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Chapter 1 Reference **Definition**	**INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES** **CHAPTER 1. DEFINITIONS** *Note.— All references to "Radio Regulations" are to the Radio Regulations published by the International Telecommunication Union (ITU). Radio Regulations are amended from time to time by the decisions embodied in the Final Acts of World Radiocommunication Conferences held normally every two to three years. Further information on the ITU processes as they relate to aeronautical radio system frequency use is contained in the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718).* When the following terms are used in this volume of the Annex, they have the following meanings: ***Simplex.*** A method in which telecommunication between two stations takes place in one direction at a time. *Note.— In application to the aeronautical mobile service, this method may be subdivided as follows:* *a) single channel simplex;* *b) double channel simplex;* *c) offset frequency simplex.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***Alternative means of communication.*** A means of communication provided with equal status, and in addition to the primary means.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 1 Reference **Definition**	***Double channel simplex.*** Simplex using two frequency channels, one in each direction. *Note.— This method was sometimes referred to as cross-band.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***Duplex.*** A method in which telecommunication between two stations can take place in both directions simultaneously.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***Frequency channel.*** A continuous portion of the frequency spectrum appropriate for a transmission utilizing a specified class of emission. *Note.— The classification of emissions and information relevant to the portion of the frequency spectrum appropriate for a given type of transmission (bandwidths) are specified in the Radio Regulations, Article 2 and Appendix 1.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***Offset frequency simplex.*** A variation of single channel simplex wherein telecommunication between two stations is effected by using in each direction frequencies that are intentionally slightly different but contained within a portion of the spectrum allotted for the operation.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 1 Reference **Definition**	***Operational control communications.*** Communications required for the exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of a flight. *Note.— Such communications are normally required for the exchange of messages between aircraft and aircraft operating agencies.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***Primary means of communication.*** The means of communication to be adopted normally by aircraft and ground stations as a first choice where alternative means of communication exist.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***Single channel simplex.*** Simplex using the same frequency channel in each direction.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 1 Reference **Definition**	***VHF digital link (VDL).*** A constituent mobile subnetwork of the aeronautical telecommunication network (ATN), operating in the aeronautical mobile VHF frequency band. In addition, the VDL may provide non-ATN functions such as, for instance, digitized voice.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 2 Reference **2.1.1** **Standard**	All emergency locator transmitters carried in compliance with Standards of Annex 6, Parts I, II and III shall operate on both 406 MHz and 121.500 MHz. N1.*ITU Radio Regulations (5.256) provide for the use of 243 MHz in addition to the above frequencies*. *N2.Specifications for ELTs are found in Annex 10, Volume III, Part II, Chapter 5 and the ITU Radio Regulations, Article 34, Section I, No. 34.1.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 2 Reference **2.2.1** **Standard**	**2.2 Search and rescue frequencies** Where there is a requirement for the use of high frequencies for search and rescue scene of action coordination purposes, the frequencies 3 023 kHz and 5 680 kHz shall be employed.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 2 Reference **2.2.2** **Recommendation**	**Recommendation**.— *Where specific frequencies are required for communication between rescue coordination centres and aircraft engaged in search and rescue operations, they should be selected regionally from the appropriate aeronautical mobile frequency bands in light of the nature of the provisions made for the establishment of search and rescue aircraft.* *Note.— Where civil commercial aircraft take part in search and rescue operations, they will normally communicate on the appropriate en-route channels with the flight information centre associated with the rescue coordination centre concerned.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 3 Reference **3.1.1** **Standard**	**CHAPTER 3. UTILIZATION OF FREQUENCIES BELOW 30 MHz** **Introduction** High frequency bands allocated to the aeronautical mobile (R) service *The frequency bands between 2.8 MHz and 22 MHz allocated to the aeronautical mobile (R) service are given in Article 5 of the ITU Radio Regulations. The utilization of these bands must be in accordance with the relevant provisions of the Radio Regulations and in particular Appendix 27 to the Radio Regulations. In the utilization of these bands, States' attention is drawn to the possibility of harmful radio interference from non-aeronautical sources of radio frequency energy and the need to take appropriate measures to minimize its effects.* **3.1 Method of operations** In the aeronautical mobile service, single channel simplex shall be used in radiotelephone communications utilizing radio frequencies below 30 MHz in the bands allocated exclusively to the aeronautical mobile (R) service.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 3 Reference **3.1.2.1** **Standard**	**3.1.2** Assignment of single sideband channels Single sideband channels shall be assigned in accordance with Volume III, Part II, Chapter 2, 2.4.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 3 Reference **3.1.2.2** **Standard**	For the operational use of the channels concerned, administrations shall take into account the provisions of 27/19 of Appendix 27 of the ITU Radio Regulations.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 3 Reference **3.1.2.3** **Recommendation**	**Recommendation.—** *The use of aeronautical mobile (R) frequencies below 30 MHz for international operations should be coordinated as specified in Appendix 27 of the ITU Radio Regulations as follows:* 27/19 The International Civil Aviation Organization (ICAO) co-ordinates radiocommunications of the aeronautical mobile (R) service with international aeronautical operations and this Organization should be consulted in all appropriate cases in the operational use of the frequencies in the Plan.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 3 Reference **3.1.2.4** **Recommendation**	**Recommendation.—** *Where international operating requirements for HF communications cannot be satisfied by the Frequency Allotment Plan at Part 2 of Appendix 27 to the Radio Regulations, an appropriate frequency may be assigned as specified in Appendix 27 by the application of the following provisions:* 27/20 It is recognized that not all the sharing possibilities have been exhausted in the Allotment Plan contained in this Appendix. Therefore, in order to satisfy particular operational requirements which are not otherwise met by this Allotment Plan, Administrations may assign frequencies from the aeronautical mobile (R) bands in areas other than those to which they are allotted in this Plan. However, the use of the frequencies so assigned must not reduce the protection to the same frequencies in the areas where they are allotted by the Plan below that determined by the application of the procedure defined in Part I, Section II B of this Appendix. *Note.— Part I, Section II B of Appendix 27 relates to Interference Range Contours, and application of the procedure results in a protection ratio of 15 dB.* 27/21 When necessary to satisfy the needs of international air operations Administrations may adapt the allotment procedure for the assignment of aeronautical mobile (R) frequencies, which assignments shall then be the subject of prior agreement between Administrations affected. 27/22 The co-ordination described in No. 27/19 shall be effected where appropriate and desirable for the efficient utilization of the frequencies in question, and especially when the procedures of No. 27/21 are unsatisfactory.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 3 Reference **3.1.2.5** **Standard**	The use of classes of emission J7B and J9B shall be subject to the following provisions of Appendix 27: 27/12 For radiotelephone emissions the audio frequencies will be limited to between 300 and 2 700 Hz and the occupied bandwidth of other authorized emissions will not exceed the upper limit of J3E emissions. In specifying these limits, however, no restriction in their extension is implied in so far as emissions other than J3E are concerned, provided that the limits of unwanted emissions are met (see Nos. 27/73 and 27/74). 27/14 On account of the possibility of interference, a given channel should not be used in the same allotment area for radiotelephony and data transmissions. 27/15 The use of channels derived from the frequencies indicated in 27/18 for the various classes of emissions other than J3E and H2B will be subject to special arrangements by the Administrations concerned and affected in order to avoid harmful interference which may result from the simultaneous use of the same channel for several classes of emission.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 3 Reference **3.1.3.1** **Standard**	3.1.3 Assignment of frequencies for aeronautical operational control communications Worldwide frequencies for aeronautical operational control communications are required to enable aircraft operating agencies to meet the obligations prescribed in Annex 6, Part I. Assignment of these frequencies shall be in accordance with the following provisions of Appendix 27: 27/9 A world-wide allotment area is one in which frequencies are allotted to provide long distance communications between an aeronautical station within that allotment area and aircraft operating anywhere in the world.1 27/217 The world-wide frequency allotments appearing in the tables at No. 27/213 and Nos. 27/218 to 27/231, except for carrier (reference) frequencies 3 023 kHz and 5 680 kHz, are reserved for assignment by administrations to stations operating under authority granted by the administration concerned for the purpose of serving one or more aircraft operating agencies. Such assignments are to provide communications between an appropriate aeronautical station and an aircraft station anywhere in the world for exercising control over regularity of flight and for safety of aircraft. Worldwide frequencies are not to be assigned by administrations for MWARA, RDARA and VOLMET purposes. Where the operational area of an aircraft lies wholly within a RDARA or sub-RDARA boundary, frequencies allotted to those RDARAs and sub-RDARAs shall be used. N1. *Tables 27/213 and 27/218 to 27/231 appearing in Appendix 27 to the ITU Radio Regulations refer to, respectively, the Frequency Allotment Plan, listing frequencies by areas, and the Frequency Allotment Plan, listing frequencies in numerical order.*	CV CAR 19, 19.B.110, (a)	No Difference		

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	N2.Guidance material on the assignment of worldwide frequencies is contained in Attachment B. 1 The type of communications referred to in 27/9 may be regulated by administrations.				
Chapter 3 Reference **3.2.1** **Recommendation**	**3.2 NDB frequency management** **Recommendation.**— *NDB frequency management should take into account the following:* a) *the interference protection required at the edge of the rated coverage;* *b) the application of the figures shown for typical ADF equipment;* *c) the geographical spacings and the respective rated coverages;* *d) the possibility of interference from spurious radiation generated by non-aeronautical sources (e.g. electric power services, power line communication systems, industrial radiation, etc.).* N1.*Guidance material to assist in determining the application of the foregoing is given in Attachment A.* *N2.Attention is drawn to the fact that some portions of the bands available for aeronautical beacons are shared with other services.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 3 Reference **3.2.2** **Recommendation**	**Recommendation.—** *To alleviate frequency congestion problems at locations where two separate ILS facilities serve opposite ends of a single runway, the assignment of a common frequency to both of the outer locators should be permitted, and the assignment of a common frequency to both of the inner locators should be permitted, provided that:* *a) the operational circumstances permit;* *b) each locator is assigned a different identification signal; and* *c) arrangements are made whereby locators using the same frequency cannot radiate simultaneously.* *Note.— The Standard in Volume I, 3.4.4.4, specifies the equipment arrangements to be made.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.1.1** **Standard**	**CHAPTER 4. UTILIZATION OF FREQUENCIES ABOVE 30 MHz** *Note.— Details pertaining to the allocation of spectrum to aeronautical services, including footnoted allocations and restrictions, are contained in both the International Telecommunication Union (ITU) Radio Regulations and the ICAO* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718)*. **4.1 Utilization in the frequency band 117.975 – 137.000 MHz** Introduction *Section 4.1 deals with Standards and Recommended Practices (SARPs) relating to the use of the frequency band 117.975 – 137.000 MHz and includes matters pertaining to the selection of particular frequencies for various aeronautical purposes. These SARPs are introduced by the following preface, which sets out the principles upon which the utilization of this frequency band on a worldwide basis with due regard to economy is being planned.* Preface *The utilization of the frequency band 117.975 – 137.000 MHz on a worldwide basis with due regard to economy and practicability requires a plan that will take into account:* *a) the need for an orderly evolution towards improved operation and the required degree of worldwide standardization;* *b) the desirability of providing for an economic transition from present utilization to optimum utilization of the frequencies available, taking into account the maximum possible utilization of existing equipment;* *c) the need to provide for coordination between international and national utilization so as to*	CV CAR 19, 19.B.110, (a)	No Difference		

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	ensure mutual protection from interference; *d) the need for providing a global framework for the coordinated development of Regional Plans;* *e) the need, in certain regions, to have more detailed plans and planning criteria in addition to the provisions in this section;* *f) the desirability of incorporating in any group of frequencies to be used those now in use for international air services;* *g) the need for keeping the total number of frequencies and their grouping in appropriate relation to the airborne equipment known to be widely used by international air services;* *h) a requirement for the provision of single frequency that may be used for emergency purposes on a world-wide basis and, also, in certain regions, for another frequency that may be used as a common frequency for special purposes; and* *i) the need for providing sufficient flexibility to allow for the differences in application necessitated by regional conditions.* *4.1.1* General allotment of frequency band 117.975 – 137.000 MHz *Note.— The plan includes a general Allotment Table that subdivides the complete frequency band 117.975 – 137.000 MHz, the chief subdivisions being the frequency bands allocated to both national and international services, and the frequency bands allocated to national services. Observance of this general subdivision should keep to a minimum the problem of coordinating national and international application.* The block allotment of the frequency band 117.975 – 137.000 MHz shall be as shown in Table 4-1.				

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	Table 4-1. Allotment table *Block allotment of frequencies (MHz)* *Worldwide utilization* *Remarks* a) 118.000 – 121.450 inclusive International and National Aeronautical Mobile Services Specific international allotments will be determined in the light of regional agreement. National assignments are covered by the provisions in 4.1.4.8 and 4.1.4.9. b) 121.500 Emergency frequency See 4.1.3.1. In order to provide a guard band for the protection of the aeronautical emergency frequency, the nearest assignable frequencies on either side of 121.500 MHz are 121.450 MHz and 121.550 MHz c) 121.550 – 121.9917 inclusive International and National Aerodrome Surface Communications Reserved for ground movement, pre-flight checking, air traffic services clearances, and associated operations. d) 122.000 – 123.050 inclusive National Aeronautical Mobile Services Reserved for national allotments. National assignments are covered by the provisions of 4.1.4.8 and 4.1.4.9. e) 123.100 Auxiliary frequency SAR See 4.1.3.4. In order to provide a guard band for the protection of the aeronautical auxiliary frequency, the nearest assignable frequencies on either side of 123.100 MHz are 123.050 MHz and 123.150 MHz. f) 123.150 – 123.6917 inclusive National Aeronautical Mobile Services Reserved for national allotments, with the exception of 123.450 MHz which is also used as				

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	an air-to-air communications channel (see g)). National assignments are covered by the provisions of 4.1.4.8 and 4.1.4.9. g) 123.450 Air-to-air communications Designated for use as provided for in 4.1.3.2. h) 123.700 – 129.6917 inclusive International and National Aeronautical Mobile Services Specific international allotments will be determined in light of regional agreement. National assignments are covered by the provisions in 4.1.4.8 and 4.1.4.9. i) 129.700 – 130.8917 inclusive National Aeronautical Mobile Services Reserved for national allotments but may be used in whole or in part, subject to regional agreement, to meet the requirements mentioned in 4.1.6.1.3. j) 130.900 – 136.875 inclusive International and National Aeronautical Mobile Services Specific international allotments will be determined in light of regional agreement. National assignments are covered by the provisions in 4.1.4.8 and 4.1.4.9. k) 136.900 – 136.975 inclusive International and National Aeronautical Mobile Services Reserved for VHF air-ground data link communications.				

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Chapter 4 Reference **4.1.2.1** **Standard**	**4.1.2** Frequency separation and limits of assignable frequencies *Note.— In the following text, the channel spacing for 8.33 kHz channel assignments is defined as 25 kHz divided by 3 which is 8.333 ... kHz.* In the frequency band 117.975 – 137.000 MHz, the lowest assignable frequency shall be 118.000 MHz and the highest 136.975 MHz.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.2.2** **Standard**	The minimum separation between assignable frequencies in the aeronautical mobile (R) service shall be 8.33 kHz. *Note.— It is recognized that in some regions or areas, 25 kHz channel spacing provides an adequate number of frequencies suitably related to international and national air services and that equipment designed specifically for 25 kHz channel spacing will remain adequate for services operating within such regions or areas. It is further recognized that assignments based on 25 kHz channel spacing as well as 8.33 kHz channel spacing may continue to co-exist within one region or area.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.2.3** **Standard**	Requirements for mandatory carriage of equipment specifically designed for 8.33 kHz channel spacing shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales for the carriage of equipment, including the appropriate lead time. *Note.— No changes will be required to aircraft systems or ground systems operating solely in regions not using 8.33 kHz channel spacing.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.2.4** **Standard**	Requirements for mandatory carriage of equipment specifically designed for VDL Mode 2, VDL Mode 3 and VDL Mode 4 shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales for the carriage of equipment, including the appropriate lead time.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.2.4.1** **Standard**	The agreement indicated in 4.1.2.4 shall provide at least two years' notice of mandatory carriage of airborne systems.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.2.5** **Standard**	In regions where 25 kHz channel spacing (DSB-AM and VHF digital link (VDL)) and 8.33 kHz DSB-AM channel spacing are in operation, the publication of the assigned frequency or channel of operation shall conform to the channel contained in Table 4-1 (*bis*). *Note.— Table 4-1 (*bis*) provides the frequency channel pairing plan which retains the numerical designator of the 25 kHz DSB-AM environment and allows unique identification of a 25 kHz VDL and 8.33 kHz channel.* **Table 4-1 (*bis*). Channelling/frequency pairing** *Frequency (MHz)* *Time slot** *Channel spacing (kHz)* *Channel* 118.0000 25 118.000 118.0000 A 25 118.001 118.0000 B 25 118.002 118.0000 C 25 118.003 118.0000 D 25 118.004 118.0000 8.33 118.005 118.0083 8.33 118.010 118.0167 8.33 118.015	CV CAR 19, 19.B.110, (a)	No Difference		

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	118.0250 A 25 118.021 118.0250 B 25 118.022 118.0250 C 25 118.023 118.0250 D 25 118.024 118.0250 25 118.025 118.0250 8.33 118.030 118.0333 8.33 118.035 118.0417 8.33 118.040 118.0500 25 118.050 118.0500 A 25 118.051 118.0500 B 25 118.052 118.0500 C 25 118.053 118.0500 D 25 118.054				

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	118.0500 8.33 118.055 118.0583 8.33 118.060 118.0667 8.33 118.065 118.0750 A 25 118.071 118.0750 B 25 118.072 118.0750 C 25 118.073 118.0750 D 25 118.074 118.0750 25 118.075 118.0750 8.33 118.080 118.0833 8.33 118.085 118.0917 8.33 118.090				

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	118.1000 25 118.100 etc. * Time slot indication is for VDL Mode 3 channels. (Ref. Annex 10, Volume III, Part I, Chapter 6 for characteristics of VDL Mode 3 operation)				

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Chapter 4 Reference **4.1.3.1.1** **Standard**	4.1.3 Frequencies used for particular functions *4.1.3.1 Emergency channel* The emergency channel (121.500 MHz) shall be used only for genuine emergency purposes, as broadly out-lined in the following: a) to provide a clear channel between aircraft in distress or emergency and a ground station when the normal channels are being utilized for other aircraft; b) to provide a VHF communication channel between aircraft and aerodromes, not normally used by international air services, in case of an emergency condition arising; c) to provide a common VHF communication channel between aircraft, either civil or military, and between such aircraft, and surface services, involved in common search and rescue operations, prior to changing when necessary to the appropriate frequency; d) to provide air-ground communication with aircraft when airborne equipment failure prevents the use of the regular channels; e) to provide a channel for the operation of emergency locator transmitters (ELTs), and for communication between survival craft and aircraft engaged in search and rescue operations; f) to provide a common VHF channel for communication between civil aircraft and intercepting aircraft or intercept control units and between civil or intercepting aircraft and air traffic services units in the event of interception of the civil aircraft. N1.*The use of the frequency 121.500 MHz for the purpose outlined in c) is to be avoided if it interferes in any way with the efficient handling of distress traffic*.	CV CAR 19, 19.B.110, (a)	No Difference		

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	N2.The ITU Radio Regulations (RR 5.200) permit the use of the aeronautical emergency frequency 121.500 MHz by mobile stations of the maritime mobile service under the conditions laid down in Article 31 of the Radio Regulations for distress and safety purposes with stations of the aeronautical mobile service.				
Chapter 4 Reference **4.1.3.1.2** **Standard**	The frequency 121.500 MHz shall be provided at: a) all area control centres and flight information centres; b) aerodrome control towers and approach control offices serving international aerodromes and international alternate aerodromes; and c) any additional location designated by the appropriate ATS authority, where the provision of that frequency is considered necessary to ensure immediate reception of distress calls or to serve the purposes specified in 4.1.3.1.1. *Note.— Where two or more of the above facilities are collocated, provision of 121.500 MHz at one would meet the requirement.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.1.3** **Standard**	The frequency 121.500 MHz shall be available to intercept control units where considered necessary for the purpose specified in 4.1.3.1.1 f).	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.1.4** **Standard**	The emergency channel shall be guarded continuously during the hours of service of the units at which it is installed.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.3.1.5** **Standard**	The emergency channel shall be guarded on a single channel simplex operation basis.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.1.6** **Standard**	The emergency channel (121.500 MHz) shall be available only with the characteristics as contained in Annex 10, Volume III, Part II, Chapter 2 (25 kHz).	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.2.1** **Standard**	*4.1.3.2 Air-to-air communications channel* An air-to-air VHF communications channel on the frequency of 123.450 MHz shall be designated to enable aircraft engaged in flights over remote and oceanic areas out of range of VHF ground stations to exchange necessary operational information and to facilitate the resolution of operational problems. *Note.— Use of the air-to-air channel can cause interference to and from aircraft using the same frequency for air-ground communications.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.2.2** **Standard**	In remote and oceanic areas out of range of VHF ground stations, the air-to-air VHF communications channel on the frequency 123.450 MHz shall be available only with the characteristics as contained in Annex 10, Volume III, Part II, Chapter 2 (25 kHz).	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.3.3.1** **Standard**	*4.1.3.3 Common signalling channels for VDL* *Common signalling channel VDL Mode 2.* The frequency 136.975 MHz is reserved on a worldwide basis to provide a common signalling channel (CSC) to the VHF digital link Mode 2 (VDL Mode 2). This CSC uses the Mode 2 VDL modulation scheme and carrier sense multiple access (CSMA).	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.3.2** **Standard**	*Common signalling channels VDL Mode 4.* In areas where VDL Mode 4 is implemented, the frequencies 136.925 MHz and 113.250 MHz shall be provided as common signalling channels (CSCs) to the VHF digital link Mode 4 (VDL Mode 4). These CSCs use the VDL Mode 4 modulation scheme.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.4.1** **Standard**	*4.1.3.4 Auxiliary frequencies for search and rescue operations* Where a requirement is established for the use of a frequency auxiliary to 121.500 MHz, as described in 4.1.3.1.1 c), the frequency 123.100 MHz shall be used.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.3.4.2** **Standard**	The auxiliary search and rescue channel (123.100 MHz) shall be available only with the characteristics as contained in Annex 10, Volume III, Part II, Chapter 2 (25 kHz). *Note.— The ITU Radio Regulations (RR 5.200) permit the use of the aeronautical auxiliary frequency 123.100 MHz by mobile stations of the maritime mobile service under the conditions laid down in Article 31 of the Radio Regulations for distress and safety purposes with stations of the aeronautical mobile service.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.4.1** **Standard**	4.1.4 Provisions concerning the deployment of VHF frequencies and the avoidance of harmful interference *Note.— In this section, the protected service volume of each facility is meant in the sense of avoidance of harmful interference.* The geographical separation between facilities operating on the same frequency shall, except where there is an operational requirement for the use of common frequencies for groups of facilities, be such that the protected service volume of one facility is separated from the protected service volume of the other facility by a distance not less than that required to provide a desired to undesired signal ratio of 20 dB or by a separation distance not less than the sum of the distances to the associated radio horizon of each service volume, whichever is smaller.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.4.2** **Standard**	For areas where frequency assignment congestion is severe or is anticipated to become severe, the geographical separation between facilities operating on the same frequency shall, except where there is an operational requirement for the use of common frequencies for groups of facilities, be such that the protected service volume of one facility is separated from the protected service volume of the another facility by a distance not less than that required to provide a desired to undesired signal ratio of 14 dB or by a separation distance not less than the sum of the distances to the associated radio horizon of each service volume, whichever is smaller. This provision shall be implemented on the basis for a regional air navigation agreement. N1.*Guidance material relating to the establishment of the minimum separation distance based on the desired to undesired signal protection ratio of 20 dB or 14 dB and radio line-of-sight is contained in Volume II of the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718).* *N2.The application of the minimum separation distance based on the sum of the radio horizon distance of each facility assumes that it is highly unlikely that two aircraft will be at the closest points between and at the maximum altitude of the protected service volume of each facility.* *N3.The distance to the radio horizon from a station in an aircraft is normally given by the formula:* $D = k \sqrt{h}$ *where* D = *distance in nautical miles;* h = *height of the aircrft station above earth;* K = *(corresponding to an effective earth's radius of 4/3 of the actual radius);* = 2.22 when h is expressed in metres; and = 1.23 when h is expressed in feet.	CV CAR 19, 19.B.110, (a)	No Difference		

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	N4. *In calculating the radio line-of-sight distance between a ground station and an aircraft station, the distance from the radio horizon of the aircraft station computed from Note 3 must be added to the distance from the radio horizon of the ground station. In calculating the latter, the same formula is employed, taking for* h *the height of the ground station transmitting antenna*. *N5.The criteria contained in 4.1.4.1 and 4.1.4.2 are applicable in establishing minimum geographical separation between VHF facilities, with the object of avoiding co-channel air-to-air interference. Guidance material relating to the establishment of separation distances between ground stations and between aircraft and ground stations for co-channel operations is contained in the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718).*				
Chapter 4 Reference **4.1.4.3** **Standard**	The geographical separation between facilities operating on adjacent channels shall be such that points at the edge of the protected service volume of each facility are separated by a distance sufficient to ensure operations free from harmful interference. *Note.— Guidance material covering separation distances and related system characteristics is contained in the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718).*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.4.4** **Standard**	The protection height shall be a height above a specified datum associated with a particular facility, such that below it harmful interference is improbable.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.4.5** **Standard**	The protection height to be applied to functions or to specific facilities shall be determined regionally, taking into consideration the following factors: a) the nature of the service to be provided; b) the air traffic pattern involved; c) the distribution of communication traffic; d) the availability of frequency channels in airborne equipment; e) probable future developments.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.4.6** **Recommendation**	**Recommendation.—** *Where the protected service volume is less than operationally desirable, separation between facilities operating on the same frequency should not be less than that necessary to ensure that an aircraft at the upper edge of the operational service volume of one facility does not come above the radio horizon with respect to emissions belonging to the service of adjacent facilities.* *Note.— The effect of this recommendation is to establish a geographical separation distance below which harmful interference is probable.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.4.7** **Standard**	The geographical separation between VHF VOLMET stations shall be determined regionally and shall be such that operations free from harmful interference are secured throughout the protected service volume of each VOLMET station. *Note.— Guidance material on the interpretation of 4.1.4.7 is contained in the* Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies *(Doc 9718).*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.4.8** **Standard**	In the frequency band 117.975 – 137.000 MHz, the frequencies used for National Aeronautical Mobile Services, unless worldwide or regionally allotted to this specific purpose, shall be so deployed that no harmful interference is caused to facilities in the International Aeronautical Mobile Services.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.4.9** **Recommendation**	**Recommendation.—** *The problem of inter-State interference should be resolved by consultation between the States concerned.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.4.10** **Standard**	The communication coverage provided by a VHF ground transmitter shall, in order to avoid harmful interference to other stations, be kept to the minimum consistent with the operational requirement for the function.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.5.1** **Standard**	4.1.5 Method of operation Single channel simplex operation shall be used in the frequency band 117.975 – 137.000 MHz at all stations providing service for aircraft engaged in international air navigation.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.5.2** **Standard**	In addition to the above, the ground-to-air voice channel associated with an ICAO standard radio navigational aid may be used, subject to regional agreement, for broadcast or communication purposes or both.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.6.1** **Standard**	The frequencies in the band 117.975 – 137.000 MHz for use in the aeronautical mobile (R) service shall be selected from the lists in 4.1.6.1.1. N1.*The frequencies 136.500 – 136.975 MHz inclusive are not available for assignment to channels of less than 25 kHz width.* *N2.Services that continue operation using 25 kHz assignments will be protected in regions implementing 8.33 kHz channel spacing.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.1.6.1.2** **Recommendation**	*4.1.6.1.1 List of assignable frequencies* List A – assignable frequencies in regions or areas where 25 kHz frequency assignments are deployed 118.000 – 121.450 MHz in 25 kHz steps 121.550 – 123.050 MHz in 25 kHz steps 123.150 – 136.975 MHz in 25 kHz steps List B – assignable frequencies in regions or areas where 8.33 kHz frequency assignments are deployed 118.000 – 121.450 MHz in 8.33 kHz steps 121.550 – 123.050 MHz in 8.33 kHz steps 123.150 – 136.475 MHz in 8.33 kHz steps **Recommendation.—** *Frequencies for operational control communications may be required to enable aircraft operating agencies to meet the obligations prescribed in Annex 6, Part I, in which case they should be selected from a dedicated band which is determined regionally*. *Note.— It is recognized that the assignment of such frequencies and the licensing of the operation of the related facilities are matters for national determination. However, in regions where a problem exists with respect to the provision of frequencies for operational control purposes, it may be advantageous if States endeavour to coordinate the requirements of aircraft operating agencies for such channels prior to regional meetings*.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.1.6.2** **Standard**	The frequencies that may be allotted for use in the aeronautical mobile (R) service in a particular region shall be limited to the number determined as being necessary for operational needs in the region. *Note.— The number of frequencies required in a particular region is normally determined by the Council on the recommendations of Regional Air Navigation Meetings*.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.2.1** **Standard**	**4.2 Utilization in the band 108 – 117.975 MHz** The block allotment of the frequency band 108 – 117.975 MHz shall be as follows: *Band 108 – 111.975 MHz:* a) ILS in accordance with 4.2.2 and Annex 10, Volume I, 3.1.3; b) VOR provided that: 3) no harmful adjacent channel interference is caused to ILS; 4) only frequencies ending in either *even tenths* or *even tenths plus a twentieth* of a megahertz are used. e) GNSS ground-based augmentation system (GBAS) in accordance with Annex 10, Volume I, 3.7.3.5, provided that no harmful interference is caused to ILS and VOR. *Note.— ILS/GBAS geographical separation criteria and geographical separation criteria for GBAS and VHF communication services operating in the 118 – 137 MHz band are under development. Until these criteria are defined and included in the SARPs, it is intended that frequencies in the band 112.050 – 117.900 MHz will be used for GBAS assignments.* *Band 111.975 – 117.975 MHz:* f) VOR; g) GNSS ground-based augmentation system (GBAS) in accordance with Annex 10, Volume I, 3.7.3.5, provided that no harmful interference is caused to VOR. N1.*Guidance material relating to the distance separation required to prevent harmful interference between ILS and VOR when using the band 108 – 111.975 MHz is found in Section 3 of Attachment C to Annex 10, Volume I.* *N2.Guidance material relating to the distance*	CV CAR 19, 19.B.110, (a)	No Difference		

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	separation required to prevent harmful interference between VOR and GBAS when using the band 112.050 – 117.900 MHz is found in Section 7.2.1 of Attachment D to Annex 10, Volume I.				
Chapter 4 Reference **4.2.2** **Standard**	For regional assignment planning, the frequencies for ILS facilities shall be selected in the following order: a) localizer channels ending in *odd tenths* of a megahertz and their associated glide path channels; b) localizer channels ending in *odd tenths plus a twentieth* of a megahertz and their associated glide path channels.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.2.2.1** **Standard**	ILS channels identified by localizer frequencies ending in an *odd tenth plus one twentieth* of a megahertz in the band 108 – 111.975 MHz shall be permitted to be utilized on the basis of regional agreement when they become applicable in accordance with the following: a) for restricted use commencing 1 January 1973; b) for general use on or after 1 January 1976. *Note.— See Note to 4.2.3.1.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.2.3** **Standard**	For regional assignment planning, the frequencies for VOR facilities shall be selected in the following order: a) frequencies ending in *odd tenths* of a megahertz in the band 111.975 – 117.975 MHz; b) frequencies ending in *even tenths* of a megahertz in the band 111.975 – 117.975 MHz; c) frequencies ending in *even tenths* of a megahertz in the band 108 –111.975 MHz; d) frequencies ending in *50 kHz* in the band 111.975 – 117.975 MHz, except as provided in 4.2.3.1; e) frequencies ending in *even tenths plus a twentieth* of a megahertz in the band 108 – 111.975 MHz except as provided in 4.2.3.1.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.2.3.1** **Standard**	Frequencies for VOR facilities ending in *even tenths plus a twentieth* of a megahertz in the band 108 – 111.975 MHz and all frequencies ending in *50 kHz* in the band 111.975 – 117.975 MHz shall be permitted to be utilized on the basis of a regional agreement when they have become applicable in accordance with the following: a) in the band 111.975 – 117.975 MHz for restricted use; b) for general use in the band 111.975 – 117.975 MHz at a date fixed by the Council but at least one year after the approval of the regional agreement concerned; c) for general use in the band 108 – 111.975 MHz at a date fixed by the Council but giving a period of two years or more after the approval of the regional agreement concerned. *Note.— "Restricted use", where mentioned in 4.2.2.1. a) and 4.2.3.1 a), is intended to refer to the limited use of the frequencies by only suitably equipped aircraft and in such a manner that:* *d) the performance of ILS or VOR equipment not capable of operating on these frequencies will be protected from harmful interference;* *e) a general requirement for the carriage of ILS or VOR airborne equipment capable of operation on these frequencies will not be imposed; and* *f) operational service provided to international operators using 100 kHz airborne equipment is not derogated.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.2.4** **Standard**	To protect the operation of airborne equipment during the initial stages of deploying VORs utilizing 50 kHz channel spacing in an area where the existing facilities may not fully conform with the Standards in Annex 10, Volume I, Chapter 3, all existing VORs within interference range of a facility utilizing 50 kHz channel spacing shall be modified to comply with the provisions of Annex 10, Volume I, 3.3.5.7.	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.2.5** **Standard**	*Frequency deployment.* The geographical separation between facilities operating on the same and adjacent frequencies shall be determined regionally and shall be based on the following criteria: a) the required functional service radii of the facilities; b) the maximum flight altitude of the aircraft using the facilities; c) the desirability of keeping the minimum IFR altitude as low as the terrain will permit. *Note.— Guidance material on this subject is contained in the Attachments to this Annex.*	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.2.6** **Recommendation**	**Recommendation.—** *To alleviate frequency congestion problems at locations where two separate ILS facilities serve opposite ends of the same runway or different runways at the same airport, the assignment of identical ILS localizer and glide path paired frequencies should be permitted provided that:* a) *the operational circumstances permit;* *b) each localizer is assigned a different identification signal; and* *c) arrangements are made whereby the localizer and glide path not in operational use cannot radiate.* *Note.— The Standards in Annex 10, Volume I, 3.1.2.7.2 and 3.1.3.9, specify the equipment arrangements to be made.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.3.1** **Standard**	**4.3 Utilization in the band 960 – 1 215 MHz for DME** *Note.— Guidance on the frequency planning of channels for DME systems is given in Annex 10, Volume I, Attachment C, Section 7.* DME operating channels bearing the suffix "X" or "Y" in Table A, Chapter 3 of Annex 10, Volume I shall be chosen on a general basis without restriction. *Note.— The channel pairing plan provides for the use of certain Y channels with either VOR or MLS. The guidance material in Annex 10, Volume I, Attachment C, Section 7, includes specific provisions relating to situations where the same, or adjacent channel, is used in the same area for both systems.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.3.2** **Standard**	DME channels bearing the suffix "W" or "Z" in Table A, Chapter 3 of Annex 10, Volume I, shall be chosen on the basis of regional agreement when they become applicable in accordance with the following: a) for restricted regional use on or after, whichever is the later: 1) 1 January 1989; or 2) a date prescribed by the Council giving a period of two years or more following approval of the regional agreement concerned; b) for general use on or after, whichever is the later: 3) 1 January 1995; or 4) a date prescribed by the Council giving a period of two years or more following approval of the regional agreement concerned. *Note.— "Restricted use" is intended to refer to the limited use of the channel by only suitably equipped aircraft and in such a manner that:* *e) the performance of existing DME equipment not capable of operating on these multiplexed channels will be protected from harmful interference;* *f) a general requirement for the carriage of DME airborne equipment capable of operating on these multiplexed channels will not be imposed; and* *g) operational service provided to international operators using existing DME equipment without the multiplexed channel capability is not derogated.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.3.3** **Standard**	For regional assignment planning, the channels for DME associated with MLS shall be selected from Table 4-2. *Group DME channels Associated paired VHF channels Remarks Assignment procedure* 1 EVEN 18X to 56X ILS 100 kHz spacings Would normally be used if a single DME is paired with ILS and is part of MLS for general use (see 4.3.1) 2 EVEN 18Y to 56Y ILS 50 kHz spacings for general use (see 4.3.1) 3 EVEN 80Y to 118Y VOR 50 kHz spacings Odd tenths of a MHz for general use (see 4.3.1) 4 ODD 17Y to 55Y VOR 50 kHz spacings for general use (see 4.3.1) 5 ODD 81Y to 119Y VOR 50 kHz spacings Even tenths of a MHz for general use (see 4.3.1) 6 EVEN 18W to 56W No associated paired VHF channel for later use (see 4.3.2) 7 EVEN 18Z to 56Z No associated paired VHF channel for later use (see 4.3.2) 8 EVEN 80Z to 118Z No associated paired VHF channel for later use (see 4.3.2) 9 ODD 17Z to 55Z No associated paired VHF channel for later use (see 4.3.2) 10 ODD 81Z to 119Z No associated paired VHF channel for later use (see 4.3.2 *Note.– DME channels in Groups 1 and 2 may be used in association with ILS and/or MLS. DME channels in Groups 3,4 and 5 may be used in association with VOR or MLS.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.3.3.1** **Standard**	*Groups 1 to 5.* These DME channels shall be permitted to be used generally. In selecting channels for assignment purposes the following rules are applicable: a) when an MLS/DME is intended to operate on a runway in association with an ILS, the DME channel, if possible, shall be selected from Group 1 or 2 and paired with the ILS frequency as indicated in the DME channelling and pairing table in Table A of Annex 10, Volume I, Chapter 3. In cases where the composite frequency protection cannot be satisfied for all three components, the MLS channel may be selected from Group 3, 4 or 5; b) when an MLS/DME is intended to operate on a runway without the coexistence of an ILS, the DME channel to be used shall preferably be selected from Group 3, 4 or 5.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.3.3.2** **Standard**	*Groups 6 to 10.* These DME channels shall be permitted to be used on the basis of a regional agreement when they have become applicable in accordance with the conditions specified at 4.3.2.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.3.4** **Recommendation**	**Recommendation.—** *Coordination of regional DME channel assignments should be effected through ICAO.*	CV CAR 19, 19.B.110, (a)	No Difference		

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Chapter 4 Reference **4.4.1** **Standard**	**4.4 Utilization in the band 5 030.4 – 5 150.0 MHz** **N1.***Guidance material on the frequency protection planning of MLS facilities is contained in Attachment G to Annex 10, Volume I.* *N2.Guidance on determining coordination distances between MLS facilities and ground stations providing feeder links to non-geostationary mobile satellites is contained in ITU-R Recommendation S.1342.* The MLS channels shall be selected from Table A, Chapter 3 of Annex 10, Volume I.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.4.2** **Standard**	For regional planning purposes MLS channels shall be selected in accordance with the conditions specified in 4.3.3 for the associated DME facility.	CV CAR 19, 19.B.110, (a)	No Difference		
Chapter 4 Reference **4.4.3** **Standard**	Channel assignments in addition to those specified in 4.4.1 shall be made within the 5 030.4 – 5 150.0 MHz sub-band as necessary to satisfy future air navigation requirements.	CV CAR 19, 19.B.110, (a)	No Difference		

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