increased in the order of 20-25 times. This improvement factor in the efficiency of existing competitive installations would, theoretically, accommodate annual growth rate in the order of 35-38% over the next decade.

In the private paging area, the growth factor within existing systems is estimated to be about 6% annually. In view of the inability of most privates to make full use of their available channels, there is no likelihood that this area of expansion will cause concern.

The annual growth rate in terms of new private systems installed is estimated to be about 15% annually. There are not the frequencies available to accommodate private coverage needs on unique assignments in congested areas, and this policy will either have to be eliminated or severely restricted in the years to come.

It is impossible to predict in precise terms how frequency needs will be distributed over the various areas in the years to come. However it is apparent that with the improvements which will ultimately be realised in the capacities of many existing systems, the demands which would otherwise be placed on the spectrum will be very significantly reduced.

1.7 - Co-Existence of Public & Competitive Paging

Public carrier and competitive paging services are complementary, each is able to provide something the other doesn't have. The carrier combines the broadest possible coverage with convenience of system access from any area to which his network extends. His rates are less, and his service is particularly suited to those who must travel extensively.

The competitive operator confines his operations to more restricted areas because he lacks an economic and effective means of integrating widely dispersed paging installations. His strength lies in his versatility, and his capability to adapt to the needs of the community he serves. Typically, telephone answering and message handling services are provided which fit naturally into the paging picture. His system is adaptable to a variety of paging services, pager types and features which appeal to individual tastes. Since it is probable that only a relatively small percentage of the paging population in larger centers require service outside their immediate area, the more restricted coverage capabilities of the competitive system is of no great concern.

It is estimated that at least 55 to 60% the paging subscribers in Canada today obtain their paging services from local competitive installations. Thus in spite of higher costs and limited coverage. the public prefer the services they have to offer.

If the choice lay between the public carrier paging systems and those provided by the competitive sector, the public's interests would probably best be served by eliminating carrier services; the competitive sector generates not only its own competition, but also that necessary to keep the carrier systems in line. Paging operators vary in their opinions as to whether or not public carriers should be active in the paging business, some are vehemently opposed while others feel the carrier has as much right there as anyone else.

As a result of the experience gained of the paging industry during the course of this study, it is felt that both the regulated and unregulated operators are essential to the public's best interests.

1.8 - Non-Urban Paging Requirements

In a data sample representing just under a third of all paging operators in Canada, slightly more than half the respondents indicated the need for paging service in non-urban areas. Furthermore, it was indicated that practically all such non-urban requirements are presently being met.

It is beyond the scope of this study to provide an in-depth evaluation of paging needs in rural areas. It should be pointed out however, that the present preoccupation with paging requirements in well populated areas has limited the consideration hitherto given to the potential needs of many outlying districts; hence it is probable that the implications of the survey result have limited significance in the overall picture.

Regions beyond the reach of urban paging facilities cannot justify the expense involved in isolated installations serving thinly populated regions. Inevitably such requirements will need the support of associated services to prove economic. Hence in many situations such needs will probably be most economically met by the public carriers.

When the pager unit becomes more of a household item than it is today, and the urban market has been satisfied, these requirements will receive more active attention. Competitive considerations in many instances will probably demand that the broader coverage needed by many subscribers (typically service agencies, fuel suppliers,

doctors, veterinatians, etc.) be met as a pre-requisite to obtaining their urban business.

1.9 - Standardisation

In a sample representing approximately 37% of the estimated public operator population, 60% indicated that a greater degree of standardisation in the paging industry is desireable.

The competitive operator requires a maximum degree of flexibility in his installation in order to remain as versatile as possible in the services he has available for public offering. A high degree of standardisation within the industry would seriously limit his ability to compete. On the other hand, the public carrier sacrifices versatility in favour of reduced costs and the ability to integrate and operate his paging facility in a standard manner throughout his network.

From the viewpoint of the competitive operator, the most important area requiring a greater degree of standardisation appears to be that of pager coding.

Too much system and equipment conformity throughout the industry will inhibit paging development, while too little will result in unnecessary compatability problems. Those areas where further standardisation are necessary appear limited, however the subject requires more detailed consideration than it has been possible to accord it during this study. Further study is recommended.

1.10 - Regulation

Opinions on whether or not the competitive paging sector should be regulated, or whether the public carriers should be de-regulated were about equally divided. The data sample was representative of approximately one third of the estimated public operator population.

A major impression received during the course of this survey has been that many competitive operators would probably welcome some measure of control being placed on the number of independent systems permitted to function in any given area.

While competition should not be unduly hampered by regulation, it should be controlled to the point that it does not have a negative effect on the service which might otherwise be available to the public. There are obvious advantages to be derived from regulation of the private sector, both from the viewpoint of the public as well as that of the paging industry itself. Operators who are assured a measure of protection in the areas they presently serve will be encouraged to commit larger investments in expansion and service improvements. At the same time the public benefits from the resulting improvements in paging facilities, and is more readily protected from operators who may otherwise provide an inferior grade of service. Furthermore, the department should be in a better position to ensure that optimum use is being made of the available spectrum.

It is therefore recommended that the benefits to be derived from regulation of the competitive paging sector be given further study. Specific areas recommended for regulation are:

1 - protection for responsible operators
2 - quality control of service and coverage as time goes on.

2.0 - Recommendations

The following constitutes a summary of the main recommendations stated or implied in the summary section of this document.

2.1 - Paging License Information

(Reference: Part I, para. 1.3).

It is recommended that the department revise present methods of accessing license information relative to radio paging operations in Canada. It should be possible to obtain reliable printouts from DOC license record which positively identify:

a) All paging operations, per se
b) Whether paging is licensed on a primary or secondary basis
c) Frequencies used for paging
d) Link frequencies involved where employed specifically for paging operations.
e) Relevant application dates.

2.2 - Modification of Existing Licensing Policies
(Reference: Part I, para. 1.4).

In view of the rapidly diminishing number of frequencies available in the more congested areas, particularly for MRS and paging applications, it is recommended that existing licensing policies be modified to prevent the possibility of spectrum availability vanishing altogether. In the field of private and public paging, the following recommendations are of particular importance with regard to the future conservation of frequency usage:

2.2.1 Voice Paging
(References: Part I, paras. 1.4.1 & 1.4.2)

In view of the severe limitations placed on RF channel capacity by the use of voice type pagers, it is recommended that their use be phased out in all areas where spectrum availibility is limited or apt to become so in the future.

2.2.2 Sharing of Facilities & Frequencies - Congested Areas
(Reference: Part I, para. 1.4.3)

It is recommended that the department give further study to the practical benefits, advantages and feasibility of licensing some RCC operators to "wholesale" paging services in frequency congested areas. The services available from such systems to be made available to smaller paging entrepreneurs, private system operators with broad coverage

requirements, etc., on a shared system basis.

2.2.3 Link Frequency Use
(Reference: Part I, para. 1.4.5).

It is recommended that the extent to which radio links are used for the control of paging transmitters be determined with a view to minimising or eliminating the use of needed frequencies. It is also recommended that an independent evaluation be made of the implications involved (from the unregulated operators' viewpoint) in effecting necessary transmitter control over wirelines.

2.2.4 Private System Frequency Usage
(Reference: Part I, para. 1.5.2).

It is recommended that further study be given to the private paging requirements to determine the implications of requiring all such installations in congested regions to limit coverage to restricted local areas only. Where more extended coverage requirements exist, it is recommended that these be obtained either from public operators, or from "wholesalers" of paging services operating shared system installations.

It is also recommended that private paging system applicants be encouraged to make more general use of "Loop" type installations where economic, or other factors, are equitable with an RF type of facility.

2.2.5 Secondary Paging on MRS Frequencies
(Reference: Part I, para. 1.4.4).

It is recommended that the Department continue to authorize MRS operators to employ MRS frequencies on a secondary basis for paging purposes. It is also recommended that such applicants be encouraged to make maximum use of paging techniques which permit simultaneous use of the channel facility for MRS purposes.

2.3 - Standardisation
(Reference: Part I, para 1.9).

It is recommended that further study be given to determining possible areas where more standardisation would prove beneficial to the industry. Particular attention should be given to an evaluation of the benefits which might accrue from a greater degree of conformity in pager coding methods.

2.4 - Regulation
(Reference: Part I, para. 1.10)

It is recommended that some degree of regulation be applied to the competitive sector to limit the number of independent systems permitted to operate in any given region. It is also recommended that the potential benefits to be derived from the regulation of other areas of paging activity be given futher study.

--Radio paging study for the Dept. of Communications.