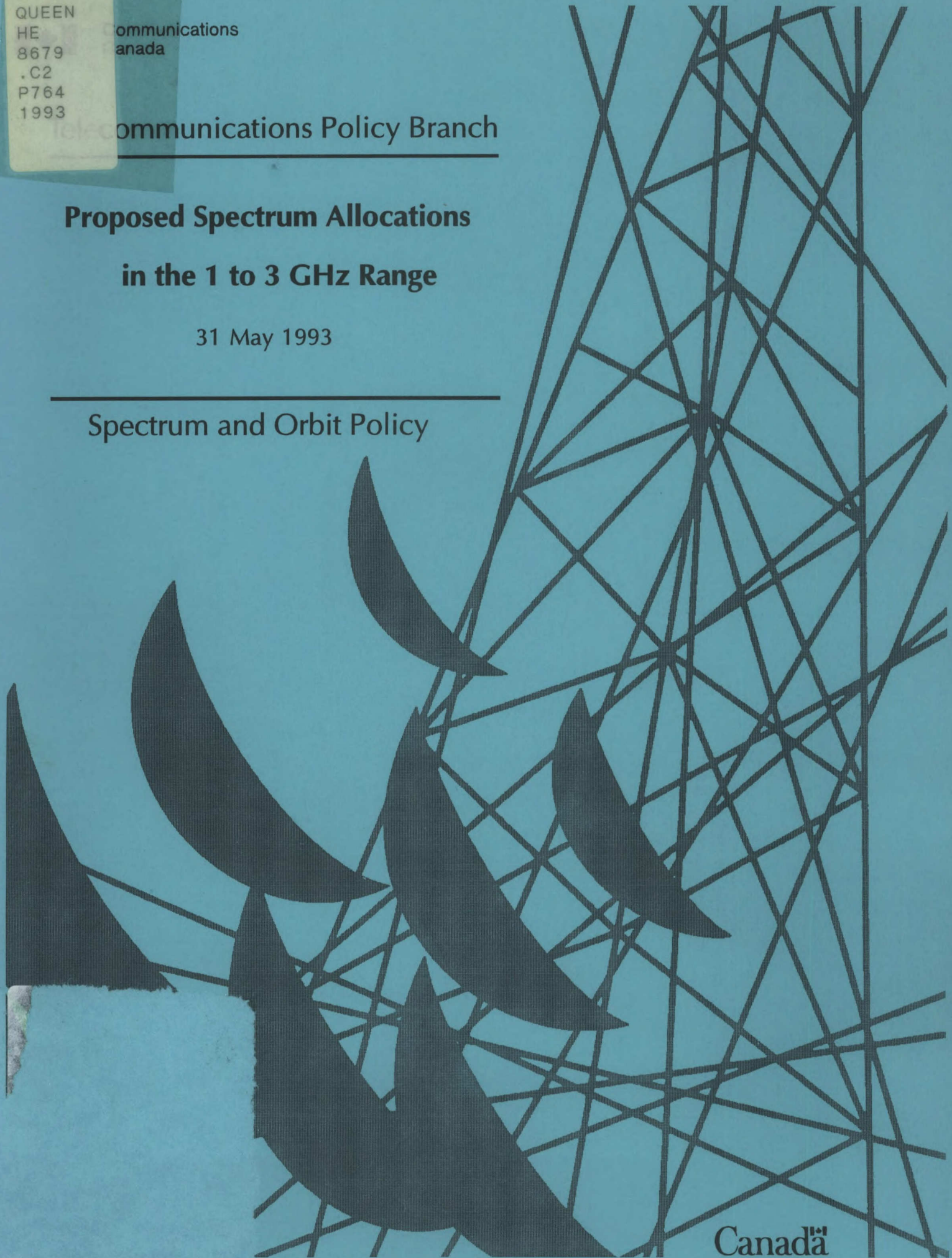
Communications Canada

Communications Policy Branch

Proposed Spectrum Allocations in the 1 to 3 GHz Range

31 May 1993

Spectrum and Orbit Policy



Canada

Preface

As a consequence of the new frequency allocations made by the 1992 World Administrative Radio Conference (WARC-92) convened by the International Telecommunications Union (ITU) in Spain, and the ongoing demand for new and existing radio services the Department has undertaken a comprehensive Spectrum Policy Review covering a wide range of spectrum allocation and utilization issues. This document forms part of the Review and addresses specific proposals for

- **spectrum allocations in the 1-3 GHz range.**

Other documents being released for public comment separately address and propose

- **spectrum allocations in the HF band, 3-30 MHz;**
- **spectrum allocations and spectrum utilization in the range 30-960 MHz;**
- **spectrum allocations above 3 GHz;**
- **spectrum utilization for certain services above 1 GHz.**

Based on the public comments received on these documents, revisions will be made to the Canadian Table of Frequency Allocations, to the relevant Spectrum Utilization Policies and, eventually to the Standard Radio System Plans.

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1 .... Introduction

1.1 ..... Intent

Decisions related to the uses to be made of many of the bands above 1 GHz are subject to extensive international debate, since countries do not always agree easily on what specific services should be allocated to the various bands. Oftentimes, differing interests cannot be fully reconciled, thus leading to significant spectrum management problems. These can be particularly challenging among immediate neighbours because of the high potential of interference, and even beyond when space services are involved. Canada will continue to play a major role in defining the international uses of the various bands, basing this activity on Canadian requirements. This requires national consensus on the spectrum needs and the related policies and standards covered by this Spectrum Review.

This Review will result in changes to the Canadian Table of Frequency Allocations and update Spectrum Utilization Policies to accommodate certain radio services for the foreseeable future.

The last major revision to the Canadian Table of Frequency Allocations (hereinafter referred to as the Canadian Table, or simply the Table) was carried out in the early 1980's. A public consultation document proposing changes to the Canadian Table was issued in May 1980; the revised Table was released on 1 January, 1982. Coincident with the WARC 79 preparation activity, the Department initiated a spectrum utilization review of the fixed service in the 1-10 GHz range. In August 1979, a discussion paper was released, followed by a policy proposal paper in July 1981, and a final policy paper in December 1982.

In contrast, this Spectrum Review will cover both the spectrum allocation and spectrum utilization issues together, rather than in two separate though parallel reviews as in the 1978-1982 period. In some aspects, this Review may appear to be more complex than predecessors. If there are allocation or utilization issues that cannot be finalized in this Review, they will revisited in future public consultations. On the other hand, there may be urgent issues that require resolution in less time than the full period allowed for this Review. Indeed, several minor revisions to the Canadian Table have had to be made since 1982.

1.2 ..... Schedule of Activity

The public is invited to submit written comment on the proposals, questions and observations contained in this document, to the Director General, Telecommunications Policy Branch, 300 Slater Street, Ottawa, Ontario, K1A 0C8, by 1 November 1993. Canada Gazette Notice

You have until 1 November 1993 to comment on this Review

DGTP-003-93 should be referenced in all replies. The Department will study all public comments and take them into consideration in the revision of the Table which is planned to be released in early 1994. These comments will also serve to finalize new spectrum utilization policies for release in the first quarter of 1994.

1.3 . . . . . Strategic Directions

Radiocommunications exert a profound influence on Canada's social, economic and cultural well-being. Canada is vitally dependent upon the judicious use of radio spectrum resources for advancing national policies, achieving telecommunications, broadcasting and cultural goals, ensuring the security and welfare of the nation in the conduct of its domestic and foreign affairs.

The legislative mandate of the Department

The Department, pursuant to the Department of Communications Act and the Radiocommunication Act, is responsible for establishing equitable spectrum allocation and utilization policies to meet national needs; for fostering the efficient development of radiocommunications in the public interest; and for ensuring the effective management of the radio frequency spectrum. In this regard, the Department periodically reviews its approach to spectrum management, as well as the pertinence of the frequency allocations and related utilization policies, in the context of a dynamic and ever-evolving radiocommunications environment.

The Department's mandate defines its central role within the federal government in strengthening the nation through communications and culture by ensuring that:

(a) Canada's communications systems evolve in an orderly fashion and remain at the forefront of global economic and technological developments and continue to meet the basic communications needs of all Canadians efficiently and at affordable costs; and

(b) Canadians have the opportunity to choose from a wide selection of Canadian cultural products and information services among the broad mix of domestic and foreign being carried over Canadian communications networks.

The Department seeks to foster the orderly development and operation of communications for Canada in the domestic and international spheres, in part through the planning and management of the radio frequency spectrum resource. In the overall national context, and to satisfy the increasing demand for radiocommunications of all kinds, it is essential that the use of the radio frequency spectrum be based on effective and equitable spectrum and licensing policies, radio regulations, radio systems standards, rules, procedures and practices designed to accommodate as many users as possible, and to promote sharing among all users in an interference-free environment.

Policies must lead to optimum utilization of the radio frequency spectrum to meet the immediate and long-term needs of all Canadian users, including the general public. From an overall spectrum management perspective, various policy directions must be pursued: those relating to the apportionment of the radio frequency spectrum among different radiocommunications services (spectrum allocation policies); to the particular use to be made of an allocated frequency band (spectrum utilization policies); and to what types of radio systems will be encouraged in Canada (radio systems policies).

Policy changes may be dictated by the need to respond to new trends in the use of the radio frequency spectrum. These can be due to a variety of factors, such as the demand for new radio services, the availability of new technologies, changes in international frequency allocations or use of the spectrum, or simply frequency congestion when demand exceeds supply.

Spectrum Objectives and Principles

As part of the Department's commitment to interface effectively with its clients, there has been an increasing delegation of responsibilities to the Regional and District offices, including microwave licensing, broadcast evaluations, associated local systems coordination, etc.

The radio frequency spectrum is, therefore, a dynamic environment requiring the ongoing review of the Department's policy and regulatory programs. Such reviews take into account how other countries regulate and manage the radio frequency spectrum. But more importantly, they are based on a public consultation process designed to achieve to the extent possible, fairness and harmony amongst all Canadian users.

In September 1990, the Department issued the discussion paper "Towards a Spectrum Policy Framework for the Twenty-First Century" to initiate public discussion on the development of a Spectrum Policy Framework. The discussion paper provided an overview of spectrum resources with emphasis on their benefits to Canada. It reviewed some of the significant trends, pressures and challenges occurring in spectrum management field and raised for discussion a number of issues in the following areas:

- o the allocation and utilization of spectrum resources;
- o spectrum policies and principles;
- o general licensing policies;
- o technical standards and spectrum planning;
- o commitments to research and development;
- o the role of government;

- o international aspects of spectrum policy;
- o spectrum resource revenues; and
- o market-based considerations for spectrum allocation and assignment.

In November 1991, the Department issued "Proposals for a Radio Spectrum Policy Framework for Canada", which reflected the public response to an earlier discussion paper, for further consultation. This Policy Proposal paper re-stated the set of core policy objectives which has formed and will continue to form the foundation for a strategic spectrum policy for Canada.

In September 1992, following a review of the responses to the policy proposals, the Minister of Communications released "A Spectrum Policy Framework for Canada". The document announced the adoption of a set of core objectives and established key policy guidelines governing the management of the radio frequency spectrum.

In January 1993, the Department issued for public consultation the draft document "Policies for the Development and Application of Mandatory Radio Standards (excluding Broadcasting)". The document enunciates the policies which guide the Department in developing and applying mandatory radio standards (excluding broadcasting) in Canada. It also discusses the importance of international standardization and the process by which the harmonization of mandatory standards is carried out with the USA.

2 Spectrum Allocation Requirements

2.1 . . . . Allocating the Radio Spectrum Resource

Like other limited public resources, there are many competing demands for use of the radio spectrum. The basic international approach to accommodating these requirements has been to group similar uses within a common radiocommunication service. Where two or more services are compatible, there is a good basis for the services to equally share a band. Where the services are incompatible, special conditions must be imposed to ensure that the most desired use of a band is protected from other uses. Sometimes, the simplest approach is to allocate services on a primary and secondary basis in a band. In practice, a secondary service assignment must not cause harmful interference to a primary service, and must always accept harmful interference from the primary service, even if the assignment to the secondary service was made first.

Among services, primary services have priority over secondary services (a distinguishing feature of frequency allocations)

The ITU and Canadian Tables are the vehicles which respectively establish, internationally and domestically:

a) the size and the location of the bands in the spectrum;

b) the services to which each band is allocated;

c) the relationships among services in cases where sharing is required.

The Table is developed as a result of discussions with the interested parties, with the aim of achieving an equitable and effective distribution of spectrum resources. Spectrum Utilization Policies (SPs), in contrast, are the product of the determination, through public consultation, of the technical and operational requirements within a given service. SPs are designed to define the preferred usage within a given service in a band. This ensures that specific uses have sufficient spectrum to develop. In Canada, a system which conforms to an SP is called standard, and if it does not conform, non-standard. These terms, as discussed in the document, *Proposed Spectrum Utilization for Certain Services Above 1 GHz,* hereinafter referred to as the Above 1 GHz Utilization paper, are also used to indicate conformance with Standard Radio System Plans (SRSPs). Standard systems have certain priorities of use of a band over non-standard systems.

Within a service, standard systems have priority over non-standard systems (a distinguishing feature of spectrum utilization)

It should be clear that the concepts of primary and secondary be applied to define the priority between two radiocommunication services (such as the fixed service and the mobile service) shown in the Table as sharing the same band. The terms standard and non-standard will apply solely to systems within a radiocommunication service, and will be based on compliance with Spectrum Utilization Policies (SPs) and Standard Radio System Plans (SRSPs).

The operative conditions that go with these two sets of terms are different. In general between services, a secondary service must immediately cease any harmful interference(1) it causes a primary service, and must accept any harmful interference. On the other hand, a non-standard system may be given up to 5 years notice that it may be required to protect a standard system (within the same service), and a 2-year notice to take remedial action or face removal.

(1) For this purpose, the ITU definition applies. "*Harmful Interference: Interference which endangers the functioning of a radionavigation service or other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with these Regulations.*"

Thus, the relative status between any two services is determined in the Table and the accompanying notes, while relationships within a service are prescribed by the relevant SPs and SRSPs. This interpretation should avoid possible cases where a system in one primary service which does not meet all of the conditions established within that service by an SP or SRSP, is considered to have a lower status than a system in another primary service. A non-standard system in one primary service will clearly not have a lower status than a system in another primary service. The other service may not even have a specific spectrum policy or standard that must be met. Primary/secondary and standard/non-standard designations can both distinctly and separately apply to a given assignment.

2.2 . . General Issues

In Canada, spectrum is generally apportioned by type of use and not by type of user. In this way diverse users using similar technology can share the same band.

Intra-Service

The sharing of bands within a service by type of use (similar system capacities or emissions) rather than the division of bands by type of user (carriers, utilities, government) has proven successful in Canada. This approach improves the spectrum utilization efficiency in all bands and, thus, postpones spectrum congestion. It also facilitates changes in policies or standards in a band, because the burden of change is spread more equitably upon several users rather than all on a single user. It may also broaden the potential market for equipment. There is no intent to depart from this important principle.

Inter-service

In preparing for WARC-92, Canada carried out a large number of inter-service sharing studies. Table 1, following, summarizes these studies, and provides a general overview of the difficulty of sharing between services in the 1-3 GHz range, as allocated by WARC-92. To use the table, enter the row or column which corresponds to the interfering

Band sharing by compatible services is encouraged

source. The intersection with another service shows the sharing potential with the recipient (victim) of the interference.

SOURCE/ VICTIM		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fixed (P-P)	1	•	M-H		L-M		L		L	M	L	H	H	H	
Fixed (P-MP)	2	M-H	•		⋈		L		L	L-M	L	⋈	⋈	H	
Mobile	3			•		L	L	L	L	⋈	⋈			H	
Mobile (PCS)	4	L-M	⋈		•	L	L	L	L	⋈	⋈			H	
MSS/GSO(E-s)	5	M-H	L-M			•		L		⋈	⋈	⋈	⋈	H	
MSS/GSO(s-E)	6	M-H	L-M	L	L		•			⋈	⋈	⋈	⋈	H	
MSS/LEO(E-s)	7	L	L			L		•		⋈	⋈	⋈	⋈	H	
MSS/LEO(s-E)	8	M-H	L-M	L	L				•	⋈	⋈	⋈	⋈	H	
DRB(terr.)	9			⋈	⋈	⋈	⋈	⋈	⋈	•	L	⋈	⋈	⋈	
DRB(BSS)	10			⋈	⋈	⋈	⋈	⋈	⋈	L	•	⋈	⋈	⋈	
Space sciences (E-s)	11		⋈	L	L	⋈	⋈	⋈	⋈	⋈	⋈	•	⋈	⋈	
Space sciences (s-E)	12	H	L	L	L	⋈	⋈	⋈	⋈	⋈	⋈	⋈	•	⋈	
RA	13	H	H	M	M	M	L	M	L	⋈	⋈	⋈	⋈	•	L
RL	14														•

H Sharing potential high
M Sharing potential moderate (coordination, minor restriction)
L Sharing potential low (difficult)
⋈ These services do not share in the Canadian context

Table 1 Simplified Summary of Inter-Service Sharing Potential

One significant and positive finding was that high capacity mobile systems such as the Future Land Mobile Telecommunications System (FPLMTS) and fixed systems can share spectrum in the same band in adjacent coverage areas, and in adjacent bands where their coverage areas overlap. This will allow the use of the spectrum designated for high density mobile usage in cities to be re-used by fixed systems in the adjacent countryside.

Proposals to allocate spectrum to services that can only share with some difficulty will require supplemental guidelines. This is the case for mobile personal communications systems (PCS) and fixed systems, which will require the specific identification of the frequency limits of high density spectrum usage, separation requirements and the location of potential mobile or fixed sites.

2.2.1 . . Reaccommodation of Existing Systems

New allocations made at WARC-92 enter into force on 12 October, 1993, unless otherwise indicated in a footnote to the International Table. To Canadian users, this means that new services cannot receive international protection until those dates. Canada has the flexibility to implement new services earlier, where international protection is not an issue of concern, or delay their implementation to a later date if this is advantageous.

The ITU Table may contain several services sharing a band on an equal basis. For purposes of compatibility or demand one or more of these may not be included in the Canadian Table.

Wherever changes to the Canadian Table are made, the Department must give realistic guidance to both existing and new users of the spectrum, such that they can all make optimum use of that part of the spectrum. The use of the spectrum and the benefits to Canada flowing therefrom will be optimum in the long term if it is recognized that access to a band by new services can best be accomplished by the orderly and timely adjustment or displacement of existing users.

When existing users are to be displaced, there must be clear rules and directions

The delay in the entry into force of new allocations is to be taken into account in the period in which existing users make any changes that may be required. As discussed in Section 2.1, the 5 and 2 Year Rule is normally applied within a service as a method of revising spectrum policies, rather than applied between services. Canada submitted a proposal to WARC-92 similar to the 2 year notice rule for non-standard systems (CAN/23/17 ADD 722B regarding L-band BSS), but it was not adopted. In some cases, it may still be acceptable to require change within 2 years.

A simple solution would be to reduce the old service to secondary status after a given date, although this may not be warranted in bands where the implementation date of the new service is uncertain.

It is noteworthy that, in a parallel situation, the USA has domestically proposed[2] to avoid a band clearing approach domestically by:

1. continuing to grant fixed licenses on a secondary basis (the secondary status is to avoid speculation in spectrum that could arise under 3. below);

2. allowing previously existing fixed users to continue to operate on a primary basis for 10-15 years (different provisions are made for certain users, an approach inconsistent with Canadian type-of-use policy);

3. requiring the providers of new services to negotiate with the existing primary users to obtain access before 10-15 years.

(2) Notice of Proposed Rule Making, In the Matter of Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunication Technologies, FCC, January 16, 1992.

The reaccommodation of a service will be eased if new spectrum can be identified at the same time the allocation is changed.

2.2.2 . . . Industrial, Scientific and Medical Equipment (ISM)

Comments are invited on the question: Are additional arrangements needed when these ISM devices share spectrum with licensed systems?

Over the past few years, a large number of new uses of the radio spectrum have arisen which are deemed to fall outside of the full regulatory process, particularly the need to adhere to the Table of Frequency Allocations and Spectrum Policies, or to licensing. Most of the devices are subject only to regulation of their technical characteristics, chiefly a requirement to operate at low power.

The Department has advised radio users that it cannot and will not protect them from interference from properly operating Industrial, Scientific and Medical (ISM) devices, which are unlicensed. This must be re-emphasized, as there are devices coming on the market in the ISM bands which are potential interferers.

2.2.3 . . International Coordination of Radio Systems

Radio systems that are capable of creating interference to systems in other countries must, by treaty, be coordinated with potentially affected systems in other countries. Except for the US, which is dealt with bilaterally under a Canada-US treaty on coordination in most frequency bands above 30 MHz, coordination is initiated through the International Frequency Registration Board. Canada's relative isolation from other countries means that its primary coordination concerns (other than the US) are to or from satellite systems of other countries, and from its satellite systems into foreign terrestrial systems.

After the proper allocation and utilization policies comes the hurdle of coordinating the stations in the band

WARC-92 adopted new allocations to the mobile-satellite service (MSS) and the broadcasting-satellite service (BSS) in the 1-3 GHz range, subject to special coordination procedures which are set forth in the ITU Radio Regulations in applicable Articles or Resolutions. Normally, Article 13 procedures apply to space systems. Article 13 is based on band sharing conditions that ensure compatibility (eg: pfd limits), which preclude the need for space networks to be coordinated with terrestrial systems. This

degree of compatibility was not achieved in the new space service allocations between 1 and 3 GHz; such new space system assignments must therefore be coordinated with terrestrial systems of other countries. This also applies to all allocations which require coordination under Article 14 and Resolution 33 (see titles below), and for assignments whose PFD exceeds a limit specified in footnotes calling for Resolution 46 coordination. Moreover, Resolution 46 now requires coordination between LEO and GSO networks.

Article 13	Notification and Recording in the Master International Frequency Register of Frequency Assignments to Radio Astronomy and Space Radiocommunications Stations Except Stations in The Broadcasting-Satellite Service.
Article 14	Supplemental Procedure to be Applied Where a Footnote in the Table of Frequency Allocations Requires an Agreement with an Administration
Resolution 33	Relating to the Bringing into Use of Space Stations in the Broadcasting-Satellite Service, Prior to the Entry into Force of Agreements and Associated Plans for the Broadcasting-Satellite Service
Resolution 46	Interim Procedures for the Coordination and Notification of Assignments of Non-Geostationary-Satellite Networks in Certain Space Services and Other Services to Which the Bands are Allocated

Resolution 46, which was adopted by WARC-92, is of special importance to prospective operators of non-GSO mobile satellite systems. These are specific procedures to coordinate such systems with other space or terrestrial services.

These international coordination provisions are important to potential users of these new bands in Canada, because not only must the Department provide favourable allocation and spectrum policy support for the application, but actual system design should be such as to facilitate international acceptance under the ITU coordination process (see Table 2). The Department would only decide to proceed along these lines if the latter condition (ie: susceptibility to coordination) seems likely to be achievable. Otherwise, spectrum policy decisions may have to be delayed until such conditions materialize.

Resolutions 33 and 46 which require coordination between the space systems and terrestrial systems are designed to protect the latter. The IFRB (now the Radiocommunications Bureau) cannot give a favourable finding to a space station that is found to cause harmful interference to a

terrestrial station. If the result of the coordination is inconclusive and the satellite is launched and causes harmful interference, that satellite must cease operation. As can be seen, the results of WARC-92 in the 1-3 GHz range leave open a number of options in the use of these bands. The allocation and utilization proposals in this Review are intended to narrow down the options to the degree possible at this time.

Table 2 MSS and BSS Coordination in Region 2

Band (MHz)	Service/ ITU Procedure	After Date	Coordination
1467-1492	BSS/RES33	93/10/12	All affected systems
1452-1492	BSS/Future Plan	Unknown	Unknown, if any
1492-1525	MSS/RES46	92/03/04	RR 2566
1525-1530	MSS-GSO/RES46	As above	As above
1525-1559/ 1626.5-1660.5	MSS-Non GSO/ RES46	As above	None
1675-1710	As above	As above	None
1970-2010	As above	05/01/01	None
2160-2200	MSS/RES46	05/01/01	RR 2566
2335-2360	BSS/RES33	93/10/12	All affected systems
2310-2360	BSS/Future Plan	Unknown	Unknown, if any
2483.5-2500	MSS/RDSS RES46	92/03/04	RR 2566
2500-2520	MSS/RES46	05/01/01	RR 2566
2500-2535	MSS-Non GSO ART14/RES46	93/10/12	RR 2566
2670-2690	MSS-Non GSO/RES46	05/01/01	None
2655-2670	MSS-Non GSO ART14/RES46	93/10/12	None

Notes:

After Date:

The Final Acts of WARC-92 enter into force on 12 October 1993. At that time, any allocations that are otherwise undated may be coordinated for use.

RES 46 became effective on March 4, 1992.

Some MSS allocations may not be brought into use until January 1, 2005.

Coordination:

Radio Regulation No. 2566 is contained in Article 28. No. 2566 limits the PFD at the surface of the earth to -152 dB(W/m²)/4 kHz at horizontal arrival angles, increasing to -142 for angles of 25 degrees and above.

Resolution 33 requires coordination with all systems that may be affected.

Broadcasting Plans typically reduces the other services sharing the same band to secondary status; however, limits may be placed on interference produced by BSS systems into areas adjacent to their coverage areas.

In some cases, footnotes require that coordination under Resolution 46 take place only where a certain PFD is exceeded. In other cases, footnotes contain no reference to a PFD, and coordination is required with any station that may be affected.

2.2.4 . . International Alignment

Now is an opportunity to align our spectrum usage closer to that of other countries.

Although Canada is free to establish its own unique uses of the radio spectrum, there can be significant advantages in making usage alignments with other countries for the purposes of accessing wider service and equipment markets, and achieving economies of scale. Of particular interest are alignments in North America and in Region 2. In frequency allocations, the USA has designated a significant portion of its spectrum in the 1-10 GHz range for military use. Canada, lacking the US scale of military infrastructure, has made most of this spectrum available for civil use. The differences are still large enough that in the 1427-1525 and 1710-2450 MHz ranges, there is little or no commonality in channelling or use of the radio spectrum.

Comments are invited to identify areas requiring further examination.

We may be entering an era when greater alignment in these frequency ranges becomes more and more desirable, as the low gigahertz range becomes populated with mass-market products such as digital radio broadcasting (DRB) and FPLMTS/PCS. The size of the North American markets have not yet been estimated. The CCIR can be expected to accelerate its work on FPLMTS and L-band DRB, but the US may head in its own direction in both areas. Differences may also originate in Europe, by way of ETSI decisions being tabled in the CCIR.

The CCIR will amend frequency plans for the fixed service, to reflect potential sharing arrangements with new services allocated in 1-3 GHz range. The CCIR will also be asked to review the 1675-1710 MHz range for sharing conditions between the MSS and the meteorological services in Region 2.

2.2.5 . . . . Canadian Industrial Opportunities

Spectrum-related policies and standards have been primarily developed to meet radiocommunication needs in Canada. Canada is in the fortunate position of being able to put some spectrum at the disposal of innovators and manufacturers to develop new products (radio equipment and services) for domestic and world markets. There are many factors in play that support this in Canada:

- a relative abundance of spectrum, because of good management, few neighbours, and the designation of spectrum to type of use rather than type of user;

Should we set aside spectrum for innovation?

- a domestic market that spans high value frequency congested areas, and areas that require low cost communications and make small demands on the spectrum. This diversity provides a wide market for equipment designed and built to serve Canadian needs;
- innovative and highly skilled researchers that have developed many highly successful products;
- government support to advanced technologies, resulting in many firsts, including the world's first domestic geostationary satellite system;
- strong industry and government presence in international standard setting activities;
- Canadians are heavy and early users of radio services, thus creating a responsive home market;

Comments are invited on how the Department's policies, standards and procedures can better advance the commercial interests of Canadian manufacturers and service providers.

- manufacturers have developed state-of-the-art products for serving niche markets, as well as large systems that are world leaders in major markets;
- service providers demand equipment standards that provide a level of service envied in most parts of the world;
- our technology and our companies are well respected throughout the world.

Spectrum policies and standards can support these opportunities by ensuring that the spectrum required by products in different markets around the world is also available in Canada, in order to provide a home market for these products. These should promote greater flexibility of use of any part of the spectrum while maintaining the opportunity to serve different demands. Specific utilization proposals are being published in the document "*Proposed Spectrum Utilization for Certain Services Above 1 GHz*".

2.2.6 . . . . . New Technologies

The last comprehensive review of the spectrum above 1 GHz commenced about 15 years ago. It might be expected then, that the next spectrum review would begin 15 years after the 1993 Review, ie. about 2007. It would be fortunate if the results of this Review were sufficiently flexible and forward-looking so as to facilitate any revisions that may be desirable in future reviews.

The 1977-1982 review took place at a turning point in solid state digital technology. Common carriers were seriously beginning their transition from analogue to digital technology. Fibre optic systems were beginning to be deployed in the early 1980's. The 1982 allocation table and associated spectrum policies were based on radio systems that were often a "soft" conversion of analog systems to digital, where analog radios were adapted to support digital traffic.

Since that time, digital technology has come to dominate telecommunications, and mobile, fixed and broadcast systems are now taking advantage of the economics, flexibility and efficiency of micro-circuitry and optical devices.

We can anticipate significant changes in the demand for, and methods of delivery of, all forms of information

In one forecast of year-2010 technology, (AT&T Technology Magazine, Volume 7, No.1, 1992), a single microchip could contain a billion components and require but 3 days to design. Multiwave photonic transmission will be using light amplifiers and photonic switching. Transmission capacity could reach as many as 1,000 "light channels" on a single fibre, providing 1 Terabit/sec of digital information, which is roughly equivalent to 15 million voice circuits or 20,000 video channels.

When implemented, these technologies will treat information transmission more like a commodity, say a bushel of wheat, than like a service. The next comprehensive Spectrum Review will need to address these almost revolutionary changes, to satisfy practically unlimited transmission capacities and customer expectations of bandwidth or transmission on demand. Spectrum allocation and utilization decisions should fully address the current issues in a way that is forward looking and adaptable to the evolving telecommunication environment.

2.3 . . Broadcasting

This section addresses spectrum allocations for Digital Radio Broadcasting (DRB) in Canada and the existing broadcasting allocations for Multipoint Distribution Systems (MDS) in Canada.

2.3.1 Sound Radio Broadcasting

2.3.1.1 Background

General information on sound broadcasting

Sound broadcasting services in Canada are available in the AM and FM broadcasting bands. The AM band, occupying 525 kHz to 1705 kHz, includes the recently expanded portion from 1605 to 1705 kHz. Until such time as receivers capable of tuning through the expanded band are in the hands of the general public, it is not anticipated that it will be a significantly occupied, especially in areas where additional FM channels are still available. The decline of the AM market, even with stereophonic improvements, is in part due to the migration to FM broadcasting and the desire of the public for improvements in sound quality.

With limitations for station growth in the FM broadcasting band (88-108 MHz) in congested areas (i.e. in the Toronto area, there are virtually no more FM channels available), additional stations can only be accommodated through improvements in receiver performance, the restructuring of the band or additional allocations of spectrum.

2.3.1.2 Digital Radio Broadcasting

There has been a significant increase in the public's desire for compact disc quality sound recordings. Recent technology developments have sparked a series of studies to accommodate a digital radio broadcasting service of similar quality. The feasibility of broadcasting medium to high quality sound broadcasting programs using a geostationary satellite directly to the general public using fixed, portable and vehicular receivers has been actively studied within the CCIR since 1977. During 1990, DRB demonstrations were held in four major market centres in Canada. This was a joint project of the Canadian Association of Broadcasters, the Canadian Broadcasting Corporation and the Department of Communications. Results indicated favourable support for future implementation of this service in Canada.

The advantages of digital sound

Some of the expected advantages of DRB systems include:

- technical quality that rivals that available from compact disks.
- broadcasting signals at these frequencies are essentially immune to multipath problems and actually uses multipath as positive components to reconstruct the signal. Most dead spaces in the coverage area can be served with gap fillers.
- satellite and terrestrial broadcasting services could be accommodated in the same band. This allows the use of the same receivers for national, regional, and local radio broadcasting stations.
- uniform quality could be provided by all broadcasters, unlike the present wide disparity between AM and FM.
- 6-8 stereophonic audio channels could be broadcast from one transmitter, with accompanying cost savings.

Digital radio broadcasting by satellite was an important item on the agenda of WARC-92. An allocation was to be found in the range 500-3000 MHz, allowing the provision of a complementary terrestrial sound broadcasting.

Canadian broadcasters have supported the move to the technologically superior digital sound broadcasting on the basis of improved audio quality and reliability of reception. The new service is to be designed for reception with portable and mobile receivers using simple antennas.

2.3.1.3 . . Canadian Proposals to WARC-92

Canadian proposals focused on the 1441-1515 MHz band (L-band) for satellite and complementary terrestrial digital broadcasting services. The spectrum proposal for a total of 74 MHz was considered adequate to produce a viable terrestrial and satellite service in Canada and the rest of North America. It was estimated that over a period of 30 years, most if not all conventional AM and FM broadcasting stations would be replaced by digital radio broadcasting.

Nationwide direct broadcast service could be provided by adopting a compatible broadcasting satellite service. A mixed terrestrial/satellite implementation was proposed as it allows the possibility of local and national coverage as well as the extension of coverage to remote and thinly populated areas. Common allocations for terrestrial and space transmissions were supported to provide compatible service to mobile receivers. The allocation proposal represented a balanced compromise between accommodating the requirement of new services and minimizing the impact on existing services.

In addition, the proposal envisaged a time-phased introduction in selected band segments to ensure that frequencies would be usable for broadcasting services when the need arose while permitting the continued use of the fixed service and the mobile service for as long as possible.

2.3.1.4 . . WARC-92 Results

WARC-92 has made available, on a world-wide basis (except in the USA), a primary allocation of 40 MHz for the Broadcasting-Satellite and the Broadcasting services in the band 1452-1492 MHz for use by both satellite and terrestrial DRB systems. By means of footnotes, a number of other countries opted for an additional frequency band at 2535-2655 MHz while the USA and India selected the 2310-2360 MHz band.

As prescribed in the footnotes associated with each of these allocations, the use of these bands is limited to digital audio broadcasting and subject to the convening of a Conference, preferably not later than 1998, to plan BSS-sound and develop procedures for the co-ordinated use of the complementary terrestrial broadcasting. The future conference also has the task of reviewing the sharing criteria with other services in this band.

In the interim period, the new broadcasting-satellite service can only be introduced in the upper 25 MHz of each of the bands under Resolution 33, to protect existing services (essentially fixed and mobile). The complementary terrestrial broadcasting may be introduced anywhere within the appropriate bands prior to the creation of a plan, subject to co-ordination with administrations which could be affected.

2.3.2 Multipoint Distribution Systems (MDS)

2.3.2.1 Background

Spectrum utilization policies

In 1985, the Canadian Table was changed to include broadcasting on a primary basis in the 2596-2686 MHz band. The first spectrum utilization policy to accommodate broadcasting service using Multipoint Distribution Systems (MDS) for the distribution of television was released in March 1985 - the Spectrum Utilization Policy for the Fixed and Broadcasting Services in the Band 2500-2686 MHz (SP 2500 MHz). Revisions were issued in April 1989 to reflect the termination of radiolocation services in the band, and in November 1991 to realign the policy with the objectives of the new Broadcasting Act.

2.3.2.2 .. Canadian Proposals to WARC-92

Canada had proposed an allocation to the mobile-satellite service (MSS) in the band 2638.5-2690 MHz and proposed to suppress the allocations to the broadcasting-satellite and fixed-satellite services in the band 2500-2655 MHz. This suppression associated with the previous Canadian proposal (see 2.3.1.3) to allocate that band for digital audio broadcasting. The proposed allocations to the MSS in the 2500 MHz band would have impacted on some of the MDS channels used by broadcasters.

2.3.2.3 .. WARC-92 Results

Several allocations were made to the MSS including the 2670-2690 MHz band, to become effective from 1 January 2005 and subject to the co-ordination procedure(s) described in section 2.2.3. Implementation in this band may take place prior to this date, but is subject to coordination under Article 14. An allocation was also made to the MSS in the 2655-2670 MHz band.

The first implementation of mobile-satellite systems in North America will take place in lower bands; thus, MDS broadcasting services in Canada and in the USA can continue unimpaired for the foreseeable future. (See 2.5.7)

2.4 Mobile

2.4.1 .. Background

Conventional mobile

The use of the mobile radiocommunications service has experienced extensive growth in the past, and this is expected to continue in the future. Among the various mobile applications, the growth of cellular service is the most significant indicating a need to establish favourable conditions for the personal communication services that have been stimulated by cellular usage. This review addresses the need and feasibility to accommodate some of this growth in bands above 1 GHz.

The traditional application of mobile radio has been for dispatch[3] operations and related applications for public and private purposes. These traditional applications are commonly referred to as "conventional mobile."

(3) Dispatch operations are defined by RP-005 as two-way radiocommunications intended for the transmission of brief messages for instruction and information, originating and terminating in mobile and base stations and normally controlled by a radio operator (dispatcher).

2.4.2 . . . . . Future Requirements for Mobile

To date, the growth requirements of conventional mobile have been met below 1 GHz through the creation of additional mobile service bands. The original broad channels used in the implementation of mobile radio have been narrowed and reasonable spectrum efficiencies have been achieved with current analog technology. Conventional mobile applications have gradually expanded from the 30-50 MHz and 150-174 MHz bands to new spectrum in the 400, 800 and 900 MHz bands that were opened to the mobile service around the years 1970, 1982 and 1990, respectively. Although the rapid growth of cellular radio has attracted the greatest attention in recent years, conventional radio has sustained continued growth and there is a reasonable expectation that this will continue.

The Department is of the view that future requirements for conventional mobile in the near to medium term can be met by a program of refarming the mobile spectrum below 1 GHz

The Department is of the view that the continuing demand for conventional mobile applications can be met by replanning or refarming the mobile bands currently allocated below 1 GHz. This approach (which will be outlined in the forthcoming document "*Proposed Spectrum Allocation and Spectrum Utilization in the Range 30-960 MHz*") takes advantage of the emerging digital technologies currently being developed for cellular radio and other techniques to further increase the level of spectrum utilization within existing mobile allocations over a period of time. The advantage of this approach is that this will at least greatly reduce, if not obviate, the need for reallocation of spectrum above 1 GHz to meet the needs for conventional mobile.

The possibility of identifying spectrum above 1 GHz for the conventional mobile service should be held open to respond to unforseen demand or unique applications that could not be met below 1 GHz. The Department will take this into account in the implementation of mobile allocations in bands above 1 GHz in order to retain the flexibility to meet such requirements in the future. A provision for experimental investigation would be included when shown to be warranted.

Personal communications services

There is significant interest in the development of personal communications services in Canada. This stems originally from the successful deployment of cellular mobile services and the increased penetration of paging services. In addition, there has been considerable

effort by Canadian industry in the current implementation of digital cordless telephone services at 944 MHz. To this end, the Department has recently awarded four licenses for the provision of public digital cordless service. There is significant interest in other countries as well. The immense potential of personal communication systems requires the designation of additional spectrum that can only be found above 1 GHz. Attention has been directed towards the utilization of spectrum in the bands near 2 GHz for personal communications in Canada as well as in other parts of the world.

The US Federal Communications Commission issued a Notice of Proposed Rulemaking (NPRM) in August, 1992 which proposed that 110 MHz of spectrum in the bands 1850-1895 MHz and 1910-1975 MHz be used for personal communications. The NPRM proposed three paired blocks of spectrum, each of 2 x 15 MHz bandwidth that would enable three separate licensed service operations. Another 20 MHz of spectrum was proposed for unlicensed operations of various bandwidths. A further 3 MHz of spectrum for personal communications was proposed for the 900 MHz band. A large number of personal communications trials are under way in the USA with many different technical and service approaches. The proposal contained in this NPRM is subject to change during the course of consultation.

International developments in personal communications services

In Europe the development of some forms of personal communications are well advanced. Public cordless telephone was first introduced in the United Kingdom and personal communications systems based on the GSM cellular standard are under development for the band 1700-1880 MHz. Digital cordless telephony is also under development in the band 1880-1900 MHz band. In Europe, these bands are expected to suffice until a new generation of personal communications is available about the year 2000 for implementation above 1900 MHz.

This worldwide interest in the development of personal communications services has been reflected in the work of the ITU. The issue of spectrum for personal communications was on of the WARC-92 agenda. Canada and many other countries proposed the designation of a modest amount of spectrum for personal communications in specific bands in the 2 GHz range. A prospective "standard" personal communications system, under study by CCIR, is known as the Future Public Land Mobile Telecommunications System (FPLMTS). The Conference identified a broad range of spectrum in which FPLMTS could be implemented, specifically 1885-2025 MHz and 2110-2200 MHz. Allocations were made to the MSS in parts of these bands and indications given that these could be used for FPLMTS.

The exclusive use of these bands by personal communications systems which meet the FPLMTS standard is not prescribed by the WARC-92 changes to the international regulations. Canada can also choose to

implement other types of personal communications or continue to use the co-primary fixed allocation. It is expected that a part of this spectrum could accommodate early versions of personal communications, leaving the remaining spectrum for the fixed service. Eventually, with the full scale implementation of systems meeting the FPLMTS standard, all of this spectrum would be required for personal communications in the areas of largest population density. Outside of these urban areas, it is expected that spectrum could continue to be shared with fixed systems.

Standards for personal communications systems

The development of global standards for FPLMTS is under way through the work of CCIR Task Group 8/1. These standards are to be in place to support the introduction of FPLMTS systems by about the year 2000. The Canadian market for telecommunications is small relative to those of the largest industrialized countries. There are advantages to achieving commonality in spectrum usage and standards with other countries.

The Department strongly supports the work of the International Telecommunications Union in the development of a global standard for personal communications (FPLMTS) and identifies it as the target vehicle for personal communications in Canada. The Department also recognizes that early versions of personal communications should be accommodated.

Impact on existing services

The impact on the existing fixed service by the implementation of the personal communication services will be taken into account. It is expected that the majority demand for personal communications services will be near urban areas, leading to potential spectrum sharing with the fixed services in rural areas. Nevertheless, many fixed systems will be affected and the implementation of personal communications systems must minimize this impact to the extent possible. It is important that spectrum for future personal communications services be identified relatively quickly.

2.4.3 . . . . . Future Requirements of Other Mobile Applications

Aeronautical Public Correspondence

It is envisaged that some spectrum will be required for other mobile applications in the spectrum above 1 GHz, chiefly in the range 1-6 GHz. For example, Spectrum is currently designated in North America for Aeronautical Public Correspondence (APC) in the 800 MHz band to provide airline passengers with telephone service. In Canada, licenses were awarded for this service in 1992. WARC-92 designated an additional pair of bands at 1670-1675 MHz and 1800-1805 MHz for APC. Given the implementation of the APC service in 800 MHz in North America, it does not appear that the allocation of these bands as well is warranted.

Possible future applications

There are a variety of other mobile service applications under study for future deployment. Many of these are in the conceptual or development stage but may eventually require spectrum in bands above 1 GHz. These applications may include highway toll collection, intelligent vehicle highway systems and other specialized applications.

Allocations for the mobile service are shown in Section 3

Section 3 contains proposals for the introduction of the mobile service in the Canadian Table in various bands above 1 GHz. Options for the implementation of personal communications services are discussed in the document being released "*Proposed Spectrum Utilization for Certain Services Above 1 GHz*".

2.5 ..... Mobile Satellite

This section addresses the mobile satellite services, reviews the related results of WARC-92 and proposes their application in Canada.

2.5.1 .. Introduction

The interest in mobile satellite communications in Canada can be traced back 20 years to the Department's MUSAT program. The development of a domestic mobile satellite service is now well underway, and Telesat Mobile Inc. (TMI) is establishing a geostationary system called MSAT for operation in 1994.

Canada is a member of Inmarsat, which provides maritime MSSs and limited aeronautical and land mobile-satellite applications. Inmarsat is expanding its service offerings to specifically cater to the aeronautical and land mobile segments of the market.

2.5.2 ..... Current Spectrum Availability

The Inmarsat and Russian Federation mobile satellite systems operate in the band 1500-1600 MHz. The spectrum available for the MSS prior to WARC-92 consisted of the bands 1530-1559 MHz and 1626.5-1660.5 MHz. It has been difficult to reach agreement on the coordination of the Canadian MSAT and the other North American systems, partly because of the highly optimistic requirements anticipated for global systems and the limited ability of GSO/MSS to reuse spectrum. In essence, stated demands exceed the capacity of the allocated spectrum, even with sophisticated spectrum reuse techniques.

2.5.3 .... WARC-92 Results Affecting the Mobile-Satellite Service

Frequency coordination difficulties in the existing bands for even the first generation mobile satellite systems spurred Canada to propose several additional allocations for the MSS at WARC-92. The outcome of the WARC was favourable; a significant number of additional allocations were made to the mobile satellite services and they were for the most part consistent with the Canadian proposals. However, these allocations are shared with other services. Concern for protection to existing services led to the adoption of coordination procedures that give ongoing protection to existing systems of the co-primary services. The challenge of coordinating mobile satellite services with the fixed (radio relay) service and other services will impact on the ability to plan the deployment of mobile satellite systems. In addition, some of the frequency bands for the MSS will not become available until the year 2005.

2.5.4 . The Evolution of Mobile Satellite Technology

The prospect of commercial non-geostationary orbit (non-GSO) mobile satellite systems has attracted the greatest amount of interest in the evolution of mobile satellite technology. The concept is based on a

relatively large number of small satellites that are placed in non-GSO orbits. Most of the proposals are for low Earth orbits (LEO), but medium and highly elliptical (MEO and HEO) orbits are also being considered. Advantages include the use of smaller, lighter satellites that are individually cheaper to build and launch; the reduction of transmission delay and power levels due to the shorter transmission paths associated with lower orbits; and the opportunity to obtain global coverage, including the polar regions. However, expensive constellations of satellites are required to provide full global coverage.

There are a number of technical and economic disadvantages associated with non-GSO mobile satellite systems as well as regulatory challenges to overcome in order to bring these systems into operation. The FCC authorized the licensing of experimental systems in the bands 1610-1626.5 MHz and 2483.5-2500 MHz (or portions thereof) for four of the US applicants. More information will become available on this in due course. At this point it is difficult to predict how well this technology will fare in competition with systems designed to use the GSO.

Improvements in GSO mobile satellite systems are expected from the increased commercial viability of larger spacecraft antennas and from improvements in spacecraft technology, such as high temperature superconductivity and digital beam forming. Current commercial antenna sizes are 5 to 6 metres and an increase to 9 metres or more is foreseen. Increases in the efficiency of RF components including antennas will also result from the use of superconductivity. Advanced digital beam forming will eventually allow geographic allocation of satellite power and bandwidth on a per call basis. This enables increases in power flux density in spotbeams and spectrum efficiency through better frequency reuse.

The evolution of the technology for universal personal communications services can be expected to be stimulated by the optimistic market forecasts. Such systems will be mostly terrestrial, but in order to provide truly universal coverage, supplementary satellite coverage will be necessary. The work of CCIR Task Group 8/1 on FPLMTS and the results of WARC-92 foresee the need for space techniques in the delivery of personal communications services. (See the discussion in 2.4.4 of the *Above 1 GHz Utilization* proposals).

2.5.5 . . . . . Sharing between the MSS with Other Services

Sharing studies between the mobile satellite service and the mobile and fixed services have been carried out in the Department internally and under contract. A great deal of this work was done in the preparation of Canada's proposals to the WARC-92. (See 2.2 above)

Sharing between the personal terminals of a high density personal communication service and MSS (Earth-to-space) is not feasible. It may

be possible to share the vehicular station portion of personal communications with MSS (Earth-to-space). It will also be difficult to operate MSS (space-to-Earth) Earth stations in geographical areas where there is a significant deployment of personal terminals. Personal communications and MSS (space-to-Earth) sharing is shown to be feasible. It is recognized internationally that space techniques to support personal communications (FPLMTS) are to be accommodated in the bands 1980-2010 MHz and 2170-2200 MHz. Separate spectrum blocks or dynamic channel sharing arrangements could be deployed to accommodate joint use. Mobile satellite systems not associated with FPLMTS could also use these techniques to share with the mobile service.

These studies indicate that sharing between the fixed and mobile satellite services could be accomplished provided that specific constraints were placed on both services. Sharing studies between the fixed and mobile satellite service are being pursued in CCIR. The practical impact on operations from sharing the fixed and mobile satellite services is not yet known.

2.5.6 . . . . . Future Deployment of Mobile Satellite Systems in other Countries and by International Organizations

The American Mobile Satellite Corporation (AMSC) and TMI are cooperating in the development of GSO mobile satellite systems for launching in 1994. TMI and AMSC are concentrating on a market that will use MSAT as an adjunct to the cellular service. Mexico is also proceeding with the development of a mobile satellite package to operate in L band.

There appears to be a stronger focus by commercial interests in the US on non-GSO, than on GSO mobile satellite systems. One aspect of non-GSO technology is the ability to reach global mobile satellite communication markets. It is therefore expected that non-GSO systems will result in pressure to provide service through these networks in Canada.

Inmarsat now provides near-global mobile satellite communications through GSO mobile satellite networks, primarily to the maritime market. They are proceeding to implement a new generation of satellites that will cater to the aeronautical and land mobile satellite markets as well. In 1991, Inmarsat announced the next generation standard earth station (Standard-P), which may be used with non-GSO systems to complement terrestrial personal communications networks. In parallel with these technical developments, Inmarsat has announced Project 21 which deals mainly with the institutional changes that are necessary to address the financial and operational challenges associated with the provision of personal communications services.

2.5.7 . . . . Discussion on the Development of a Domestic Allocation Policy for Specific Mobile-Satellite Bands

A) 1530-1559 and 1626.5-1660.5 MHz

These bands are currently used by Inmarsat and the Russian Federation mobile satellite system GLONASS. The Canadian MSAT system will operate in this frequency range and agreement has been reached in principle with some of the operators for suitable spectrum.

WARC-92 allocated the 1525-1530 MHz band to the MSS in Regions 2 and 3 and the maritime mobile-satellite service (MMSS) in Region 1. WARC-92 also adopted several footnotes in the existing mobile satellite bands that reallocate the maritime and land mobile-satellite spectrum to the MSS in Canada and some other countries.

Proposal

It is proposed that the international allocations in these bands, including the in-Canada footnotes, be reflected in the Canadian Table.

At both the 1987 and 1992 WARCs, Canada advocated the retention of 3 MHz (paired, ie: 2x3 MHz) of spectrum for the aeronautical MSS with priority access for the service given in an additional 10 MHz (paired) of spectrum. This concept, which is already reflected in the current Canadian Table, was not accepted and, instead, 10 MHz of exclusive spectrum (paired) was retained for aeronautical mobile-satellite use.

Proposal

Considering the extensive international negotiations regarding the allocations to the aeronautical mobile-satellite service, and the benefits of aligning domestic allocation policy with the ITU Table, it is proposed that the WARC-92 result be incorporated in the Canadian Table and that footnote C12A be suppressed.

B) 1492-1525 and 1675-1710 MHz

WARC-92 allocated the bands 1492-1525 MHz and 1675-1710 MHz to MSS, to be shared with existing services. The use of the band 1492-1525 MHz by MSS is dependent on successful coordination with applications such as the aeronautical telemetry used in the USA. The use of the band 1675-1710 MHz for MSS is dependent on obtaining agreement with administrations and agencies concerned with the use of meteorological satellite and meteorological aids services. A likely outcome is that only a portion of the 1675-1710 MHz band would become available for mobile satellite services (e.g. 10 MHz), therefore a similar amount of spectrum should be allocated in the band 1492-1525 MHz. It is unlikely that the band 1700-1710 MHz could be coordinated between MSS and existing services, so this spectrum is not proposed for inclusion in the domestic Table for
MSS. A bandwidth of 10 MHz, paired, and the available frequency separation is viewed as adequate for a mobile satellite system.

Proposal **It is proposed that the bands 1515-1525 MHz and 1675-1700 MHz be allocated to the mobile-satellite service.**

This approach has the advantage that it would facilitate the planning of Canadian fixed systems in the 1500 MHz band by confining mobile satellite systems to a portion of the international allocation. The disadvantage is that it is difficult to predict how international agreements to use these bands will evolve. This may bring about, as a solution, the use of a part of the band 1492-1525 MHz band different from that used in Canada. The allocation to the MSS domestically of the entire band 1675-1700 MHz is intended to provide the flexibility to coordinate the mobile satellite service where feasible and will allow fixed systems to continue to use the band 1700-1710 MHz.

C) 1610-1626.5 and 2483.5-2500 MHz

Most of the interest in the use of these bands is focused upon non-GSO mobile satellite systems. The regulations adopted at the WARC-92 for EIRP limits on mobile Earth stations in the 1610-1626.5 MHz band would effectively preclude GSO mobile satellite systems. There are five applications before the FCC from American firms for non-GSO satellite systems, the so-called "big LEO's". It is possible that there will be proposals to provide service in Canada using these or other systems. The Department wishes to facilitate the availability of all cost-effective mobile satellite systems to Canadian users and service providers.

Proposal **It therefore proposed to allocate the bands 1610-1626.5 MHz and 2483.5-2500 MHz for the mobile satellite service in Canada.**

The Department will take the necessary steps to negotiate the best arrangement with the United States and other administrations for appropriate Canadian access to the mobile satellite spectrum.

D)	**1980-2010 and 2170-2200 MHz**	**(primary, global)**
	1970-1980 and 2160-2170 MHz	**(primary, Region 2)**
	1930-1970 and 2120-2160 MHz	**(secondary, Region 2)**

WARC-92 allocated spectrum at 2 GHz to the mobile-satellite service on both a primary and secondary basis, overlapping the identified FPLMTS and fixed services. In Canada, these mobile satellite bands overlap the upper 2 GHz microwave frequency plan, raising the issue of devising a suitable transition plan to remove fixed systems and to introduce the new radio services. This is further complicated by the need to accommodate the introduction of personal communication services in these bands, both early personal communication systems and, eventually, FPLMTS.

Due to the potential for rechannelling the fixed service in the upper 2 GHz band, and the complementarity of the MSS with FPLMTS, it is recommended that this band be considered as a priority in the implementation of the new mobile-satellite systems.

Proposal **It is proposed that the mobile satellite bands allocated internationally on a primary basis (1970-2010 MHz and 2160-2200 MHz) be also allocated on a primary basis in the Canadian Table. It is not regarded as necessary to add the secondary allocations. In order to ease the sharing constraints with the mobile-satellite service, it is proposed to displace the fixed service in the long term (to year 2005).**

It must be noted that in considering the space-to-Earth direction of higher powered mobile satellite systems, fixed systems would also need to be removed from neighbouring countries to be able to achieve successful coordination under Resolution 46. The recent action of the FCC to reallocate these bands, as a first step towards accommodating emerging technologies, is noted.

E) 2500-2520 and 2670-2690 MHz, allocated on a primary basis in the year 2005, subject to Article 14 before that date. 2520-2535 and 2655-2670 MHz, subject to Article 14.

The European countries strongly promoted an allocation to the mobile satellite service in this frequency range at the WARC-92. Canada had brought a similar proposal before the Conference. On the other hand, the United States opposed this allocation due to potential impact to their fixed systems (MDS broadcasting systems). The implementation of mobile satellite in Canada would necessitate the rechannelling of the broadcasting MDS band. It is felt that it will be potentially more difficult to gain access to this band for mobile satellite services than at 2 GHz due to the necessity to successfully coordinate with fixed systems in the United States.

Proposal **It is not proposed to adopt the mobile-satellite allocations at 2500/2600 MHz at this time. The allocation of this spectrum could, nevertheless, be reconsidered in the future as necessary.**

2.6 . . . . . Fixed

The fixed service is a heavy user of the spectrum in Canada

In Canada, the fixed service currently has access to about 4.5 GHz of spectrum in the 1-10 GHz range, and about 5.3 GHz in the 10-23.6 GHz range. There are about 28,800 fixed assignments between 1 and 10 GHz, and only about 1,700 non-VHCM assignments above 10 GHz (there are about 12,800 VHCM assignments, mostly MCS, in the 12.7-13.2 GHz band).

The concentration of microwave radio relay systems below 10 GHz is a result of a several factors. Early radio systems evolved in the lower

bands because of the available technology. As lower bands became congested, market forces encouraged the development and supply of equipment in higher bands; an ongoing process. This effect was felt earlier and more strongly in the USA, resulting in an ample supply of relatively low-cost equipment. The reduction of available fixed spectrum below 3 GHz to accommodate other services will accelerate the use of bands above 3 GHz. (See also 2.6.6 in *Above 1 GHz Utilization*)

Path losses due to the absorption of RF energy by water is an increasingly important factor above 10 GHz. This explains the short path lengths used above 10 GHz as typically found in urban areas. Since the higher bands are less congested, the equipment has generally not yet achieved the very high spectral efficiencies found at lower frequencies.

WARC-92 took action that will effectively release another 1.2 GHz of spectrum to the fixed service for use in Canada in the 21.2-23.6 GHz band. This is a result of making future provision for BSS in the band 17.3-17.8 GHz in ITU Region 2 in place of the band 22.5-23 GHz. Another 9 GHz of spectrum is available between 23.6 and 40.5 GHz, that has not yet been designated for any specific use.

2.6.1 Future Demand

Future demand for radio spectrum for the fixed service will depend on a number of factors:

1. the replacement of existing fixed systems, the options being:

   o upgrading within currently-used bands because of
   - transmission performance (greater service quality)
   - maintenance and operating costs (new equipment should also be more spectrum efficient),
   - need for greater capacity
   - need for new technology (eg. digitalization)

   o moving to another band/sub-band because of

   - reallocation of spectrum
   - policy change in service usage
   - lack of growth potential in currently-used bands

Fixed service spectrum demand is difficult to forecast

The changes that may arise from upgrades generally do not result in an increase in demand in spectrum, and in some cases, may decrease it. However, as a result of reallocation, the potential changes for existing bands will be influenced by:

   o WARC-92 decisions

- o imbalances in use of existing spectrum
- o spectrum shortages for certain types of systems

2. the introduction of new fixed systems, motivated by:

- o growth of traditional demand
  - expansion of public networks (including cellular)
  - expansion of broadcast programming carriage
  - expansion of private fixed systems
  - expansion of other public fixed systems
- o new types of demand
  - private intercity microwave
  - private local microwave
  - digital video, video conferencing
  - Broadband ISDN; bandwidth on demand
  - PCS backhaul networks
  - MSS backhaul networks
  - DRB STL's and feeders

In preparation for WARC-92, the new types of demand for PCS, MSS and DRB had been thoroughly discussed. There is need to make adjustments in light of the actual Conference results. It is difficult to estimate the other new types of demand.

3. Phasing out of fixed systems (lowering of demand)

- o more competitive alternatives
  - FOTS
  - lower tariffs/competition
  - public data services
  - new mobile services
  - new broadcasting services
- o spectrum policy
  - change in type of use
  - removal of non-standard systems
  - loss of allocation (and alternatives)

2.6.2 . . . . . Future Growth in the Fixed Service

Overall, the growth of fixed assignments increased steadily in the sixties and seventies and levelled off in the eighties. The ongoing development of the Fibre Optic Transmission System (FOTS) has the potential for dramatically decreasing the number of fixed service assignments, particularly for long haul systems. This potential, if it materializes, should have become clearly apparent by the end of the century.

In some parts of the country, geography continues to support the economics of radio for the provision of primary routes or routing diversity. As listed above, new carrier entry, bandwidth on demand, and other factors will continue to put demand on the spectrum.

Spectrum proposals for future fixed systems, as presented here and in the companion document on Spectrum Utilization Above 1 GHz, are not based on comprehensive forecast analyses. Rather, the proposals are based on re-arranging and improving the use of the existing spectrum and, to the extent possible, on providing flexibility to accommodate changes in future need.

2.7 . . Space Science Services

The bands 2025 - 2110 MHz and 2200 - 2290 MHz were allocated to space science services (space research service, space operations service and earth exploration-satellite service) on a worldwide primary basis at WARC-92. This action was in recognition of the need for reliable communications between spacecraft and earth terminals, the vast number of space science systems already using these bands and the very favourable sharing arrangement with the fixed service. Emissions of space science stations are limited to the Earth-to-space direction in the 2025 - 2110 MHz band and to the space-to-Earth direction in the 2200 - 2290 MHz band. Both bands support space-to-space transmissions.

The Canadian Space Agency (CSA) plans to use these bands for tracking, telemetry and command communications on RADARSAT, Canada's first entry into Earth resource application space platforms. Tracking stations in Canada will be developed to support RADARSAT and other Canadian and international joint ventures in space.

Sharing between the fixed service and the space science services has proven through experience and through analysis to be quite favourable. Essentially both services may used these bands without inter service coordination of new systems and without excessive parameter limitations. The technical limitations placed on these services at WARC-92 are as follows:

1. The maximum pfd level from a space science spacecraft at the surface of the Earth is:

   -154 dB(W/m^2) in any 4 kHz band for angles of arrival between 0° and 5° above the horizontal plane;

   -154 + 0.5(δ - 5) dB(W/m^2) in any 4 kHz band for angles of arrival between 5° and 25° above the horizontal plane;

   -144 dB(W/m^2) in any 4 kHz band for angles of arrival between 25° and 90° above the horizontal plane.

2. The direction of the maximum radiation of any fixed service station should be at least 2 degrees away from the geostationary orbit, taking into account the effect of atmospheric refraction. Also fixed service receiving stations should avoid directing their antenna towards the geostationary orbit if the potential for interference exists given the pfd limits for this band.

3 Proposals to Modify the Canadian Table of Frequency Allocations

This Section proposes changes to the existing Canadian Table. Revisions to the ITU Table made by WARC-92 are shown in Annex 1 to this document. The reader is referred to the current issue of the Canadian Table and to the previous ITU Table, for footnotes unchanged by WARC-92.

For each of the bands concerned, information is presented in the following format:

- o Discussion (background; current situation; etc)
- o A proposed revised entry for that band in the Canadian Table
- o The accompanying footnotes
- o Reasons for the proposed changes

In the following tables, proposals to add services or footnotes are shown with underlining, while strike-outs indicate proposals to remove existing entries. Primary services are shown in all capital letters, while secondary services use the normal combination of capital and lower case letters. Proposed Canadian footnotes are shown as C LLL; if adopted they will be included in the Table in the form C nnn.

3.1 . . . . . 1350-1525 MHz

There are several major factors influencing the use of this band:

a) the existing use of, and future needs for, spectrum by fixed systems;

b) the potential use, and timing thereof, of all or parts of the band 1452-1492 MHz in populated areas by DRB;

c) the potential use, and timing thereof, of the 1452-1492 MHz band by the BSS;

d) the potential use of a portion of the band 1492-1525 MHz by the MSS;

e) the continued use of the band by the aeronautical mobile service in the USA, which has prevented its use in certain adjacent parts of Canada.

1350-1400 MHz

Discussion

Canada submitted a proposal to WARC-92 to add the fixed and mobile services to 1370-1400 MHz, which in Canada is used by military radars in coastal areas and in the far north. The WARC did not approve such a change, primarily because of US concerns about frequency coordination. However, the US domestic table includes fixed and mobile, limited to government use, and the Department proposes a similar arrangement for Canada. Although the band 1350-1370 MHz is also used by air traffic control radars, some use by the fixed and mobile services may be possible by the same government agencies that operate the radars.

Proposals

MHz

1350-1370	RADIOLOCATION AERONAUTICAL RADIONAVIGATION 714 FIXED C5 MOBILE C5 718
1370-1400	FIXED C5 MOBILE C5 RADIOLOCATION 718 720 C AAZ

C AAZ In the band 1370-1400 MHz the fixed and mobile services must take into account existing and future high power radar systems.

Reasons: The fixed and mobile services will be used by the Government of Canada, which also operates radar systems in these bands. The primary status allows inter-service frequency coordination to take place; however, the radiodetermination uses are given priority in order to, among other things, accommodate the unavoidably broad emission characteristics of radar.

1427-1525 MHz

Discussion:

It should be noted that the sound broadcasting can, interchangeably, be referred to as Digital Audio Broadcasting (**DAB**) or as Digital Radio Broadcasting (**DRB**). The term DRB is used in this document.

The use of this band in the USA by the aeronautical mobile service has prompted Canadian fixed systems to generally avoid the populated areas near the Canada/US border. This, coincidentally, permits the use of the 1452-1492 MHz portion for terrestrial DRB in many of the areas where it is most needed, but will still conflict with the implementation of DRB-BSS since the space-to-Earth transmission will interfere with the aeronautical mobile systems. Moreover, the terrestrial broadcasting application should be more amenable to coordination with the US mobile telemetry systems than was the fixed service.

The future use and growth of DRB-BSS is difficult to predict, although it is reasonable to assume that terrestrial DRB will precede the space application. Interference from DRB-BSS will be more difficult to avoid than from the terrestrial system. If DRB-BSS is planned, segments of the 1452-1492 MHz band may be available for the fixed service in remote areas of Canada, but the precise sub-bands cannot be predicted at this time.

Proposals

MHz

1 427-1 429 (NOC)	SPACE OPERATION (Earth-to-space) FIXED 722
1 429-1 452	FIXED MOBILE ~~C5 C12~~ C AAF 722
1 452-1 492	BROADCASTING 722A BROADCASTING-SATELLITE 722A FIXED ~~MOBILE~~ ~~C5 C12~~ Mobile 722 C AAA C AAB C AAC
1 492-1 515	FIXED MOBILE ~~C5 C12~~ C AAF 722

1515-1525 MHz FIXED C AAD MOBILE ~~C5 C12~~ C AAF MOBILE-SATELLITE (space-to-Earth) 723C 722

C AAA Until at least 1 January, 2000, the use of the band 1452-1492 MHz by the broadcasting-satellite service shall not cause harmful interference to the fixed and mobile services, after which date the use of the fixed and mobile services may be reduced to secondary when the broadcasting-satellite service is implemented in Canada. This footnote will be reviewed and revised prior to 1 January, 2000.

Reasons: Until planning of BSS is accomplished, coordination under RES 33 will provide adequate technical and procedural protection to whatever will be Canada's preferred use of these bands; only the 1467-1492 MHz portion may be coordinated for BSS. WARC-92 requested the ITU Administrative Council to consider including the planning of the whole band 1452-1492 MHz for Sound BSS in the agenda of a WARC to be held "preferably not later than the year 1998".

C AAB Existing fixed stations may continue to use the band 1452-1492 MHz provided they protect, and not claim protection from, stations operating in the broadcasting service which are in accordance with a domestic allotment plan.

Reason: In less populated areas, where past demand for fixed service (particularly subscriber radio) has been higher, the demand for DRB should be lower. The introduction of DRB will likely be gradual, beginning with experiments in one or more major cities; awaiting the development of a sufficiently large international demand for mass produced and marketed equipment before becoming widely available. This means that the fixed service can continue to use existing spectrum for some time, and in some remote areas, indefinitely.

C AAC Stations in the broadcasting service shall be implemented in accordance with a domestic allotment plan which takes into account stations in the fixed service, to the extent possible.

Reason: Since DRB will be implemented in accordance with an allotment plan, it will be possible to minimize the impact on existing fixed users in remote areas.

C AAD — In the band 1515-1525 MHz, the use of the fixed service may be reduced to secondary in the event that the mobile-satellite service is implemented in Canada.

Reasons: The practical use of the WARC-92 MSS allocation to the MSS in the band 1492-1525 MHz is conditional on finding a matching uplink in the band 1675-1700 MHz, which is now widely used by space and terrestrial meteorological systems. As discussed in 2.2.3, because of the application of RES 46 of WARC-92, which makes it necessary to obtain broad international agreement, it would be unlikely that more than 10 MHz of spectrum could be identified in the band 1675-1700 MHz. Consequently, the band 1515-1525 MHz is proposed for use by the MSS in Canada. This also reduces the impact on the fixed service.

C AAF — The use of the bands 1429-1452 MHz, 1492-1525 MHz, 1870-2025 and 2110-2200 MHz by the mobile service is withheld, pending and subject to the resolution of relevant policy and regulatory issues.

Reason: In general, the Department supports the allocation of more than one service to a band if sharing is feasible, and if there is no conflict with known patterns of demand. On this basis, the mobile service is allocated on a primary basis in several bands, but its implementation is postponed by C AAF until these issues are resolved.The decision to implement mobile in some bands or in some portions of the bands mentioned in C AAF will be made following public consultation.

3.2 . . . . . 1525-1700 MHz

1525-1559 and 1626.5-1660.5 MHz

WARC-92 allocated the band 1525-1530 MHz to the MSS in Regions 2 and 3 and to the MMSS in Region 1. WARC-92 also adopted several footnotes in the existing mobile satellite bands, 1530-1544/1626.5-1646.5 and 1555-1559/1656.5-1660.5 MHz, that reallocated the maritime and land mobile satellite spectrum to the MSS in Canada and some other countries. It is proposed to include these international provisions for these bands, as well as the in-Canada footnotes. Canadian footnote C12 would be deleted.

As noted in 2.5.7, Canada's proposal for the aeronautical MSS was not adopted by WARC-92; it is proposed that the Table be modified by aligning it with the WARC-92 decision.

1660.5-1700 MHz

WARC-92 designated the bands 1670-1675 MHz (and 1800-1805 MHz) for Aeronautical Public Correspondence (APC). APC is used by airline passengers for communications interconnected with the public switched telephone network. Licences were awarded in Canada for APC in 1992 in the 800 MHz band. There is no requirement to designate the band 1670-1675 MHz (nor 1800-1805 MHz) for APC in Canada. Hence the Footnote 740A is not proposed for inclusion in the Table.

As discussed in 2.5.7, WARC-92 allocated the band 1675-1710 MHz (and 1492-1525 MHz) to the MSS, sharing with existing services. In the expectation that 10 MHz can be found in some portion of the band 1675-1700 MHz to match the 1515-1525 MHz space-to-Earth MSS allocation, it is proposed to allocate the band 1675-1700 MHz to the MSS (Earth-to-space) in addition to the existing services in the Table.

1610-1626.5/ 2483.5-2500 MHz

Most of the interest in the use of these bands is focused upon non-GSO mobile-satellite systems. The regulations adopted at WARC-92 for EIRP limits on mobile earth stations in the 1610-1626.5 MHz band effectively preclude GSO systems. It is proposed to allocate the bands 1610-1626.5 MHz and 2483.5-2500 MHz for the MSS domestically in accordance with WARC-92 for non-GSO mobile-satellite systems. The Department will take the necessary steps to negotiate the best arrangement with the United States and other administrations to ensure appropriate Canadian access to this spectrum.

Proposals

MHz

1525-1530	~~SPACE OPERATION (space-to-Earth)~~ ~~MOBILE C5 C12~~ MOBILE-SATELLITE (space-to-Earth) Space Operation (space-to-Earth) Earth Exploration-Satellite ~~Fixed~~ 722 726A 726D
1530-1535	MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite ~~Fixed~~ 722 726A 726C 726D

1535-1544	MOBILE-SATELLITE (space-to-Earth) 722 726A 726C 726D
1544-1545	MOBILE-SATELLITE (space-to-Earth) 722 726D 727A
1545 ~~1548~~ 1555	AERONAUTICAL MOBILE-SATELLITE (R) (space-to-Earth) Mobile-Satellite 722 726A 726D 729 729A ~~C12A~~
~~1548~~ 1555-1559	MOBILE-SATELLITE (space-to-Earth) 722 726A 726D 730B 729 ~~C12A~~

1610-1610.6	AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) 722 731E 732 733 733A 733E
1610.6-1613.8	AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) RADIOASTRONOMY 722 731E 732 733 733A 733E 734
~~1610~~ 1613.8-1626.5	AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) Mobile-Satellite (space-to-Earth) 722 731E 732 733 733A 733E

1626.5-1645.5	MOBILE-SATELLITE (Earth-to-space) 722 726A 726C 726D
1645.5-1646.5	MOBILE-SATELLITE (Earth-to-space) 722 726D 734B
1646.5 ~~1649.5~~ 1656.5	AERONAUTICAL MOBILE-SATELLITE (R) (Earth-to-space) Mobile-Satellite 722 726A 726D 729A 735 ~~C12A~~
~~1649.5~~ 1656.5-1660	MOBILE-SATELLITE (Earth-to-space) 722 726A 726D 730B 735 ~~C12A~~
1660-1660.5	MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY 722 726A 726D 730B 735 736 ~~C12A~~

1670 ~~1700~~ 1675	METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) 722
1675-1700	METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) C AAM 671 722 735A

C AAM In the band 1675-1700 MHz, up to 10 MHz of the mobile satellite allocation may be implemented, paired with the band 1515-1525 MHz and subject to No. 735A.

Reasons: This is the matching footnote to C AAD, for the future identification of 10 MHz of new MSS spectrum. The current and planned use of 1700-1710 MHz by the meteorological-satellite service makes it less attractive to the MSS than 1675-1700 MHz. The exclusion of MSS from the band 1700-1710 MHz also enables its use as a substitute for that portion of the fixed service frequency plan in the band 1710-1900 MHz, which will be used by the mobile service.

3.3 ..... 1700-2290 MHz

The major factors influencing the allocation of this band are:

a) the potential implementation (timing, amount and location of spectrum segments) of FPLMTS in the bands 1885-2025 and 2110-2200 MHz;

b) the future use of the band 1850-1900 MHz by the PCS in the USA;

c) the potential implementation of initial personal communication systems prior to the development of systems meeting the FPLMTS standard.

d) the existing use of, and future demand for, fixed spectrum in the bands 1700-1900 MHz and 1900-2290 MHz.

e) the implementation of MSS in the bands 1970-2010 and 2160-2200 MHz;

f) the use of space bands by mobile systems.

While the fixed service and the scientific space services can readily share the 2025-2110 and 2200-2290 MHz bands, there may be difficulties between the mobile service and the scientific space services. These two sub-bands will remain available to the fixed service on a primary basis.

1885-2025/ 2200-2290 MHz

If Canada implements FPLMTS in accordance with Resolution 212 of WARC-92, parts of the bands 1885-2025 and 2200-2290 MHz could become unavailable for fixed use in populated areas. It is unclear when this might occur, but FPLMTS use, per se, is "expected to commence by the year 2000" (RES 212). The whole of the 230 MHz designated for FPLMTS should accommodate PCS and FPLMTS growth for 20+ years. Less spectrum will be required in non-urban areas. The initial introduction of personal communications systems will likely begin to make use of this spectrum before that date.

As discussed in section 2.2, sharing by geographical separation seems feasible. Section 2.4 describes allocation alternatives, and section 2.4 of the *Above 1 GHz Utilization* document describes implementation options for the mobile service in this band. The preferred option proposes the implementation of mobile systems above 1870 MHz. If the preferred

option is selected, the fixed service could continue on a primary basis below 1870 MHz for the foreseeable future.

Proposals

MHz

1700-1710 (NOC)	FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) 671 722
1710-1870	FIXED Mobile C5 722 744 745
1870-1970	FIXED C AAE ~~Mobile C5~~ MOBILE C AAF 746A
1970-2010	FIXED C AAE ~~Mobile C5~~ MOBILE C AAF MOBILE-SATELLITE (Earth-to-space) 746A 746B C AAI
2010-2025	FIXED C AAE ~~Mobile C5~~ MOBILE C AAF 746A

2025-2110	FIXED SPACE RESEARCH (Earth-to-space) (space-to-space) SPACE OPERATIONS (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) Mobile C5 C AAJ ~~747~~ 750A
2110-2120	FIXED C AAE ~~Mobile C5~~ MOBILE C AAF SPACE RESEARCH (deep space)(Earth- to-space) ~~748~~ 746A
2120-2160	FIXED C AAE ~~Mobile C5~~ MOBILE C AAF 746A
2160-2200	FIXED C AAE ~~Mobile C5~~ MOBILE C AAF MOBILE-SATELLITE (space-to-Earth) 746A 746B C AAI
2200-2290	FIXED SPACE RESEARCH (space-to-Earth) (space-to-space) SPACE OPERATIONS (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) Mobile C5 C AAJ ~~750~~ 750A

C AAE In the bands 1870-2025 MHz and 2110-2200 MHz, new fixed stations may become secondary to stations in the mobile service in certain geographical areas or sub-bands, as may be determined by future policy review. Such a change in status would not occur before the year 1998 in any sub-band in the range 1870-1890 MHz and 1950-1970 MHz, or before the year 2001 in any sub-band in the ranges 1890-1950 MHz, 1970-2010 MHz and 2110-2290 MHz.

Reason: In order to be able to accommodate mobile needs, it should be possible to reduce the fixed service to secondary status in the bands 1870-2025 and 2110-2200 MHz as it becomes required. As noted in C AAE, the changes would be phased in. Existing fixed stations would continue to operate on a primary basis until future policy proceedings approve mobile access to this spectrum, and until mobile stations are implemented. At that time, it may be possible to retain portions of the fixed service allocations at primary status in certain areas of Canada if mobile operations are restricted geographically.

C AAI In the bands 1970-2010/2160-2200 MHz, stations in the fixed service may become secondary to stations in the mobile-satellite service in certain sub-bands as may be determined by future policy review.

Reasons: WARC-92, through RES 46, provided for the protection of the fixed service using the bands 1970-2010 and 2160-2200 MHz against interference from the MSS in both a technical and procedural sense. Canada will only approve a request for coordination by another country wishing to use these bands, if there is no adverse impact on their planned use in Canada. This would also occur when Canada needs the band for MSS. The planning process for satellite networks allows several years notice before such systems become operational. It is possible that Canada would be forced into a coordination exercise at an earlier time than would normally be expected; such premature coordination could prejudice the effective implementation of Canadian MSS systems at some later date. In this case, Canada should possibly accelerate its MSS planning for the use of this band.

Unlike the mobile service, sharing with the MSS cannot be reliably contained within small geographical areas, and the fixed service could be affected in all parts of Canada. Within the 2 GHz MSS bands, it is clear that in the long term, the fixed service will need to be removed if the MSS is implemented.

C AAJ The status of the mobile service in the bands 2025-2110 MHz and 2200-2290 MHz may be subject to future policy review.

Reasons: The sharing difficulty between high capacity mobile systems, which produce extremely high aggregate powers at space stations, and the space services in 2025-2100/2200-2290 MHz is recognized. In the future, these bands might also support low capacity mobile systems if this can be proven practical. .

3.4 . . . . . 2290-2500 MHz

The major factors influencing the uses of the band 2290-2500 MHz in Canada are:

a) existing fixed service uses:

low capacity point-to-point and MCS in the bands 2290-2350 and 2390-2450 MHz;

temporary TV Links and TV Pick-ups (ENG) in the band 2450-2500 MHz.

b) current mobile telemetry use of the band 2350-2390 MHz, with a requirement for, and a limited number of, assignments outside this sub-band;

c) ISM, particularly microwave ovens around 2410 MHz which, in addition to unlicensed Low Power Devices, are raising the noise floor in urban areas in at least the 2400-2483.5 MHz band (C AAW);

d) the new allocation to the MSS in the band 2483.5-2500 MHz.

Although the allocation to BSS in the USA falls within this band, the protection to existing services under the ITU procedure, Resolution 33, is fully adequate to ensure that fixed and mobile Canadian uses of the band are not affected. The BSS allocation in the 2310 - 2360 portion of the band applies only, by footnote, to the USA in Region 2,

The band 2483.5-2500 MHz is allocated internationally to the radiodetermination-satellite service (RDSS) and the MSS. In Canada, only those systems whose emissions closely resemble those the MSS would be considered, and not those systems which bear more resemblance to radionavigation, radiolocation or earth exploration space systems and which might conform to the RDSS definition. For this reason, the RDSS allocation is not included in the proposed Canadian Table.

International Radio Regulation No. 751 was expanded by WARC-92 to include "In Canada, the use of the band 2300-2483.5 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile services." The intent was to make coordination in this band similar to that in the band 1492-1525 MHz (see footnote No. 723C which refers to No. 723). The proposals for the band 2300-2483.5 MHz would

have corresponded to 723C in the 2300-2483.5 MHz range, but they were not adopted by the WARC; therefore, the inclusion of a reference to No. 751 in the Canadian Table is not essential, particularly since existing Canadian footnote C12 still applies.

It appears that radiolocation is no longer required in the band 2300-2500 MHz.

Proposals

MHz

2290-2300 (NOC)	FIXED SPACE RESEARCH (deep space) (space-to-Earth) Mobile C5
2300-2450	FIXED MOBILE C12 ~~RADIOLOCATION~~ Amateur 664 752 C AAW
2450-2483.5	FIXED ~~RADIOLOCATION~~ 752 C AAW
2483.5-2500	FIXED C AAX ~~RADIOLOCATION~~ ~~RADIODETERMINATION-SATELLITE~~ ~~(space-to-Earth) 753A~~ MOBILE-SATELLITE (space-to-Earth) Radiolocation 752 753F C AAW

C AAW Station operators in the band 2400-2500 MHz should be aware of the potential interference from microwave ovens and unlicensed low power radio devices, particularly in urban areas.

Reasons: It is reported that the noise floor in this frequency range is steadily increasing due to other uses of the band. This is an advisory footnote.

C AAX In the band 2483.5-2500 MHz, the fixed service may be reduced to secondary status in the event that the MSS is implemented in Canada.

Reasons: The implementation of either non-GSO or GSO MSS in the band 2483.5-2500 MHz is subject to coordination with other space or terrestrial systems which are operating or planned. As noted in section 2.2.3, this will require widespread agreement, since the coordination requirements could be extremely difficult to meet. C AAX is meant to maintain the priority of the fixed service in this band until the Department allows access to the band by the MSS.

3.5 . . . . . 2500-2690 MHz

The removal of the secondary allocations to the fixed and broadcasting services in the following bands is simply an editorial change to reflect the decisions announced in the November 1991 issue of SP 2500 MHz. The allocation to Broadcasting in these bands is on a domestic basis only.

It is not foreseen that fixed-satellite and broadcasting-satellite services will be implemented in Canada in these bands. Their removal simplifies the Table, and would facilitate the possible future addition of the MSS.

WARC-92 allocated the bands 2500-2535 MHz (Nos. 754 and 760A) and 2670-2690 MHz (Nos. 764A and 766) to the MSS. As concluded in section 2.5.7 it does not appear appropriate to incorporate these allocations in the Table at this time.

The use of the band 2500-2690 MHz in Canada by the radiolocation service is no longer required; thus, C13 could be deleted.

Proposals

MHz

2500-2596	FIXED 762 764 ~~FIXED-SATELLITE (space-to-Earth) 761~~ ~~BROADCASTING-SATELLITE 757 760~~ ~~Broadcasting~~ Mobile C5 720 ~~C13~~

2596-2655	~~FIXED-SATELLITE (space-to-Earth) 761~~ BROADCASTING ~~BROADCASTING-SATELLITE 757-760~~ ~~Fixed 762-764~~ Mobile C5 720 ~~C13~~
2655-2686	~~FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 761~~ ~~BROADCASTING-SATELLITE 757-760~~ BROADCASTING Earth Exploration-Satellite (passive) Space Research (passive) Radio Astronomy ~~Fixed 762-764~~ Mobile C5 765 ~~C13~~
2686-2690	FIXED 762 764 ~~FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 761~~ ~~BROADCASTING-SATELLITE 757-760~~ Earth Exploration-Satellite (passive) Radio Astronomy Space Research (passive) 765 ~~C13~~

4 Synopsis

The revised sections of the Canadian Table presented in Section 3 are proposals made by the Department and are submitted for review and comment by all interested parties in Canada. It is reasonable to expect that the final Table entries reflect the comments received. At this stage of the consultation process, it can be stated that the adoption of these proposals will have the following effects:

1. Allocations to the mobile service in the 2 GHz range will accommodate the development of personal communications systems.

2. Digital Radio Broadcasting (DRB) development will be accommodated in the band 1452-1492 MHz.

3. As DRB approaches commercial reality, greater detail will be provided regarding the future use of the band by the fixed service. In addition, at that time the potential impact of satellite DRB will be better known, and could be taken into account.

4. Additional domestic allocations will be made to the mobile-satellite service, based on the WARC-92 provisions, to accommodate both GSO and non-GSO systems.

5. The domestic mobile-satellite allocations at L band (1525-1559 and 1626.5-1660.5 MHz) will be modified to coincide with the WARC-92 decisions.

6. The implementation of MSS in the bands 1610-1626.5 MHz and 2483.5-2500 MHz will be subject to the outcome of future policy deliberations on the MSS.

7. It is planned that the mobile satellite allocations at 2 GHz be implemented prior to those at 2.5/2.6 GHz. This means the fixed and broadcasting systems at 2.5/2.6 GHz will not be affected in the foreseeable future. Further international work is necessary to clarify the implementation date for the 2 GHz allocations.

8. The implementation of MSS in the bands 1515-1525 MHz and an equivalent amount in the band 1675-1700 MHz will be dependent on obtaining successful coordination with existing systems of other services.

9. The coordination requirements imposed by WARC-92 for new space services in 1-3 GHz will be considered adequate to protect

the interests of terrestrial users of these bands from foreign systems.

10. The fixed service will continue to use allocated spectrum in each of the 1-3 GHz bands.

DEPARTMENT OF COMMUNICATIONS
RADIOCOMMUNICATION ACT
NOTICE NO. DGTP-003-93

Proposed Spectrum Allocations in the 1-3 GHz Range

As a result of the 1992 World Administrative Radio Conference (WARC) held in Torremolinos, Spain in February 1992, and a number of developments in radiocommunications, the Department is proposing a number of changes to the Canadian Table of Frequency Allocations.

To assist the Department in the revisions to the Canadian Table, a Proposals Paper has been prepared which provides background information on bands in the 1 to 3 GHz range, including WARC-92 related issues, and proposed changes to the Canadian Table of Frequency Allocations. A related document dealing with spectrum utilization will also be released separately, which will provide information and proposals for the more detailed use of the services in this frequency range.

Therefore, the Department of Communications invites interested and affected parties to provide their views and comments.

Copies of the document entitled: Proposed Spectrum Allocations in the 1 to 3 GHz Range, is available from Information Services, Department of Communications, 300 Slater Street, Ottawa, Ontario K1A 0C8, (Telephone (613) 990-4900) or from the Department's Regional Offices in Moncton, Montreal, Toronto, Winnipeg and Vancouver.

Submissions should be addressed to the Director General, Telecommunications Policy Branch, Department of Communications, 300 Slater Street, Ottawa, Ontario, K1A 0C8 to be received on or before 1 November 1993. All representations should cite the Canada Gazette Part I Notice publication date, title, and the Notice reference number.

Written comments received in response to this Notice will be made available for viewing by the public two weeks after the closing date of this Notice, during normal business hours, at the Department of Communications Library, 300 Slater Street, Ottawa and at the Regional Offices of the Department at Moncton, Montreal, Toronto, Winnipeg and Vancouver for a period of one year.

Also, approximately two weeks after the close of the comment period, copies of the comments may be obtained, by mail order or over-the-counter, from ByPress Printing and Copy Centre Inc., 300 Slater Street, Unit 101A, Ottawa, K1P 6A6 (Telephone (613) 234-8826). Reasonable costs of duplication will be charged.

Dated at Ottawa this 18th day of May, 1993.

Paul Racine
Assistant Deputy Minister
Communications Policy

Final Acts - WARC 92
(1-3 GHz)

Authorization No. LAU/93/04

Extracts from Article 8 "Frequency Allocations" of the Radio Regulations, as revised by the 1992 World Administrative Radio Conference (WARC-92, Malaga-Torremolinos, 1992), as well as the text of Resolutions adopted by this Conference which are relevant to the aforesaid Article, have been reproduced with the authorization of the International Telecommunications Union (ITU) as holder of the copyright. According to the arrangements of the Final Acts of WARC-92, the revisions to Article 8 as well as the whole of the partial revisions of the Radio Regulations adopted by this Conference come into effect on 12 October 1993 at 0001 hours CUT.

The choice of the extracts is incumbent on the authors and is not in any way the responsibility of the Union.

The complete volume of the Final Acts of WARC-92 can be obtained at the following address:

International Telecommunications Union
Secrétariat général - Service des ventes
Place des Nations
CH - 1211 Genève 20 (Suisse)

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MOD

MHz

1 429 – 1 525

Allocation to Services		
Region 1	Region 2	Region 3
1 429 – 1 452 FIXED MOBILE except aeronautical mobile 722 723B	**1 429 – 1 452** FIXED MOBILE 723 722	
1 452 – 1 492 FIXED MOBILE except aeronautical mobile BROADCASTING-SATELLITE 722A 722B BROADCASTING 722A 722B 722 723B	**1 452 – 1 492** FIXED MOBILE 723 BROADCASTING-SATELLITE 722A 722B BROADCASTING 722A 722B 722 722C	
1 492 – 1 525 FIXED MOBILE except aeronautical mobile 722 723B	**1 492 – 1 525** FIXED MOBILE 723 MOBILE-SATELLITE (space-to-Earth) 722 722C 723C	**1 492 – 1 525** FIXED MOBILE 723 722

ADD **722A** (WARC-92) Use of the band 1 452 - 1 492 MHz by the broadcasting-satellite service, and by the broadcasting service, is limited to digital audio broadcasting and is subject to the provisions of Resolution **528 (WARC-92)**.

ADD **722B** WARC-92 *Different category of service:* in the Federal Republic of Germany, Bangladesh, Botswana, Bulgaria, Burkina Faso, Colombia, Cuba, Denmark, Egypt, Ecuador, Spain, Greece, Hungary, Ireland, Italy, Jordan, Kenya, Malawi, Mozambique, Panama, Poland, Portugal, United Kingdom, Sri Lanka, Sweden, Swaziland, Czech and Slovak Federal Republic, Yemen, Yugoslavia and Zimbabwe, the allocation of the band 1 452 - 1 492 MHz to the broadcasting-satellite service and the broadcasting service is on a secondary basis until 1 April 2007.

ADD **722C** WARC-92 *Alternative allocation:* in the United States of America, the band 1 452 - 1 525 MHz is allocated to the fixed and mobile services on a primary basis. (See also No. **723**.)

ADD **723B** WARC-92 *Additional allocation:* in Belarus, the Russian Federation and Ukraine, the band 1 429 - 1 535 MHz is also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1 452 - 1 492 MHz is subject to agreement between the administrations concerned.

ADD **723C** WARC-92 The use of the band 1 492 - 1 525 MHz by the mobile-satellite service is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. However, with the exception of the situation referred to in No. **723**, on a provisional basis, coordination of space stations of the mobile-satellite service with respect to terrestrial services is required only if the power flux-density produced at the Earth's surface exceeds the limits in No. **2566**. In respect of assignments operating in this band, the provisions of Section II, paragraph 2.2 of Resolution **46 (WARC-92)** shall also be applied to geostationary transmitting space stations with respect to terrestrial stations.

MOD

MHz

1 525 – 1 530

Allocation to Services		
Region 1	Region 2	Region 3
1 525 – 1 530	**1 525 – 1 530**	**1 525 – 1 530**
SPACE OPERATION (space-to-Earth)	SPACE OPERATION (space-to-Earth)	SPACE OPERATION (space-to-Earth)
FIXED	MOBILE-SATELLITE (space-to-Earth)	FIXED
MARITIME MOBILE-SATELLITE (space-to-Earth)	Earth Exploration-Satellite	MOBILE-SATELLITE (space-to-Earth)
Land Mobile-Satellite (space-to-Earth) 726B	Fixed	Earth Exploration-Satellite
Earth Exploration-Satellite	Mobile 723	Mobile 723 724
Mobile except aeronautical mobile 724		
722 723B 725 726A 726D	722 723A 726A 726D	722 726A 726D

MOD **726A** WARC-92 The bands 1 525 - 1 544 MHz, 1 545 - 1 559 MHz, 1 626.5 - 1 645.5 MHz and 1 646.5 - 1 660.5 MHz shall not be used for feeder links of any service. In exceptional circumstances, however, an earth station at a specified fixed point in any of the mobile-satellite services may be authorized by an administration to communicate via space stations using these bands.

MOD **726B** WARC-92 The use of the bands 1 525 - 1 530 MHz, 1 533 - 1 544 MHz, 1 626.5 - 1 631.5 MHz and 1 634.5 - 1 645.5 MHz by the land mobile-satellite service is limited to non-speech low bit-rate data transmissions.

ADD **726D** The use of the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz by
WARC-92 the mobile-satellite services are subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. In Regions 1 and 3 in the band 1 525 - 1 530 MHz coordination of space stations of the mobile-satellite services with respect to terrestrial services is required only if the power flux-density produced at the Earth's surface exceeds the limits in No. **2566**. In respect of assignments operating in the band 1 525 - 1 530 MHz, the provisions of Section II, paragraph 2.2 of Resolution **46 (WARC-92)** shall also be applied to geostationary transmitting space stations with respect to terrestrial stations.

MOD

MHz

1 530 – 1 533

Allocation to Services		
Region 1	Region 2	Region 3
1 530 – 1 533	**1 530 – 1 533**	
SPACE OPERATION (space-to-Earth)	SPACE OPERATION (space-to-Earth)	
MARITIME MOBILE-SATELLITE (space-to-Earth)	MARITIME MOBILE-SATELLITE (space-to-Earth)	
LAND MOBILE-SATELLITE (space-to-Earth)	LAND MOBILE-SATELLITE (space-to-Earth)	
Earth Exploration-Satellite	Earth Exploration-Satellite	
Fixed	Fixed	
Mobile except aeronautical mobile	Mobile 723	
722 723B 726A 726D	722 726A 726C 726D	

SUP **726**
WARC-92

ADD **726C** *Additional allocation:* in Argentina, Australia, Brazil, Canada, the
WARC-92 United States, Malaysia and Mexico, the band 1 530 - 1 544 MHz is also allocated to the mobile-satellite (space-to-Earth) service, and the band 1 626.5 - 1 645.5 MHz is also allocated to the mobile-satellite (Earth-to-space) service, on a primary basis subject to the following conditions:

maritime mobile-satellite distress and safety communications shall have priority access and immediate availability over all other mobile-satellite communications operating under this provision. Communications of mobile-satellite system stations not participating in the global maritime distress and safety system (GMDSS) shall operate on a secondary basis to distress and safety communications of stations operating in the GMDSS. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services.

MOD

MHz

1 533 – 1 559

Allocation to Services		
Region 1	Region 2	Region 3
1 533 – 1 535 SPACE OPERATION (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite Fixed Mobile except aeronautical mobile Land Mobile-Satellite (space-to-Earth) 726B 722 723B 726A 726D	**1 533 – 1 535** SPACE OPERATION (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite Fixed Mobile 723 Land Mobile-Satellite (space-to-Earth) 726B 722 726A 726C 726D	
1 535 – 1 544	MARITIME MOBILE-SATELLITE (space-to-Earth) Land Mobile-Satellite (space-to-Earth) 726B 722 726A 726C 726D 727	
1 544 – 1 545	MOBILE-SATELLITE (space-to-Earth) 722 726D 727 727A	
1 545 – 1 555	AERONAUTICAL MOBILE-SATELLITE (R) (space-to-Earth) 722 726A 726D 727 729 729A 730	
1 555 – 1 559	LAND MOBILE-SATELLITE (space-to-Earth) 722 726A 726D 727 730 730A 730B 730C	

ADD **730B** WARC-92 *Alternative allocation:* in Australia, Canada and Mexico, the band 1 555 - 1 559 MHz is allocated to the mobile-satellite (space-to-Earth) service, the band 1 656.5 - 1 660 MHz is allocated to the mobile-satellite (Earth-to-space) service, and the band 1 660 - 1 660.5 MHz is allocated to the mobile-satellite (Earth-to-space) and the radio astronomy services, on a primary basis.

ADD **730C** WARC-92 *Alternative allocation:* in Argentina and the United States, the band 1 555 - 1 559 MHz is allocated to the mobile-satellite (space-to-Earth) service, the band 1 656.5 - 1 660 MHz is allocated to the mobile-satellite (Earth-to-space) service, and the band 1 660 - 1 660.5 MHz is allocated to the mobile-satellite (Earth-to-space) and radio astronomy services, on a primary basis subject to the following conditions: the aeronautical mobile-satellite (R) service shall have priority access and immediate availability over all other mobile-satellite communications within a network operating under this provision; mobile-satellite systems shall be interoperable with the aeronautical mobile-satellite (R) service; account shall be taken of the priority of safety-related communications in the other mobile-satellite services.

MOD

MHz

1 610 – 1 613.8

Allocation to Services		
Region 1	Region 2	Region 3
1 610 – 1 610.6 AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) 722 727 730 731 731E 732 733 733A 733B 733E 733F	**1 610 – 1 610.6** AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) 722 731E 732 733 733A 733C 733D 733E	**1 610 – 1 610.6** AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) Radiodetermination-Satellite (Earth-to-space) 722 727 730 731E 732 733 733A 733B 733E
1 610.6 – 1 613.8 AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY 722 727 730 731 731E 732 733 733A 733B 733E 733F 734	**1 610.6 – 1 613.8** AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY 722 731E 732 733 733A 733C 733D 733E 734	**1 610.6 – 1 613.8** AERONAUTICAL RADIONAVIGATION MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Radiodetermination-Satellite (Earth-to-space) 722 727 730 731E 732 733 733A 733B 733E 734

MOD

MHz

1 613.8 – 1 626.5

Allocation to Services		
Region 1	Region 2	Region 3
1 613.8 – 1 626.5	**1 613.8 – 1 626.5**	**1 613.8 – 1 626.5**
AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION
MOBILE-SATELLITE (Earth-to-space)	RADIODETERMINATION-SATELLITE (Earth-to-space)	MOBILE-SATELLITE (Earth-to-space)
Mobile-Satellite (space-to-Earth)	MOBILE-SATELLITE (Earth-to-space)	Radiodetermination-Satellite (Earth-to-space)
	Mobile-Satellite (space-to-Earth)	Mobile-Satellite (space-to-Earth)
722 727 730 731 731E 731F 732 733 733A 733B 733E 733F	722 731E 731F 732 733 733A 733C 733D 733E	722 727 730 731E 731F 732 733 733A 733B 733E

SUP **731A**
WARC-92

SUP **731B**
WARC-92

SUP **731C**
WARC-92

SUP **731D**
WARC-92

ADD **731E**
WARC-92 The use of the band 1 610 - 1 626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination-satellite service (Earth-to-space) is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. A mobile earth station operating in either of the services in this band shall not produce an e.i.r.p. density in excess of –15 dB(W/4 kHz) in the part of the band used by systems operating in accordance with the provisions of No. **732**, unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, a value of –3 dB(W/4 kHz) is applicable. Stations of the mobile-satellite service shall not cause harmful interference to, or claim protection from, stations in the aeronautical radionavigation service, stations operating in accordance with the provisions of No. **732** and stations in the fixed service operating in accordance with the provisions of No. **730**.

ADD **731F**
WARC-92 The use of the band 1 613.8 - 1 626.5 MHz by the mobile-satellite service (space-to-Earth) is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**.

MOD **733A**
WARC-92 With respect to the radiodetermination-satellite and mobile-satellite services the provisions of No. **953** do not apply in the frequency band 1 610 - 1 626.5 MHz.

MOD **733E**
WARC-92 Harmful interference shall not be caused to stations of the radio astronomy service using the band 1 610.6 - 1 613.8 MHz by stations of the radiodetermination-satellite and mobile-satellite services. (No. **2904** applies.)

MOD **734**
WARC-92 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service in the band 1 610.6 - 1 613.8 MHz from harmful interference. Emissions from space or air-borne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

MOD

MHz

1 626.5 – 1 660.5

Allocation to Services		
Region 1	Region 2	Region 3
1 626.5 – 1 631.5 MARITIME MOBILE-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) 726B 722 726A 726D 727 730	**1 626.5 – 1 631.5** MOBILE-SATELLITE (Earth-to-space) 722 726A 726C 726D 727 730	
1 631.5 – 1 634.5	MARITIME MOBILE-SATELLITE (Earth-to-space) LAND MOBILE-SATELLITE (Earth-to-space) 722 726A 726C 726D 727 730 734A	
1 634.5 – 1 645.5	MARITIME MOBILE-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) 726B 722 726A 726C 726D 727 730	
1 645.5 – 1 646.5	MOBILE-SATELLITE (Earth-to-space) 722 726D 734B	
1 646.5 – 1 656.5	AERONAUTICAL MOBILE-SATELLITE (R) (Earth-to-space) 722 726A 726D 727 729A 730 735	
1 656.5 – 1 660	LAND MOBILE-SATELLITE (Earth-to-space) 722 726A 726D 727 730 730A 730B 730C 734A	
1 660 – 1 660.5	RADIO ASTRONOMY LAND MOBILE-SATELLITE (Earth-to-space) 722 726A 726D 730A 730B 730C 736	

MOD

MHz

1 670 – 1 700

Allocation to Services		
Region 1	Region 2	Region 3
1 670 – 1 675 METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE 740A 722		
1 675 – 1 690 METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 722	**1 675 – 1 690** METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MOBILE-SATELLITE (Earth-to-space) 722 735A	**1 675 – 1 690** METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 722
1 690 – 1 700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) Fixed Mobile except aeronautical mobile 671 722 741	**1 690 – 1 700** METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (Earth-to-space) 671 722 735A 740	**1 690 – 1 700** METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) 671 722 740 742

ADD **735A** WARC-92 In the band 1 675 - 1 710 MHz, stations in the mobile-satellite service shall not cause harmful interference to, nor constrain the development of, the meteorological-satellite and meteorological aids services (see Resolution **213 (WARC-92)**) and the use of this band shall be subject to the provisions of Resolution **46 (WARC-92)**.

ADD **740A** WARC-92 The bands 1 670 - 1 675 MHz and 1 800 - 1 805 MHz are intended for use, on a worldwide basis, by administrations wishing to implement aeronautical public correspondence. The use of the band 1 670 - 1 675 MHz by stations in the systems for public correspondence with aircraft is limited to transmissions from aeronautical stations and the use of the band 1 800 - 1 805 MHz is limited to transmissions from aircraft stations.

MOD

MHz

1 700 – 1 970

Allocation to Services		
Region 1	Region 2	Region 3
1 700 – 1 710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 671 722	**1 700 – 1 710** FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MOBILE-SATELLITE (Earth-to-space) 671 722 735A	**1 700 – 1 710** FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 671 722 743
1 710 – 1 930	FIXED MOBILE 740A 722 744 745 746 746A	
1 930 – 1 970 FIXED MOBILE 746A	**1 930 – 1 970** FIXED MOBILE Mobile-Satellite (Earth-to-space) 746A	**1 930 – 1 970** FIXED MOBILE 746A

MOD

MHz

1970 – 2010

Allocation to Services		
Region 1	Region 2	Region 3
1970 – 1980 FIXED MOBILE 746A	**1970 – 1980** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 746A 746B 746C	**1970 – 1980** FIXED MOBILE 746A
1980 – 2010	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 746A 746B 746C	

ADD **746A** WARC-92 The frequency bands 1885 - 2025 MHz and 2110 - 2200 MHz are intended for use, on a worldwide basis, by administrations wishing to implement the future public land mobile telecommunication systems (FPLMTS). Such use does not preclude the use of these bands by other services to which these bands are allocated. The frequency bands should be made available for FPLMTS in accordance with Resolution **212 (WARC-92)**.

ADD **746B** WARC-92 The use of the bands 1970 - 2010 MHz and 2160 - 2200 MHz by the mobile-satellite service shall not commence before 1 January 2005 and is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. In the band 2160 - 2200 MHz coordination of space stations of the mobile-satellite service with respect to terrestrial services is required only if the power flux-density produced at the Earth's surface exceeds the limits in No. **2566**. In respect of assignments operating in this band, the provisions of Section II, paragraph 2.2 of Resolution **46 (WARC-92)** shall also be applied to geostationary transmitting space stations with respect to terrestrial stations.

ADD **746C** WARC-92 In the United States of America, the use of the bands 1970 - 2010 MHz and 2160 - 2200 MHz by the mobile-satellite service shall not commence before 1 January 1996.

MOD

MHz
2 010 – 2 200

Allocation to Services		
Region 1	Region 2	Region 3
2 010 – 2 025	FIXED MOBILE 746A	
2 025 – 2 110	FIXED MOBILE 747A SPACE RESEARCH (Earth-to-space) (space-to-space) SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) 750A	
2 110 – 2 120	FIXED MOBILE SPACE RESEARCH (deep space) (Earth-to-space) 746A	
2 120 – 2 160 FIXED MOBILE 746A	**2 120 – 2 160** FIXED MOBILE Mobile-Satellite (space-to-Earth) 746A	**2 120 – 2 160** FIXED MOBILE 746A
2 160 – 2 170 FIXED MOBILE 746A	**2 160 – 2 170** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 746A 746B 746C	**2 160 – 2 170** FIXED MOBILE 746A
2 170 – 2 200	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 746A 746B 746C	

MOD

MHz
2 200 – 2 290

Allocation to Services		
Region 1	Region 2	Region 3
2 200 – 2 290	FIXED SPACE RESEARCH (space-to-Earth) (space-to-space) SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) MOBILE 747A 750A	

SUP **747**
WARC-92

ADD **747A** WARC-92 In making assignments to the mobile service in the bands 2 025 - 2 110 MHz and 2 200 - 2 290 MHz, administrations shall take into account Resolution **211 (WARC-92)**.

SUP **748**
WARC-92

SUP **749**
WARC-92

SUP **750**
WARC-92

ADD **750A** **WARC-92** Administrations are urged to take all practicable measures to ensure that space-to-space transmissions between two or more non-geostationary satellites, in the space research, space operations and Earth exploration-satellite services in the bands 2025 - 2110 MHz and 2200 - 2290 MHz, shall not impose any constraints on Earth-to-space, space-to-Earth and other space-to-space transmissions of those services and in those bands between geostationary and non-geostationary satellites.

MOD

MHz

2290 – 2483.5

Allocation to Services		
Region 1	Region 2	Region 3
2290 – 2300	FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	
2300 – 2450 FIXED MOBILE Amateur Radiolocation 664 751A 752	**2300 – 2450** FIXED MOBILE RADIOLOCATION Amateur 664 750B 751 751B 752	
2450 – 2483.5 FIXED MOBILE Radiolocation 752 753	**2450 – 2483.5** FIXED MOBILE RADIOLOCATION 751 752	

SUP **743A** **WARC-92**

ADD **750B** **WARC-92** *Additional allocation:* in the United States of America and India, the band 2310 - 2360 MHz is also allocated to the broadcasting-satellite service (sound) and complementary terrestrial sound broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to the provisions of Resolution **528 (WARC-92)**.

MOD **751** WARC-92 In Australia, the United States and Papua New Guinea, the use of the band 2300 - 2390 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile services. In Canada, the use of the band 2300 - 2483.5 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile services.

ADD **751A** WARC-92 In France, the use of the band 2310 - 2360 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.

ADD **751B** WARC-92 Space stations of the broadcasting-satellite service in the band 2310 - 2360 MHz operating in accordance with No. **750B** that may affect the services to which this band is allocated in other countries shall be coordinated and notified in accordance with Resolution **33 (WARC-79)**. Complementary terrestrial broadcasting stations shall be subject to bilateral coordination with neighbouring countries prior to their bringing into use.

MOD

MHz

2483.5 – 2500

Allocation to Services		
Region 1	Region 2	Region 3
2483.5 – 2500	**2483.5 – 2500**	**2483.5 – 2500**
FIXED	FIXED	FIXED
MOBILE	MOBILE	MOBILE
MOBILE-SATELLITE (space-to-Earth)	RADIODETERMINATION-SATELLITE (space-to-Earth) 753A	RADIOLOCATION
Radiolocation	RADIOLOCATION	MOBILE-SATELLITE (space-to-Earth)
	MOBILE-SATELLITE (space-to-Earth)	Radiodetermination-Satellite (space-to-Earth) 753A
733F 752 753 753A 753B 753C 753F	752 753D 753F	752 753C 753F

MOD **753** WARC-92 *Different category of service:* in France, the band 2450 - 2500 MHz is allocated on a primary basis to the radiolocation service (see No. **425**). Such use is subject to agreement with administrations having services operating or planned to operate in accordance with the Table of Frequency Allocations which may be affected.

MOD **753C** WARC-92 *Different category of service:* in Angola, Australia, Bangladesh, Burundi, China, Côte d'Ivoire, Ethiopia, India, the Islamic Republic of Iran, Israel, Italy, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New Guinea, Senegal, Sudan, Swaziland, Syria, Tanzania, Thailand, Togo, Zaire and Zambia, the allocation of the band 2483.5 - 2500 MHz to the radiodetermination-satellite service (space-to-Earth) is on a primary basis (see No. **425**) subject to agreement obtained under the procedure of Article **14** with other countries not listed in this provision.

SUP **753E**
WARC-92

ADD **753F**
WARC-92 The use of the band 2 483.5 - 2 500 MHz by the mobile-satellite and the radiodetermination-satellite services is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. Coordination of space stations of the mobile-satellite and radiodetermination-satellite services with respect to terrestrial services is required only if the power flux-density produced at the Earth's surface exceeds the limits in No. **2566**. In respect of assignments operating in this band, the provisions of Section II, paragraph 2.2 of Resolution **46 (WARC-92)** shall also be applied to geostationary transmitting space stations with respect to terrestrial stations.

MOD

MHz

2 500 – 2 520

Allocation to Services		
Region 1	Region 2	Region 3
2 500 – 2 520	**2 500 – 2 520**	
FIXED 762 763 764	FIXED 762 764	
MOBILE except aeronautical mobile	FIXED-SATELLITE (space-to-Earth) 761	
MOBILE-SATELLITE (space-to-Earth)	MOBILE except aeronautical mobile	
	MOBILE-SATELLITE (space-to-Earth)	
754 754B 755A 756 759 760A	754 754A 755 755A 760A	

MOD **754**
WARC-92 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 520 - 2 535 MHz (until 1 January 2005 the band 2 500 - 2 535 MHz) may also be used for the mobile-satellite (space-to-Earth), except aeronautical mobile-satellite, service for operation limited to within national boundaries. The coordination and notification procedures set forth in Resolution **46 (WARC-92)** apply. However, coordination of space stations of the mobile-satellite service with respect to terrestrial services is required only if the power flux-density produced by the station exceeds the limits in No. **2566**.

ADD **754B**
WARC-92 *Additional allocation:* in France, the band 2 500 - 2 550 MHz is also allocated to the radiolocation service on a primary basis. Such use is subject to agreement with the administrations having services operating or planned to operate in accordance with the Table of Frequency Allocations which may be affected.

ADD **755A** WARC-92 In the band 2 500 - 2 520 MHz, the power flux-density at the surface of the Earth from space stations operating in the mobile-satellite (space-to-Earth) service shall not exceed –152 dB(W/m²/4 kHz) in Argentina, unless otherwise agreed by the administrations concerned.

ADD **760A** WARC-92 The allocation of the frequency band 2 500 - 2 520 MHz to the mobile-satellite service (space-to-Earth) shall be effective on 1 January 2005 and is subject to the application of the coordination and notification procedures set forth in Resolution **46 (WARC-92)**. Coordination of space stations of the mobile-satellite service with respect to terrestrial services is required only if the power flux-density produced at the Earth's surface exceeds the limits in No. **2566**. In respect of assignments operating in this band, the provisions of Section II, paragraph 2.2 of Resolution **46 (WARC-92)** shall also be applied to geostationary transmitting space stations with respect to terrestrial stations.

MOD

MHz

2 520 – 2 655

Allocation to Services		
Region 1	Region 2	Region 3
2 520 – 2 655 FIXED 762 763 764 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 720 754 754B 756 757A 758 759	**2 520 – 2 655** FIXED 762 764 FIXED-SATELLITE (space-to-Earth) 761 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 720 754 755	**2 520 – 2 535** FIXED 762 764 FIXED-SATELLITE (space-to-Earth) 761 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 754 **2 535 – 2 655** FIXED 762 764 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 720 757A

MOD **757** WARC-92 The use of the band 2 520 - 2 670 MHz by the broadcasting-satellite service is limited to national and regional systems for community reception and such use shall be subject to agreement obtained under the procedure set forth in Article **14**. The power flux-density at the Earth's surface shall not exceed the values given in Nos. **2561** to **2564**.

ADD **757A** *Additional allocation:* in Bangladesh, Belarus, China, the Republic of
WARC-92 Korea, the Russian Federation, India, Japan, Pakistan, Singapore, Sri Lanka, Thailand and Ukraine, the band 2 535 - 2 655 MHz is also allocated to the broadcasting-satellite service (sound) and complementary terrestrial broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to provisions of Resolution **528 (WARC-92)**. The provisions of Nos. **757** and **2561** to **2564** do not apply to this additional allocation.

MOD **758** *Alternative allocation:* in the Federal Republic of Germany and Greece,
WARC-92 the band 2 520 - 2 670 MHz is allocated to the fixed service on a primary basis.

MOD

MHz

2 655 – 2 690

Allocation to Services		
Region 1	Region 2	Region 3
2 655 – 2 670	**2 655 – 2 670**	**2 655 – 2 670**
FIXED 762 763 764	FIXED 762 764	FIXED 762 764
MOBILE except aeronautical mobile	FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 761	FIXED-SATELLITE (Earth-to-space) 761
BROADCASTING-SATELLITE 757 760	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile
Earth Exploration-Satellite (passive)	BROADCASTING-SATELLITE 757 760	BROADCASTING-SATELLITE 757 760
Radio Astronomy	Earth Exploration-Satellite (passive)	Earth Exploration-Satellite (passive)
Space Research (passive)	Radio Astronomy	Radio Astronomy
	Space Research (passive)	Space Research (passive)
758 759 765 766	765 766	765 766
2 670 – 2 690	**2 670 – 2 690**	**2 670 – 2 690**
FIXED 762 763 764	FIXED 762 764	FIXED 762 764
MOBILE except aeronautical mobile	FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 761	FIXED-SATELLITE (Earth-to-space) 761
MOBILE-SATELLITE (Earth-to-space)	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile
Earth Exploration-Satellite (passive)	MOBILE-SATELLITE (Earth-to-space)	MOBILE-SATELLITE (Earth-to-space)
Radio Astronomy	Earth Exploration-Satellite (passive)	Earth Exploration-Satellite (passive)
Space Research (passive)	Radio Astronomy	Radio Astronomy
	Space Research (passive)	Space Research (passive)
764A 765 766	764A 765 766	764A 765 766

ADD **764A** The allocation of the frequency band 2 670 - 2 690 MHz to the mobile-
WARC-92 satellite service shall be effective from 1 January 2005. When introducing mobile-satellite systems in this band administrations shall take all necessary steps to protect the satellite systems operating in this band prior to 3 March 1992. The coordination of mobile-satellite systems in the band shall be in accordance with Resolution **46 (WARC-92)**.

MOD **766** Subject to agreement obtained under the procedure set forth in
WARC-92 Article **14**, the band 2 655 - 2 670 MHz (until 1 January 2005 the band 2 655 - 2 690 MHz) may also be used for the mobile-satellite (Earth-to-space), except aeronautical mobile-satellite, service for operation limited to within national boundaries. The coordination and notification procedures set forth in Resolution **46 (WARC-92)** apply.

List of Terms and Abbreviations

AM	Amplitude Modulation; also broadcasting stations in the band 540-1705 kHz
ABSOC	Advanced Broadcast Systems of Canada (committee)
ADD	Additional item
APC	Aeronautical Public Correspondence
ANIK	Satellites of Canada's domestic fixed-satellite network; Inuit for "friend"
ATM	Asynchronous Transfer Mode
ATPC	Automatic Transmitter Power Control
B-ISDN	Broadband Integrated Services Digital Network
B	Broadcasting (Service)
Bits/sec/Hz	Spectral efficiency in bits per second for each Hertz of spectrum used
BSS	Broadcasting-Satellite Service
Canadian Table	Canadian Table of Frequency Allocations
C-band	Frequency range around 4 - 6 GHz
CATV	Cable TV
CCIR	International Radio Consultative Committee, or Comité consultatif international des radiocommunications (of the ITU)
CCITT	International Telegraph and Telephone Consultative Committee, or Comité consultatif international télégraphique et téléphonique (of the ITU)
CD	Compact Disc
CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications Administrations
CISPR	International Special Committee on Radio Interference
CRTC	Canadian Radio-Television and Telecommunications Commission
Department	Department of Communications
DAB	Digital Audio Broadcasting
DRB	Digital Radio Broadcasting
DRNAC	Digital Radio National Advisory Committee
DS-0	Digital Signal, Level 0: 64 kbit/s one digital voice channel, with signalling
DS-1	Level 1: T1 1.544 Mbit/s 24 DS-0
DS-2	Level 2: T2 6.312 Mbit/s 96 DS-0
DS-3	Level 3: T3 44.736 Mbit/s 672 DS-0
dB	Decibel (ratio of powers expressed in $\log_{10}$)
DBS	Direct Broadcasting-Satellite
DECT	Digital European Cordless Telecommunications
E-s	Earth-to-space
EC	European Community
EHF	Extremely High Frequency (30 - 300 GHz)

EIA	Electronics Industry Association
EMC	Electromagnetic compatibility
ENG	Electronic News Gathering
ETSI	European Telecommunications Standards Institute
F	Fixed (Service)
FCC	Federal Communications Commission (USA)
FM	Frequency Modulation, also broadcast stations operating in 88-108 MHz
FPLMTS	Future Public Land Moblle Telecommunication Systems
FOTS	Fibre Optic Transmission Systems
FSS	Fixed-Satellite Service
GHz	GigaHertz = 1000 MegaHertz
Glonass	an MSS network operated by the Russian Federation
GSM	Global System for Mobile communications (European digital system)
GSO	Geostationary-Satellite Orbit
HDTV	High Definition Television
HC	High Capacity (2 DS-3 and above)
ICAO	International Civil Aviation Organisation
IEC	International Electro-technical Commission
IFRB	International Frequency Registration Board
IMO	International Maritime Organisation
INMARSAT	International Maritime Satellite Organisation
INTELSAT	International Telecommunication Satellite Organization
International Table	International Table of Frequency Allocations (ITU)
ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific and Medical Equipment
ISO	International Standards Organization
ITU	International Telecommunication Union
ITU Table or International Table	International Table of Frequency Allocations contained in Article 8 of the Radio Regulations of the ITU.
ITV	Instructional Television (fixed service)
Ka-band	Frequency range near 20 - 30 GHz
Ku-band	Frequency range near 11 - 14 GHz
kHz	kiloHertz = 1000 Hertz
L2 GHz	Lower 2 GHz band 1710-1900 MHz
LAN	Local Area Network
L-band	Frequency range near 1500 MHz
LC	Low Capacity (transmission capacity) 1 DS-1 to 3 DS-2
LEO	Low Earth Orbit
Long Term	beyond 10-15 years
M	Mobile (Service)

MAN	Metropolitan Area Network
MC	Medium Capacity (transmission capacity) 3DS-2 to 2 STS-1
Mbit/s	Megabits/sec (millions of bits per second)
Medium Term	5-10 years
MHz	MegaHertz = 1000 kiloHertz
MMSS	Maritime Mobile-Satellite Service
MSS	Mobile Satellite-Service
MSAT	the MSS network(s) operated in Canada and the US
MCS	Multipoint Communication Systems (Fixed)
MDS	Multipoint Distribution Systems (Broadcasting)
MUSAT	Multi-purpose UHF Satellite (an early DOC mobile satellite program.
NASA	National Aeronautics and Space Administration (USA)
No.	reference to an ITU RR
NOC	No Change
NOI	Notice of Inquiry (USA)
Non-GSO	Orbits other than GSO
NPRM	Notice of Proposed Rulemaking (USA)
NTSC	National Television Standards Committee (standard for North American TV)
OC-1	Optical Carrier, Level 1: STS-1 51.84 Mbit/s 672 DS-0
OC-3	Level 3: STM-1 155.52 Mbit/s 2,016 DS-0
OC-48	Level 48: 16 STM-1 2.48832 Gbit/s 32,256 DS-0
PABX	Private Automatic Branch Exchange
PCS	Personal Communications Service
PFD	Power flux-density
PIN	Personal Identification Number
P-P	Point to point radio (fixed service)
P-MP	Point to multipoint radio (fixed service)
PNO	Public Network Operator
PSTN	Public Switched Telephone Network
RA	Radio Astronomy (Service)
RABC	Radio Advisory Board of Canada
RAM	Random Access Memory
RDSS	Radiodetermination-Satellite Service
Region 2	ITU Region 2 (the Americas)
REC	Recommendation (typically of the CCIR or of CEPT)
RES	Resolution (typically of the ITU or of ETSI)
RF	Radio Frequency
RLAN	Radio Local Area Network
RNSS	Radionavigation-Satellite Service
RR	Radio Regulations (of the ITU)
S2 GHz	Super 2 GHz band 2290-2450 MHz
s-E	space-to-Earth

SDH	Synchronous Digital Hierarchy
SG	Study Group (of the CCIR or of the CCITT)
SHF	Super High Frequency (3 - 30 GHz)
Short Term	0-5 years
SNG	Satellite News Gathering
SONET	Synchronous Optical Network
SP	Spectrum Utilization Policy
SP-GEN	SP-General Information
SRS	Subscriber Radio System (used to connect remote areas to PSTN)
SRSP	Standard Radio System Policy
SSB	Single Side Band modulation
Standard system	System which conforms to an SP and an SRSP
STL	Studio-Transmitter Link
STS-1	OC-1 51.84 Mbit/s 672 DS-0's
STM-1	OC-3 155.52 Mbit/s 2,016 DS-0's
SUP	Suppression of the item
Table	Canadian Table of Frequency Allocations
TDMA	Time Division Multiple Access
TFTS	Terrestrial Flight Telecommunications System
TG	Task Group - CCIR
TV	Television
U2 GHz	Upper 2 GHz band 1900-2290 MHz
U4 GHz	Upper 4 GHz band 4400-5000 MHz
UHF	Ultra High Frequency (300 MHz- 3 GHz)
VHCM	Very High Capacity Microwave (for CATV distribution)
VHF	Very High Frequency (30 - 300 MHz)
VLC	Very Low Capacity (transmission capacity) equal to or less than 1 DS-1)
VSAT	Very Small Aperture Terminal
W	Watt
WRC	World Radiocommunication Conference (replaces WARCs in 1993)
WARC	World Administrative Radio Conference (of the ITU)
WARC-92	the WARC held in 1992