

POLICY FOR THE COORDINATION OF MILITARY RADIO FREQUENCY ALLOCATIONS AND ASSIGNMENTS BETWEEN COOPERATING NATIONS

ACP 194



APRIL 2005

FOREWORD

1 The Combined Communications-Electronics Board (CCEB) is comprised of the five member nations, Australia, Canada, New Zealand, United Kingdom and United States and is the Sponsoring Authority for all Allied Communications Publications (ACPs). ACPs are raised and issued under common agreement between the member nations.

2 ACP 194, POLICY FOR THE COORDINATION OF MILITARY RADIO FREQUENCY ALLOCATIONS AND ASSIGNMENTS BETWEEN COOPERATING NATIONS, is an UNCLASSIFIED CCEB publication.

3 This publication contains Allied military information for official purposes only.

4 It is permitted to copy or make extracts from this publication.

5 This ACP is to be maintained and amended in accordance with the provisions of ACP 198.

**THE COMBINED COMMUNICATIONS-ELECTRONICS BOARD
LETTER OF PROMULGATION FOR ACP 194**

1. The purpose of this Combined Communications-Electronics Board (CCEB) Letter of Promulgation is to implement ACP 194 within the Armed Forces of the CCEB Nations. ACP 194, POLICY FOR THE COORDINATION OF MILITARY RADIO FREQUENCY ALLOCATIONS AND ASSIGNMENTS BETWEEN COOPERATING NATIONS, is an UNCLASSIFIED publication developed for Allied use under the direction of the CCEB Principals. It is promulgated for guidance, information, and use by the Armed Forces of the CCEB nations and NATO.
2. ACP 194 is effective upon receipt for CCEB Nations and when directed by the NATO Military Committee (NAMILCOM) for NATO nations and Strategic Commands.

EFFECTIVE STATUS

Publication	Effective for	Date	Authority
ACP 194	CCEB	On Receipt	LOP

3. All proposed amendments to the publication are to be forwarded to the national coordinating authorities of the CCEB or NAMILCOM.

For the CCEB Principals

WARREN J. QUENNELL
Squadron Leader, RNZAF
CCEB Permanent Secretary

TABLE OF CONTENTS

TITLE PAGE..... i
FOREWORD..... iii
THE COMBINED COMMUNICATIONS-ELECTRONICS BOARD LETTER OF
PROMULGATION FOR ACP 194 v
RECORD OF MESSAGE CORRECTIONS..... vii
TABLE OF CONTENTS..... ix

CHAPTER 1

POLICY FOR THE COORDINATION OF MILITARY RADIO FREQUENCY
ALLOCATIONS AND ASSIGNMENTS BETWEEN COOPERATING NATIONS.... 1-1
 INTRODUCTION 1-1
 DEFINITIONS 1-1
 OBJECTIVES OF MILITARY FREQUENCY MANAGEMENT..... 1-1
 ACHIEVEMENT OF FREQUENCY MANAGEMENT OBJECTIVES..... 1-2
 STANDARD FREQUENCY ACTION FORMAT 1-2

CHAPTER 2

POLICY AND PROCEDURES FOR COORDINATION OF SPACE RADIO
FREQUENCY ASSIGNMENTS 2-1
 INTRODUCTION 2-1
 POLICY 2-1
 PROCEDURE..... 2-1

CHAPTER 3

RESOLUTION OF HARMFUL INTERFERENCE 3-1
 INTRODUCTION 3-1
 POLICY 3-1
 PROCEDURE..... 3-1

 FORMAT FOR CLEARANCE OF INTERFERENCE MESSAGE

 ANNEX A - STATION CAUSING INTERFERENCE 3A-1
 TRANSMITTER STATION EXPERIENCING INTERFERENCE 3A-1
 RECEIVING STATION EXPERIENCING INTERFERENCE..... 3A-2

CHAPTER 4

SPECTRUM REALLOCATION AND PRICING.....4-1

 INTRODUCTION4-1

 INTERNATIONAL SPECTRUM MANAGEMENT DEVELOPMENTS4-1

 IMPLICATIONS OF SPECTRUM REALLOCATION AND PRICING.....4-2

 THE CASE AT THE NATIONAL LEVEL CASE FOR MILITARY SPECTRUM
 ACCESS4-2

 RESOURCES REQUIRED FOR PREPARATION OF MILITARY ARGUMENTS
 4-4

 CONCLUSIONS.....4-5

CHAPTER 5

AIDE-MÉMOIRE5-1

MILITARY SPECTRUM REALLOCATION AND PRICING CONCERNS5-1

 INTRODUCTION5-1

 AIM.....5-1

 MILITARY PRINCIPLES.....5-1

 ECONOMIC FACTORS.....5-3

 POLITICAL FACTORS5-3

 CONCLUSION.....5-4

 RECOMMENDATION5-4

CHAPTER 6

TABLE OF HARMONISED FREQUENCY BANDS.....6-1

 INTRODUCTION6-1

ANNEX A - CCEB TABLE OF HARMONISED FREQUENCY BANDS6A-1

CHAPTER 1

POLICY FOR THE COORDINATION OF MILITARY RADIO FREQUENCY ALLOCATIONS AND ASSIGNMENTS BETWEEN COOPERATING NATIONS

INTRODUCTION

101. Nations, or coalitions of nations, are responsible for reviewing and coordinating the allocation and assignment of frequencies at the military-strategic level to satisfy their joint and combined military requirements. This requires the full coordination of allocations and assignments necessary to ensure that equipment is Radio Frequency (RF) spectrum supportable and to reduce the possibility of harmful interference across national boundaries, or for use by the forces of one nation to be deployed in areas controlled by another cooperating nation.

DEFINITIONS

102. For the purpose of military frequency management, the following definitions apply:

- a. Administration - Any governmental department or service responsible for discharging the obligations undertaken in the Constitution of the International Telecommunication Union (ITU) or in the Convention of the International Telecommunication Union;
- b. Allocation (of a frequency band) - Entry in a Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radio communications services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned;
- c. Assignment (of a radio frequency or a radio frequency channel) - Authorisation given by a designated authority for an electromagnetic emitter to use a frequency or frequency channel under specified conditions;
- d. Harmful Interference – interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with the ITU radio regulations; and
- e. Battlespace Spectrum Management (BSM). – In the context of this publication, it is the application of the concepts of spectrum management in other than routine military operations.

OBJECTIVES OF MILITARY FREQUENCY MANAGEMENT

103. The objectives of military Frequency Management between cooperating nations are as follows:

- a. The coordination of the allocation of frequency bands to equipment where operation of such equipment is likely to affect existing or future equipment used by another nation (i.e., where there is a perceived interoperability or

- EMC issue);
- b. The exchange of information about national frequency allocations;
 - c. To provide information, the operational and emission characteristics of the military communications – electronic (C-E) equipment used by each nation;
 - d. Provide frequency assignments for a particular purpose (e.g., transiting of aircraft, ships, etc);
 - e. As part of BSM planning, provide frequency assignments when two or more nations are conducting combined or coalition operations or exercises; and
 - f. To ensure that national administrations understand and represent as appropriate military spectrum requirements at international regulatory forums.

ACHIEVEMENT OF FREQUENCY MANAGEMENT OBJECTIVES

104. The objectives of military frequency management between cooperating nations are achieved as follows:

- a. Allocations of frequency bands to radio services are coordinated in accordance with agreed procedures;
- b. Exchange of information about national allocations of frequency bands to equipment is achieved by exchanging national allocation tables and circulating amendments as required;
- c. Information about the operational and emission characteristics of military C-E equipment are exchanged in accordance with agreed procedures;
- d. As part of BSM planning, frequency assignments are coordinated in accordance with agreed procedures;
- e. Large scale frequency assignments to support combined or coalition operations or exercises are coordinated in accordance with ACP 190, its supplements or any more detailed document which may be produced for a particular operation or exercise; and
- f. Coordination of military spectrum requirements before meetings of international regulatory forums is achieved by discussions at suitable meetings, with circulation of relevant information papers before such meetings.

STANDARD FREQUENCY ACTION FORMAT

105. Refer to ACP 190 (B) Annex E for details of the Standard Frequency Action Format (SFAF) which may be used for radio frequency proposals, assignments, modifications, renewals, reviews, and deletions.

CHAPTER 2**POLICY AND PROCEDURES FOR COORDINATION OF SPACE
RADIO FREQUENCY ASSIGNMENTS****INTRODUCTION**

201. Coordination between nations of frequency assignments for space systems should be effected as required, taking into account the provisions of the ITU Radio Regulations.

POLICY

202. To ensure that the military authorities of cooperating nations may adequately identify, consider, and advise their national civil authorities with regard to the military space systems of the other nations, information should be provided to the nations affected through military channels before the submission of Advance Publication or Coordination Requests to the ITU.

PROCEDURE

203. It is normal for satellite coordination meetings to take place directly between satellite operators (including military authorities) under the delegated authority of their respective national administrations. Meeting records are then passed to the national administration with a request to inform the ITU of the coordination status achieved.

204. Whenever military space systems for which no international recognition will be sought are to be established, coordination may nevertheless be desirable between the military authorities of co-operating nations. In such cases, the same elements of information that would be required for international coordination should be exchanged between relevant military authorities as early as possible.

CHAPTER 3**RESOLUTION OF HARMFUL INTERFERENCE****INTRODUCTION**

301. Harmful interference is defined in paragraph 102.d.

POLICY

302. Within the congested portions of the radio frequency spectrum interference can be expected and often must be tolerated. Assignments of replacement frequencies should be considered when efforts to alleviate interference are ineffective.

PROCEDURE

303. When the source of harmful interference is considered to emanate from a station of a cooperating nation, the military frequency-management authority for the station suffering interference should attempt to clear this interference directly with the military frequency management authority of the nation to which the suspect interfering station belongs. If this attempt is unsuccessful, the interference should be reported by the military frequency-management authority for the station suffering interference to the civil administration of that nation. The civil administration should be requested to refer the matter to the civil administration of the nation from where the interference is believed to be emanating.

Messages regarding clearance of interference should include the essential elements of the format specified in Annex A to this chapter.

FORMAT FOR CLEARANCE OF INTERFERENCE MESSAGE

STATION CAUSING INTERFERENCE

- a. Name, call sign or other means of identification
- b. (1) Frequency measured
(2) Date
(3) Time (UTC)
- c. Class of emission,
- d. Bandwidth (indicate whether measured or estimated)
- e. (1) measured field strength or power flux-density
(2) Date
(3) Time
- f. Observed polarisation
- g. Class of station and nature of service
- h. Location/position/area/bearing
- i. Location of the facility which made the above measurements

TRANSMITTER STATION EXPERIENCING INTERFERENCE

- j. Name, call sign or other means of identification
- k. Frequency assigned
- l. (1) Frequency measured
(2) Date
(3) Time (UTC)
- m. Class of emission
- n. Bandwidth (indicate whether measured or estimated)
- o. Location/position/area
- p. Location of the facility which made the above measurements

RECEIVING STATION EXPERIENCING INTERFERENCE

- q. Name of station
- r. Location/position/area
- s. Dates and times (UTC) of occurrence of harmful interference
- t. Bearings on other particulars
- u. Nature of interference
- v.
 - (1) Field strength or power flux-density of the wanted emission at the receiving station experiencing the interference
 - (2) Date
 - (3) Time (UTC)
- w. Polarisation of the receiving antenna or observed polarisation
- x. Action requested

- NOTES:**
- 1. The class of emission shall contain the basic characteristics listed and if possible, the additional characteristics. If any characteristic cannot be determined, indicate the unknown symbol with a dash.
 - 2. When measurements are not available, signal strengths according to the QSA scale (see ACP 131 (E)) should be provided.

CHAPTER 4**SPECTRUM REALLOCATION AND PRICING****INTRODUCTION**

401. The radio frequency spectrum is a vital, but limited natural resource. It is the sovereign right¹ of each nation to use the radio frequency spectrum, within its borders, in any manner that it sees fit. With the rapid evolution and application of new radio technologies, there is an increasing demand for spectrum for new services.

402. Several major developments - emerging technologies and networks, the growth in the use of spectrum resources and services, and legislative and regulatory developments - have all highlighted the need for a continual assessment of military spectrum requirements.

403. This chapter identifies the actions required to protect vital military access to the radio frequency spectrum in light of increased demands for spectrum and developments in spectrum management. The Chapter comprises 4 parts:

- a. International spectrum management developments;
- b. implications of spectrum reallocation and spectrum pricing;
- c. guide to National Arguments; and
- d. resources required for the preparation of military arguments.

INTERNATIONAL SPECTRUM MANAGEMENT DEVELOPMENTS

404. The rapid evolution and application of new radio technologies that has occurred in recent years has seen an increase in radio based systems. Commercial pressures on national administrations for more spectrum to accommodate new technology and potentially high public benefit has forced reviews of spectrum management legislation in many countries.

405. Some countries have introduced market based approaches which in theory allow a responsive use of the spectrum, to enable it to respond to changes in technology and consumer demand.

406. National frequency allocations are being reviewed, and spectrum is under consideration in some countries for reallocation from "government" to "non government" sectors. National reviews are concentrating on spectrum efficiency and are focusing on the military use of the spectrum. The overall impact is a gradual reallocation of spectrum from military to civil use.

407. As market-oriented spectrum management regimes are introduced, the military, under the auspices of the government, may be required to purchase or relinquish spectrum, which could have an operational impact on military effectiveness.

¹ See the Preamble to the Constitution of the International Telecommunication Union.

IMPLICATIONS OF SPECTRUM REALLOCATION AND PRICING

408. Access to relatively interference free spectrum is essential for military preparedness and the conduct of operations. Contrary to a view that spectrum affects solely communications systems, virtually every aspect of military readiness and effectiveness depends upon the radio spectrum. Target acquisition, weapon control and guidance, dissemination of intelligence information, navigation and terminal control, administrative telecommunications and command and control rely on adequate access to the spectrum.

409. Increasingly, the network-centric warfare philosophies being adopted by modern military forces relies upon assured spectrum access. There are clear, finite minimum spectrum requirements which are related, directly, to the operational effectiveness of radio, radar and weapon systems. Spectrum reallocations in one country may disrupt system interoperability in alliances.

410. Pressure is being brought to bear on government agencies to make military spectrum available for commercial development in the interests of advancing public benefit. In the event that the military cannot compete in the market place with commercial organisations, then complete military radio based systems may be required to relocate to other parts of the spectrum or to be prematurely withdrawn from service.

411. Arranging temporary access to the spectrum for military exercises will become more difficult as the spectrum is sold. The military will have to negotiate shared usage with owners of spectrum instead of with national administrations. Temporary access of this nature will no doubt attract a cost.

412. Spectrum lost to the military as a result of market based reforms in spectrum management will not be recovered and may jeopardise current and future military capabilities.

THE CASE AT THE NATIONAL LEVEL CASE FOR MILITARY SPECTRUM ACCESS

413. Changes to spectrum management practices involve legislative action. The military needs to be involved at all levels and as early as possible during this process. This will ensure that military requirements are recognised and accounted for in any new legislation. In making the appropriate bill/act, national regulation must not only take cognisance of international treaties such as the ITU Radio Regulations but also any international military agreements. Senior government officials must be constantly reminded of their obligation to ensure provision is made for public safety and security.

414. Military radio interests are diverse and complex. As such the national administration, in the absence of direct timely advice from the military, may make ill-informed decisions concerning military spectrum which could have an adverse impact on operational capabilities. It is incumbent upon the military to ensure that officials are aware of military problems and priorities.

415. The military case for continued access to the spectrum must be related to Defence policy tasks so that the political impact of spectrum loss can be seen. It is also very important for the military frequency manager to participate in national and international civil/industrial spectrum planning bodies. Military participation and advice can help

industry avoid problems and may even help industry to identify commercial possibilities.

416. The military arguments should highlight the following points:

- a. The total investment in military radio based systems, including the cost of system development and expected service lifetime of these systems;
- b. The identification of vital spectrum interests and common frequency bands;
- c. The cost to relocate systems in the event they are displaced, along with the cost of any new replacement equipment if existing systems are forced into premature retirement;
- d. A definition of vital military requirements during training and conflict, including requirements for today's systems as well as the systems of the future, must be prepared to support the military case;
- e. It is essential that the military demonstrate that the spectrum is being used in the most efficient manner possible. Continual reviewing of frequency band plans in light of new radio technology and identify future requirements, in a timely fashion, will assist in this task;
- f. Some multinational military organisations have arranged common frequency bands in order to facilitate interoperability, despite the fact that such bands do not always exist on a worldwide basis. The military case will be strengthened when it is shown that spectrum efficiency is being improved through the use of these common frequency bands;
- g. The existence of these harmonised bands may make them very attractive to government and to the commercial sector, especially when this sector is seeking regional or world wide harmonised bands for development of commercial systems. This possibility must be borne in mind and suitable arguments prepared to safeguard these harmonised bands where they exist;
- h. Access to new spectrum will become difficult as spectrum reforms are enacted. Once spectrum has been reallocated to civil use, military access may be denied unless prior sharing agreements have been set in place;
- i. The military may have to compete in the market place for continued spectrum access unless governments make separate provision for Defence and national security.
- j. Adequate spectrum must be available to national Defence and to visiting forces for peacetime communications and training. This dictates that some spectrum must be reserved for these intermittent activities, giving rise to a possible perception of spectrum waste;
- k. The use of the spectrum by the military in peace time is not reflective of the total spectrum requirements during conflict. These additional combat requirements have often been identified during exercises and operations and have been met by sharing with civil radio systems
- l. Difficulties which may occur if classified information cannot be made available to support the military case. To overcome this the appropriate persons in the civil administration must hold adequate security clearances;

- m. There is no peace dividend in military use of the spectrum. A peace dividend is illusory because reductions in military forces do not necessarily produce accompanying reductions in spectrum requirements (unless complete systems are cut). At best, force reductions produce a decrease in the frequency reuse factor. Regardless of ongoing force reductions, most military forces are adding radio and radar systems to their inventories. Commanders, faced with cuts in combat manpower, seek force multipliers in the areas of surveillance and warning, target acquisition and, command and control all based on radio spectrum dependent systems
- n. Spectrum lost to the military as a result of market based reforms in spectrum management will not be recovered and may jeopardise current and future military capabilities.

RESOURCES REQUIRED FOR PREPARATION OF MILITARY ARGUMENTS

417. The preparation of the military arguments can only be completed with the assistance of qualified staff. Initially, the identification of vital frequency bands would need to be addressed by national military frequency management staffs in close coordination with colleagues in cooperating nations. Compilation of equipment numbers, cost details and mission impact data is required if investment arguments are to be presented. This collection is both essential and manpower intensive and involves several military organisations (procurement, supply, finance, operations, etc) to cover both current and future requirements.

418. Legal Support

- a. As the spectrum management reforms are legislative and binding on the military, legal support is required from the outset. Agreements may have to be negotiated when spectrum that has been sold/auctioned is required temporarily for exercises, etc. The military could be held accountable for any economic harm caused by harmful interference to businesses owning spectrum. This could result in legal action for the recovery of lost revenue by the owner of the spectrum through the judicial system.
- b. There is a requirement for Defence legal staff to provide frequency planners with counsel regarding international and national regulations.

419. Meetings between Military Spectrum Managers of Cooperating Nations
- a. Bi-lateral and multi-lateral military discussions are necessary if the military is to minimise the impact of the changes in spectrum management. Although the reforms are national decisions, some advantage can be gained in international fora such as the ITU by having prior coordination discussions to attempt to influence national positions in the lead up to meetings of such fora. Combined military efforts are required with continual information exchange necessary and any necessary meetings to review developments.
 - b. To keep abreast of civil developments, and to ensure that Defence goals are reflected in national policies, it is essential that frequency planners work in various civil symposia and conferences that address spectrum management. In particular conferences such as the annual CEPT Radio Conference, which addresses the European Detailed Spectrum Investigation, should have a military presence. ITU Radiocommunications Sector meetings and WRCs should be monitored and attended. The investment to attend such meetings/conferences is small compared to the losses that will result if spectrum is withdrawn
420. Technical Developments
- a. Technical advances in electronic equipment over the last decade have enabled more and different radio systems to be introduced. The military can take advantage of these developments when replacing systems by bringing more spectrum efficient equipment into service, with tighter technical specifications, particularly in radio receivers. Introducing such equipment into the civil sector will also help in achieving these advantages. This would permit greater opportunities for sharing resulting in more efficient use of the spectrum. Use of data reduction techniques and digital signal processing may relieve some of the congestion in spectrum usage.

CONCLUSIONS

421. Multinational military organisations provide an effective forum to generate arguments for continued adequate military use of the spectrum. However, national spectrum management authorities will determine the use of the spectrum within their boundaries.
422. The military must be prepared to argue its case at a political level for continued adequate spectrum access. These arguments must be based on military operational requirements reflecting government policies and must include emphasis on informing non-military authorities of military spectrum requirements.
423. To assist in developing national military arguments, adequate financial and legal resources must be provided to ensure that Defence goals are protected in international and national regulatory and spectrum allocation fora.

424. Spectrum lost will not be recovered. This may jeopardise access for future military systems and impose restrictions on current operations and training.

CHAPTER 5

*AIDE-MÉMOIRE***MILITARY SPECTRUM REALLOCATION AND PRICING CONCERNS****INTRODUCTION**

501. The radio frequency spectrum is a vital, but limited natural resource. It is the sovereign right² of each nation to use the radio frequency spectrum, within its borders, in any manner it sees fit. With the rapid evolution and application of new radio technologies, there is an increasing demand for spectrum for new services. The demand is expressed by both national and international agencies: business and users, internally, and in the International Telecommunication Union (ITU), representing the world view at its World Radio communication Conferences (WRCs).

AIM

502. This *Aide-Mémoire* aims to assist senior Defence staff in the task of protecting vital military interests which need spectrum.

MILITARY PRINCIPLES

503. Spectrum which is lost will not be recovered; sharing is preferable.

This might be described as the master principle. Some senior military officers, including some spectrum managers may talk about recovering spectrum from civil users in time of crisis/transition to war. This will only happen in extremes; otherwise, almost all spectrum which is used by the civil sector will be incorporated into the national broadcasting and telecommunications infrastructure, both of which are vital to mobilisation and any war effort. Inter-service sharing is common practice in the civil sector - it requires effort but it can be made to work.

504. Sharing is a two way street:

There is a tendency in some civil administrations to consider sharing only in the context of placing civil systems in spectrum reserved for military requirements. The argument needs to be made that sharing is a two way street, and that it is also necessary to examine spectrum reserved for civil purposes in order to ascertain the extent to which military systems may operate in these bands.

505. Military interests must be recognised and protected by administrations as part of the broad national interest.

This is, in essence, what the frequency managers want senior military officers to help with. Senior military officers need to recognise that they are only one player (albeit, a very important one) in the spectrum access game. This should not deter

² See the Preamble to the Constitution of the International Telecommunication Union.

them however from making the military's case whenever possible. Senior military officers should, indeed, seek out opportunities to meet with their civil counterparts in the radio communications industry and, especially, in the national administration and to clearly state the military's spectrum requirements.

506. Force reductions may generate increased demand for spectrum based systems.

This may be obvious to senior military officers, but some civilians have difficulty with the concept. In essence, force reduction, even major force reductions, do not, generally, reduce spectrum requirement unless a complete class of system is retired. Normally the only change in military spectrum use is that the congestion in military bands is reduced. Force reductions are, often, accompanied by programmes which aim to offset the worst effects on combat capabilities by increasing the capabilities and capacities of surveillance, warning, target acquisition, weapon control and guidance and command and control systems, almost all of which work in the spectrum. Far from reducing military spectrum requirements, therefore, force reductions might actually increase them.

507. The increasing performance requirements of systems require increased radio bandwidth.

*The laws of physics, or at least the radar equations, are at work here. To track smaller missiles, moving more quickly and closer to the wave tops than it is **necessary to** increase bandwidth - there is a limit to the gains which signal processing can make. Before the information can be processed enough information must be acquired for analysis to occur.*

508. Military spectrum use is tied to military tasks which are set by government. Loss of spectrum may prejudice the tasks or dictate unexpected procurement requirements for replacement systems.

*This is a political/public policy consideration which **should** be meaningful to senior officials in the national administration.*

509. Interference from/to military systems will have an adverse effect on operations.

For example, a change in naval operations from "blue water" to "littoral water" has increased the likelihood of interference between maritime and shore based radio systems. A similar situation applies when training areas are decreased. Although the same amount of spectrum is required, the geographical area is smaller and may be closer to populated areas resulting in an increased potential to cause interference.

510. Spectrum use is constrained by treaty obligations.

This cuts both ways. Multi-national military obligations can be used to justify spectrum access and, in the case of Europe, the European industry respects the civil/military NATO Joint Frequency Agreement (NJFA). However the ITU Radio Regulations constitute a treaty regarding spectrum use and the military, by using "out of band" systems, may violate the provisions of that treaty.

511. Spectrum must be reserved for contingencies and survivability.

There is a vital operational requirement which covers, for example, most of the 1215 - 1400 MHz bands which is used to provide ECM protection for Naval radars and

all the channels which are reserved in COMMPLANS. As far as military frequency managers are concerned these "empty" channels are assigned, licensed and paid for. To civil users they may represent all the evidence needed to prove that the military wastes spectrum.

ECONOMIC FACTORS

512. The spectrum is vital for economic development.

Senior military officers must be prepared for this point. It will be raised by private sector executives and by senior officials in the national administrations acting in support of their governments' efforts to increase national prosperity and create jobs.

513. Spectrum has a real capital value which is growing and can generate revenue. A market based approach to spectrum pricing may make sharing very difficult.

*There are really two factors here. The first concerns the capital value of the spectrum. It is indisputable. In countries where spectrum cannot be traded like any other commodity, the value of the spectrum is appreciated by those who have to pay for it. The second factor is that when the national regime allows for spectrum to be traded, then sharing (the master principle) can be very difficult. It is possible however, to design regulatory regimes which can allow **both** spectrum rights and sharing.*

514. Spectrum can be seen as a commodity which can be traded.

This is a fact. Some organisations see the spectrum as investment opportunities which can increase in value and then traded for profit. This could encourage spectrum hoarding.

515. Military capabilities represent a national capital investment.

This is also a fact, however it is often understated or overlooked.

516. Military budgets are not as flexible as commercial funding.

This is another important factor which is often unappreciated by executives in the private sector: the service life of military radio systems. Civil systems have evolved in response to growing and increasingly sophisticated consumer demand and may have a short service lifetime before being replaced by more sophisticated systems. Robust military systems, on the other hand, may have very long service lifetimes and may use more bandwidth than is technically necessary due to the somewhat dated technology being employed.

517. Competition in the market place can result in unused spectrum.

This factor relates to the duplication of systems and services which results when, for example, a number of telecommunications service providers in a country may each have national networks. It is possible that none may use their available spectrum to capacity.

POLITICAL FACTORS

518. National spectrum management is subject to international regulations and pressures.

This is, in part, a repeat of the "treaty" factor above but with the addition of the

aspect of pressures to conform. This is especially relevant to countries with small economies base which border larger, more dynamic economies.

519. The perceived reduction in the direct military threat encourages a demand for a peace dividend in the spectrum.

See discussion under "force reductions" above.

CONCLUSION

520. The need for military spectrum must be understood by both military and national senior civil management.

This is a statement of the obvious. There are a few others:

- a. The military must recognise that it is in a competition for spectrum.*
- b. The military must recognise that its mission may not entitle it to an automatic place at the head of the spectrum line.*
- c. The military must recognise that its practices and procedures cause civilians in the private sector and in the national administration to see waste where the military sees only flexibility or budget restrictions.*

RECOMMENDATION

521. Every opportunity should be taken to present to senior military and civilian officials the case for military access to the spectrum.

This is, indeed, about all that senior military officers can be expected to do. The battle for spectrum access must be waged on several fronts. While the frequency managers are the main combatants, senior military officers can and should play a very important supporting role - especially in fora not normally available to the frequency managers.

CHAPTER 6**TABLE OF HARMONISED FREQUENCY BANDS****INTRODUCTION**

601. The table in the Annex to this chapter is an example of spectrum which has been harmonised for military use by the CCEB nations, which are located in all three ITU Regions.

602. The Table of Frequency Bands indicates, in tabular form, those bands in which these countries operate military radio equipment. The Table shows, in order of increasing frequency, the type of military radio service operated in particular bands

603. The Table also shows, for all three ITU Regions, that much of the spectrum usage by military forces of these nations is harmonised to enhance the interoperability of their forces, and hence their ability to act in concert in Joint and Combined Operations anywhere in the world. This table should not be taken as fully definitive since national allocation tables may differ in detail.

CCEB TABLE OF HARMONISED FREQUENCY BANDS

In the following tables, the CCEB Members and identified in accordance with the following table, which also shows the ITU Region in which the Member is located.

CCEB Member	ITU Region	Country Abbreviation
Australia	3	AU
Canada	2	CA
New Zealand	3	NZ
United Kingdom	1	UK
United States	2	US

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
14-70 kHz	Low Frequency Communications and Sounders for Submarines	X	X		X	X
70-148.5 kHz	Naval Communications.	X	X		X	X
255-283.5 kHz	Air Navigation and Beacons.	X	X	X	X	X
283.5-415 kHz	Tactical Non-Directional Beacons.	X	X	X	X	X
415-526.5 kHz	Tactical Non-Directional Beacons.	X	X	X	X	X
	Naval and Fixed Ground Communications.		X	X	X	X

UNCLASSIFIED

**ANNEX A TO
CHAPTER 6 TO
ACP 194**

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
1606.5 kHz - 30 MHz	Long Distance Airborne Communications.	X	X	X	X	X
	Telephony Duplex/Simplex Channels; Wideband Telegraphy Channels; & Naval Communications.	X	X	X	X	X
	Fixed and Tactical Communications.	X	X	X	X	X
	Over-the-Horizon Radars	X ^{AU1}			X	X
30-87.5 MHz	Army Air Force and Navy Tactical/Combat Net Radio Systems. (See End Notes 1 and 2)	X	X ^{CA1}	X ^{NZ1}	X	X
87.5-108 MHz	Army and Air Force Tactical/Combat Radio Systems.					X ^{US 1} US2
108-136 MHz	Aeronautical Radionavigation and Aeronautical Mobile(R)	X	X			X
138-144 MHz	Air Traffic Control Communications.			X	X ^{UK1}	
	Land Mobile Communications and Sonobuoy Operations.	X ^{AU2}	X	X	X	X
148-149.9 MHz	Land Mobile Communications.	X	X		X ^{UK2}	X

^{AU1} For AU, 3025 kHz - 45 MHz

^{CA1} In Canada, Combat Net Radio operation outside the band 30-50 MHz is unlikely.

^{NZ1} Portions of this band are unavailable due to TV Broadcasting

^{US 1} Navy has a few SINCGARS assignments in 87.5-88 operation on OOB basis with note RR 144 applied. Army has 1 XT assignment and AF has 2 XT assignments

^{US2} 88 – 108 MHz is allocated in the U.S. on an exclusive basis to civil FM broadcasting.

^{UK1} In UK 142.5 – 143 MHz.

^{AU2} In Australia the band 137-144 MHz is used for TV in some areas. Some geographic restrictions exist to military access to this band.

^{UK2} In UK 149-149.9 MHz.

UNCLASSIFIED

**ANNEX A TO
CHAPTER 6 TO
ACP 194**

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
150-150.8 MHz	Land Mobile Communications.	X	X			X
150.8-156 MHz	Land Mobile Communications ^{US2}	X	X		X ^{UK2}	X
156-174 MHz	Sonobuoy Operations at Sea and in Port (For UK and NZ, 136-174 MHz)	X	X	X	X	X
	Naval Communications.	X	X	X	X	X
174-225 MHz	Land Mobile Communications and Broadcast.					X
225-400 MHz	Navy, Army and Air Force Tactical Command and Control. Tactical Satellite. (See End Note 3)	X ^{AU3}	X	X ^{NZ2}	X	X ^{US3}
400.15-406 MHz	Meteorological Aids and Meteorological Satellite Service.	X	X	X	X	X
406.1-420 MHz	Land Mobile Communications.	X	X		X ^{UK3}	X ^{US4}
	Launch Booster Safety Systems.					
	Land, Naval and Airborne Radars.					
420-450 MHz	Land Mobile, Radar	X	X		X	X

^{US2} Military use is OOB.

^{UK2} In UK 153.5-154MHz

^{AU3} In Australia the band is 230-400 MHz.

^{NZ2} in New Zealand the band is 230-400 MHz

^{US3} IN U.S., military ILS and Air Traffic Control functions are also in this band.

^{UK3} In UK, Land Mobile use only

^{US4} NTIA manual calls for discontinuation of these operations in the 406.1-420 MHz band as of 31 Dec 87. The NTIA manual also states that these operations should be carried out in the 420-450 MHz band.

UNCLASSIFIED

ANNEX A TO
CHAPTER 6 TO
ACP 194

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
450-581.9 MHz	Land and Aeronautical Mobile.	X				X
582-606 MHz	Land Mobile Communications					X
606-790 MHz	Broadcasting and Radar Site Communications.					X
790-960 MHz	Army and Air Force Tactical Command and Control (point to point links) Interconnecting Communications Centres.		X		X	X
	Naval Air Search Radars	X ^{AU4}	X	X ^{NZ3}		X
960-1215 MHz (See End Note 10)	TACAN/DME (Air Navigation)	X	X	X	X	X
	JTIDS/MIDS (TDMA Naval Air and Land Control Links)	X	X		X	X
1215-1350 MHz	NAVSTAR Global Positioning System.	X	X	X	X	X ^{US5}
	Long Range Air Defence Warning Radars.					
1350-1400 MHz	Long Range Air Defence Warning Radars.	X	X	X		X ^{US6}
1350-1610 MHz	Army and Air Force Tactical, Mobile, Global Positioning System, Airborne Telemetry, and Naval Radar.	X	X	X	X ^{UK4}	X ^{US7}

^{AU4} in Australia the band is 850-942 MHz

^{NZ3} in New Zealand the band is 850-942 MHz

^{US5} GPS L2 emissions extend from 1215-1240 MHz centred on 1227 MHz.

^{US6} Radar use limited to 1350-1390 MHz.

^{UK4} In UK only 1375-1400, 1429-1452 and 1559-1610 MHz is available for military use.

^{US7} Global Navigation Satellite Systems authorised in 1559-1610 MHz band.

UNCLASSIFIED

**ANNEX A TO
CHAPTER 6 TO
ACP 194**

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
1670-1700 MHz	Meteorological Aids		X		X	X
1755-1850 MHz	Army, Air Force and Navy Fixed and Mobile, Space Operations in Region 2					X
2200-2290 MHz	Fixed links, Space Operations (Downlinks)					X
2300-2450 MHz	Airborne Telemetry		X ^{CA2}			X ^{US8}
2700-3100 MHz	Navy, Army and Air Force Surveillance Radars.	X	X	X	X	X
3100-3410 MHz	Navy, Army and Air Force Radars.	X	X	X	X	X
3410-3650 MHz	Naval and Land Based Radars (3100-3600 in UK).		X	X	X	X
4200-4400 MHz	Radio Altimeters.	X	X	X	X	X
4400-5000 MHz	Fixed and Mobile Command and Control and Tactical Radio Relay (See End Note 2)	X	X	X	X	X
5000-5150 MHz	Airborne radar and Microwave Landing Systems (5030-5150 MHz per RR 5.444).		X		X	X
5250-5925 MHz	Navy, Army and Air Force Radars.	X	X	X	X	X
5925-7250 MHz	Fixed and Fixed-Satellite Communications. (US Fixed starts at 7125 MHz)		X			X

^{CA2} In Canada airborne telemetry is limited to 2360 – 2400 MHz

^{US8} The U.S. authorises airborne telemetry only in the 2360-2390 MHz band.

UNCLASSIFIED

**ANNEX A TO
CHAPTER 6 TO
ACP 194**

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
7250-7750 MHz	Satellite Downlinks, Mobile Satellite for Naval and Land Mobile Earth Stations, Fixed Systems. (See End Note 4)	X	X		X	X
7750-7900 MHz	Fixed Systems	X				X
7900-8400 MHz	Satellite Uplinks, Naval and Land Mobile Satellite Earth Stations, Earth Exploration Satellite Downlinks, and Fixed Systems. (See End Note 4 & 5)	X	X		X	X
8400-8500 MHz	Fixed and Mobile systems.	X				X
8500 MHz -10.7 GHz	Navy, Army and Air Force Radars.	X	X	X	X	X
10.7-13.4 GHz	Target Tracking and Lock-On Systems.			X		
13.4-14.0 GHz	Navy, Army and Air Force Radars.	X	X	X	X	X
14.62-15.23 GHz	Operational Command and Control. (See End Note 2)	X	X	X	X	X
15.4-15.7 GHz	Airborne Radars.					X
15.7-17.3 GHz	Navy, Army and Air Force Radars. (See End Note 5)	X	X	X	X	X
17.3-17.7 GHz	Navy, Army and Air Force Radars. (See End Note 14)	X				X
17.7-20.2 GHz	Space and Fixed Systems.		X			X
20.2-21.2 GHz	Satellite Downlinks. (See End Note 3)	X	X	X	X	X
21.2-24.05 GHz	Fixed Microwave Communications.		X			X
24.05-24.25 GHz	Radars	X				X

UNCLASSIFIED

**ANNEX A TO
CHAPTER 6 TO
ACP 194**

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
25.25-27.5 GHz	Operational Command and Control (Existing or Planned Satellite Systems).	X	X		X	X
30-31 GHz	Planned Satellite Uplinks. (See End Note 3&7)	X	X	X	X	X
33.4-36.0 GHz	Radar Systems. (See End Note 3)	X	X		X	X
36-37 GHz	Fixed, Mobile and Planned Satellite Systems. (See End Note 3)	X	X		X	X
37-39.5 GHz	Existing and Future Fixed and Satellite Systems.	X	X			X
39.5-40.5 GHz	Future Satellite Downlinks. (See End Note 3&8)	X	X			X
43.5-45.5 GHz	Satellite Uplinks and Mobile Systems. (See End Note 3)	X	X		X	X
50.4-51.4 GHz	Future Satellite Uplinks and Planned Terrestrial Systems. (See End Note 3)	X	X			X
54.25-58.2 GHz	Planned Aeronautical Mobile and Satellite Systems.					X
59-64 GHz	Planned and Existing fixed, Mobile, Radiolocation, Intersatellite Communications and Wireless Computer Systems. (See End Note 9)	X	X		X	X
66-71 GHz	Future Satellite and Land Mobile Systems.	X				X
71-74 GHz	Future Satellite Uplinks. (See End Note 8)		X			X
74-75.5 GHz	Future Fixed, Mobile and Satellite Systems.	X				
76-81 GHz	Future Radar Systems.	X	X		X	X
81-84 GHz	Future Satellite Downlinks. (See End Note 8)		X			X
92-95 GHz	Future, Planned and Existing Radar, Fixed, Mobile and Satellite Systems.	X	X		X	X

UNCLASSIFIED

**ANNEX A TO
CHAPTER 6 TO
ACP 194**

Frequency Band	Military Requirements/Usage	Participating CCEB Nations				
		AU	CA	NZ	UK	US
95-100 GHz	Future, Planned and Existing Radar Systems.	X	X		X	X
126-134 GHz	Future, Command and Control, Radar and Intersatellite Systems.	X				X
134-142 GHz	Future and Planned Mobile and Radar Systems.	X				X
144-149 GHz	Future Radar Systems.	X				X
190-265 GHz	Future Radionavigation and Mobile Systems.					X
231-235 GHz	Future Fixed and Satellite Systems.					X
235-241 GHz	Future Fixed and Mobile Systems and Satellite Downlinks.					X
241-248 GHz	Future Radar Systems.					X
252-265 GHz	Future Mobile Systems.					X
300-1000 GHz	Infrared Technology Development.					X ^{US9}

NOTES

- 1 45-47 MHz is harmonised NATO band type 1 (46.60-47 MHz also accessible by the military in ITU region 2).
- 2 This is a harmonised NATO band type 1.
- 3 This is a harmonised NATO band type 1, including ITU region 2.
- 4 This is a harmonised NATO band type 1 for satellite downlinks.

^{US9} In the U.S., reference is made to NTIA Allocation Table, 5.565 and US 375

- 5
- 6 This is a harmonised NATO band type 1 for satellite uplinks.
- 7 15.7-17.1 GHz is a harmonised NATO band type 1.
- 8 This is a harmonised NATO band type 2.
- 9 This is a harmonised NATO band type 3 including ITU Region 2.
- 10 59-61 GHz is a harmonised NATO band type 2 including ITU Region 2.
- 11 Global Navigation Satellite Systemms are authorised in the 1164-1215 MHz band.
- 12 NATO band type 1: a frequency band that is in general military use in NATO Europe.
- 13 NATO band type 2: a frequency band that is planned for military use in NATO Europe.
- 14 NATO band type 3: a frequency band that is has been identified for possible military use in NATO Europe.
- 15 Radiolocation is allowed in this band on a secondary basis to fixed systems and satellite uplink or downlink systems, depending on the ITU region involved.

On behalf of **AUSTRALIA**:

On behalf of **CANADA**:

On behalf of **NEW ZEALAND**:

On behalf of the **UNITED KINGDOM**:

On behalf of the **UNITED STATES OF AMERICA**: