Air Navigation Order (ANO)
For
Aeronautical Radio frequency Spectrum Utilization

ANO (COM) A.5

FIRST EDITION

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CIVIL AVIATION AUTHORITY
BANGLADESH

RECORD OF AMENDMENTS AND CORRIGENDA

Amendments and Corrigenda to ANO (COM) A.5 are issued by the Chairman of the Civil Aviation Authority, Bangladesh. The space below is provided to keep records of such amendments. The amendment number and effective date are printed on each revised (replacement) or additional page(s).

Amendment			
No.	Date applicable	Date entered	Entered by

Corrigenda			
No.	Date applicable	Date entered	Entered by

FOREWORDS

1. Article 28 (Air navigation facilities and standard systems) of the Convention on International Civil Aviation requires each Contracting State to provide, in its territory, airports, radio services, meteorological services and other air navigation services to facilitate international air navigation, in accordance with the standards and recommended practices established from time to time, pursuant to this Convention.

2. Under article 37 (Adoption of international Standards and Procedures) of the Convention, each Contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation.

3. To this end, the International Civil Aviation Organization (ICAO) adopts and amends from time to time, as may be necessary, international standards and recommended practices and procedures dealing with aeronautical radio frequency spectrum utilization in ICAO Annex 10, Volume V.

4. In exercise of the powers conferred by Rule 4 of the Civil Aviation Rules 1984 and to give effect to Rule 225, the Chairman of Civil Aviation Authority, Bangladesh is pleased to issue the following Air Navigation Orders relating to aeronautical radio frequency spectrum utilization in order to give effect to the Convention.

5. ANO (COM) A.5 contains the national Standards and Recommendations for utilization of aeronautical frequencies and is applicable to all concerned air navigation service providers.

6. This order shall have immediate effect.

15.02.2009

Chairman
Civil Aviation Authority
Bangladesh

COMPONENT PARTS

ANO (COM) A.5 is made up of the following component parts. These parts comprise the ANO (COM) A.5 proper.

(a) Standards and Recommendations as defined bellow:

Standard: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of air navigation and to which concerned operators (aerodrome operator and/or aeronautical service provider) will conform; in the event of impossibility of compliance, notification to the Chairman, Civil Aviation Authority, Bangladesh is compulsory.

Recommendation: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of air navigation, and to which concerned operators (aerodrome operator and/or aeronautical service provider) will endeavour to conform.

(b) **Appendices** comprising material grouped separately for convenience but forming part of the Standards and Recommendations.

(c) **Notes** included in the text, where appropriate, to give factual information or references bearing on the Standards or Recommendations in question, but not constituting part of the Standards or Recommendations.

(d) **Definitions** of terms used in the Standards and Recommendations which are not self-explanatory in that they do not have accepted dictionary meanings. A definition does not have independent status but is an essential part of each Standard and Recommendation in which the term is used, since a change in the meaning of the term would affect the specification.

(e) **Tables and Figures** which add to or illustrate a Standard or Recommendation and which are referred to therein, form part of the associated Standard or Recommendation and have the same status.

EDITORIAL PRACTICES

(a) The following practice is adhered to in order to indicate at a glance the status of each statement:

Standards are printed in light face roman;

Recommendations are printed in light face italics, the status being indicated by the prefix Recommendation; and

Notes are printed in light face italics, the status being indicated by the prefix Note.

(b) The following editorial practice is followed in the writing of specifications:

for **Standards** the operative verb "shall" is used; and

for **Recommendations** the operative verb "should" is used.

(c) Any reference to a portion of this document, which is identified by a number and/or title, includes all subdivisions of that portion.

PROMULGATION OF INFORMATION

The establishment and withdrawal of and changes to facilities, services and procedures affecting aircraft operations provided in accordance with the Standards and Recommendations specified in this ANO (COM) A.5, should be notified and take effect in accordance with the provisions of the Civil Aviation Rules 1984, Part XV and the Air Navigation Order Number ANO (AIS) A.1.

REFERENCES

Guidance material on deployment of frequencies, geographical separation criteria, avoidance of harmful interference etc. can be found in the *Annex 10* to the Convention on International Civil Aviation, Volume V, Attachments A through C, Second Edition, July 2001.

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CHAPTER 1
DEFINITIONS

When the following terms are used in this volume, they have the following meanings:

Alternative means of communication. A means of communication provided with equal status, and in addition to the primary means.

Double channel simplex. Simplex using two frequency channels, one in each direction.

Note.— This method was sometimes referred to as crossband.

Duplex. A method in which telecommunication between two stations can take place in both directions simultaneously.

Frequency channel. A continuous portion of the frequency spectrum appropriate for a transmission utilizing a specified class of emission.

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.

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.

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.

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.

Single channel simplex. Simplex using the same frequency channel in each direction.

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.

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CHAPTER 2
DISTRESS FREQUENCIES

2.1 Frequencies for emergency locator transmitters (ELTs) for search and rescue

2.1.1 Until 1 January 2005 emergency locator transmitters carried in compliance with the Civil Aviation Rules 1984, Part VI shall operate either on both 406 MHz and 121.5 MHz or on 121.5 MHz.

2.1.2 All emergency locator transmitters installed on or after 1 January 2002 and carried in compliance with the Civil Aviation Rules 1984, Part VI shall operate on both 406 MHz and 121.5 MHz.

2.1.3 From 1 January 2005, emergency locator transmitters carried in compliance with the Civil Aviation Rules 1984, Part VI shall operate on both 406 MHz and 121.5 MHz.

Note .— Specifications for ELTs are found in ANO (COM) A.3, Part II, Chapter 5.

2.2 Search and rescue frequencies

2.2.1 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.

2.2.2 **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.

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CHAPTER 3
UTILIZATION OF FREQUENCIES BELOW 30 MHZ

3.1 Method of operations

3.1.1 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.

3.1.2 Assignment of single sideband channels

3.1.2.1 Single sideband channels shall be assigned in accordance with ANO (COM) A.3, Part II, Chapter 2, 2.4.

3.1.2.2 For the operational use of the channels concerned administrations shall take into account the provisions of S27/19 of Appendix S27 of the ITU Radio Regulations.

3.1.2.3 **Recommendation**.— *The use of aeronautical mobile (R) frequencies below 30 MHz for international operations should be coordinated as specified in Appendix S27 of the ITU Radio Regulations as follows:*

S27/19 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.

3.1.2.4 **Recommendation**.— *Where international operating requirements for HF communications cannot be satisfied by the Frequency Allotment Plan at Part 2 of Appendix S27 to the Radio Regulations, an appropriate frequency may be assigned as specified in Appendix S27 by the application of the following provisions:*

S27/20 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 S27 relates to Interference Range Contours, and application of the procedure results in a protection ratio of 15 dB.

S27/21 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.

S27/22 The co-ordination described in No. S27/21 shall be effected where appropriate and desirable for the efficient utilization of the frequencies in question, and especially when the procedures of No. S27/19 are unsatisfactory.

3.1.2.5 The use of classes of emission J7B and J9B shall be subject to the following provisions of Appendix S27:

S27/12 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. S27/73 and S27/74).

S27/14 On account of the possibility of interference, a given channel should not be used in the same allotment area for radiotelephony and data transmissions. S27/15 The use of channels derived from the frequencies indicated in S27/18 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.

3.1.3 Assignment of frequencies for aeronautical operational control communications

3.1.3.1 Worldwide frequencies for aeronautical operational control communications are required to enable aircraft operating agencies to meet the obligations prescribed in the Civil Aviation Rules 1984, Part VI. Assignment of these frequencies shall be in accordance with the following provisions of Appendix S27:

S27/9 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.*

S27/217 The world-wide frequency allotments appearing in the tables at No. S27/213 and Nos. S27/218 to S27/231, 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. World-wide 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.

Note 1.— Tables S27/213 and S27/218 to S27/231 appearing in Appendix S27 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.

3.2 NDB frequency management

3.2.1 **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.).

Note.— Attention is drawn to the fact that some portions of the bands available for aeronautical beacons are shared with other services.

3.2.2 **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 ANO (COM) A.1, 3.4.4.4, specifies the equipment arrangements to be made.

***** The type of communications referred to in S27/9 may be regulated by administrations.

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CHAPTER 4
UTILIZATION OF FREQUENCIES ABOVE 30 MHZ

4.1 Utilization in the band 117.975 – 137 MHz

Preface

The utilization of VHF 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 ensure mutual protection from interference;

d) the need for providing a framework for the integrated development of Regional Plans;

e) the desirability of incorporating in any group of frequencies to be used those now in use for international air services;

f) 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;

g) a requirement for the provision of a single frequency that may be used for emergency purposes on a worldwide basis and, also, in certain regions, for another frequency that may be used as a common frequency for special purposes; and

h) 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 MHz

Note.— The plan includes a general Allotment Table that subdivides the complete band 117.975 – 137 MHz, the chief subdivisions being the bands of frequencies allocated to both national and international services, and the bands allocated to national services. Observance of this general subdivision should keep to a minimum the problem of coordinating national and international application.

4.1.1.1 The block allotment of the frequency band 117.975 – 137 MHz shall be as shown in Table 4-1.

4.1.1.2 **Recommendation**.— *In the case of the band 136 – 137 MHz, international applications have not yet been agreed, and these frequencies should be brought into use on a regional basis where and in the manner required.*

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.

4.1.2.1 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, 100 kHz, 50 kHz or 25 kHz channel spacing provides an adequate number of frequencies suitably related to international and national air

services and that equipment designed specifically for 100 kHz, 50 kHz or 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.

4.1.2.2 Until at least 1 January 2005, DSB-AM equipment specifically designed for 25 kHz channel spacing shall be safeguarded with respect to its suitability for the aeronautical mozbile (R) service (AM(R)S) except in those regions or areas where regional agreement permits the use of equipment specifically designed for 8.33 kHz channel spacing or for VDL Mode 3 when used for air-ground voice communications.

Table 4-1. Allotment table

Block allotment of frequencies (MHz)	*Worldwide utilization*	*Remarks*
a) 118 – 121.4 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 4.1.5.9.
b) 121.5	Emergency frequency	In order to provide a guard band for the protection of the aeronautical emergency frequency, the nearest assignable frequencies on either side of 121.5 MHz are 121.4 MHz and 121.6 MHz, except that by regional agreement it may be decided that the nearest assignable frequencies are 121.3 MHz and 121.7 MHz.
c) 121.6 – 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 – 123.05 inclusive	National Aeronautical Mobile Services	Reserved for national allotments.
e) 123.1	Auxiliary frequency SAR	See 4.1.4.1.
f) 123.15 – 123.6917 inclusive	National Aeronautical Mobile Services	Reserved for national allotments, with the exception of 123.45 MHz which is also used as the worldwide air-to-air communications channel (see g)).
g) 123.45	Air-to-air communications	Designated for use as provided for in 4.1.3.2.1.
h) 123.7 – 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 4.1.5.9.
i) 129.7 – 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 4.1.8.1.3.
j) 130.9 – 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 4.1.5.9. (See the Introduction to 4.1 regarding the band 132 – 137 MHz.)
k) 136.9 – 136.975 inclusive	International and National Aeronautical Mobile Services	Reserved for VHF air-ground data link communications.

4.1.2.2.1 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.

4.1.2.2.2 Until at least 1 January 2005, equipment specifically designed for 8.33 kHz channel spacing shall be safeguarded with respect to its suitability for the AM(R)S.

4.1.2.2.3 Requirements for mandatory carriage of equipment specifically designed for 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.

4.1.2.2.3.1 The agreement indicated in 4.1.2.2.3 shall provide at least two years' notice of mandatory carriage of airborne systems.

4.1.2.2.4 Until at least 1 January 2010, equipment specifically designed to the VDL Mode 3 and VDL Mode 4 SARPs shall be safeguarded with respect to its suitability for the AM(R)S.

4.1.2.3 In the band 117.975 – 137 MHz, the lowest assignable frequency shall be 118 MHz and the highest 136.975 MHz.

4.1.2.4 In regions where 25 kHz channel spacing (DSBAM 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.

4.1.3 Frequencies used for particular functions

4.1.3.1 Emergency channel

4.1.3.1.1 The emergency channel (121.5 MHz) shall be used only for genuine emergency purposes, as broadly outlined 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.

Note 1.— The use of the frequency 121.5 MHz for the purpose outlined in c) is to be avoided if it interferes in any way with the efficient handling of distress traffic.

Note 2.— The current Radio Regulations make provisions that the aeronautical emergency frequency 121.5 MHz may also be used by mobile stations of the maritime mobile service, using A3E emission to communicate on this frequency for safety purposes with stations of the aeronautical mobile service (RR S5.200 and Appendix S13, Part A2).

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
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
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
118.1000		25	118.100

Etc.

* Time slot indication is for VDL Mode 3 channels.

4.1.3.1.2 The frequency 121.5 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 121.5 MHz at one would meet the requirement.

4.1.3.1.3 The frequency 121.5 MHz shall be available to intercept control units where considered necessary for the purpose specified in 4.1.3.1.1 f).

4.1.3.1.4 The emergency channel shall be guarded continuously during the hours of service of the units at which it is installed.

4.1.3.1.5 The emergency channel shall be guarded on a single channel simplex operation basis.

4.1.3.1.6 The emergency channel (121.5 MHz) shall be available only with the characteristics as contained in ANO (COM) A.3, Part II, Chapter 2.

4.1.3.2 Air-to-air communications channel

4.1.3.2.1 An air-to-air VHF communications channel on the frequency of 123.45 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.

4.1.3.2.2 In remote and oceanic areas out of range of VHF ground stations, the air-to-air VHF communications channel on the frequency 123.45 MHz shall be available only with the characteristics as contained in ANO (COM) A.3, Part II, Chapter 2.

4.1.3.3 *Common signalling channel.* The frequency 136.975 MHz is reserved on a worldwide basis to provide a common signalling channel (CSC) to the VHF digital link (VDL). This CSC uses the Mode 2 VDL modulation scheme and carrier sense multiple access (CSMA).

4.1.4 Auxiliary frequencies for search and rescue operations

4.1.4.1 Where a requirement is established for the use of a frequency auxiliary to 121.5 MHz, as described in 4.1.3.1.1 c), the frequency 123.1 MHz shall be used.

4.1.4.2 The auxiliary search and rescue channel (123.1 MHz) shall be available only with the characteristics as contained in ANO (COM) A.3, Part II, Chapter 2.

4.1.5 Provisions concerning the deployment of VHF frequencies and the avoidance of harmful interference

4.1.5.1 In the case of those VHF facilities providing service up to the radio horizon, the geographical separation between facilities working 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 points at the protection heights and at the limit of the functional service range of each facility are separated by distances not less than that required to provide a desired to undesired signal ratio of 14 dB. This provision shall be implemented on the basis of a regional air navigation

agreement. For areas where frequency assignment congestion is not severe or is not anticipated to become severe, a 20 dB (10 to 1 distance ratio) separation criteria or radio line-ofsight (RLOS) separation criteria (whichever is smaller) may be used.

4.1.5.2 In the case of those VHF facilities providing service beyond the radio horizon, except where there is an operational requirement for the use of common frequencies for groups of facilities, planning for co-channel operations shall be such that points at the protection heights and at the limits of the functional service area of each facility are separated by distances not less than the sum of distances from each point to its associated radio horizon.

4.1.5.3 The geographical separation between facilities working on adjacent channels shall be such that points at the protection heights and at the limit of the functional service range of each facility are separated by a distance sufficient to ensure operations free from harmful interference.

4.1.5.4 The protection height shall be a height above a specified datum associated with a particular facility, such that below it harmful interference is improbable.

4.1.5.5 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.

4.1.5.6 **Recommendation**.— *Where the protection heights determined are less than those operationally desirable, separation between facilities operating on the same frequency should not be less than that necessary to ensure that an aircraft at the limit of the functional service range and the operationally desirable protection height of one facility does not come above the radio horizon with respect to adjacent facilities.*

Note.— The effect of this recommendation is to establish a geographical separation distance below which harmful interference is probable.

4.1.5.7 The geographical separation between VHF VOLMET stations shall be determined regionally and, generally, shall be such that operations free from harmful interference are secured at the highest altitude flown by aircraft in the area concerned.

4.1.5.8 Frequencies in the aeronautical mobile VHF band used for national services, unless worldwide or regionally allotted to this specific purpose, shall be so deployed that minimum interference is caused to facilities for the international air services in this band.

4.1.5.9 **Recommendation**.— *The problem of inter-State interference on frequencies allotted worldwide or on a regional basis to national services, should be resolved by consultation between the administrations concerned.*

4.1.5.10 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.

4.1.5.11 **Recommendation**.— *For ground VHF facilities which provide service beyond the radio horizon, any spurious or harmonic radiation outside the band ±250 kHz from the assigned carrier frequency should not exceed an effective radiated power of 1 mW in any azimuth.*

4.1.6 Equipment requirements

4.1.6.1 **Recommendation**.— *The antenna gain of an extended range VHF facility should preferably be such as to ensure that, beyond the limits of ±2 Φ about the centre line of the angular width Φ of the area to be served, it does not exceed 3 dB above that of a dipole. But, in any case, it should be such as to ensure freedom from harmful interference with other radio services.*

Note.— The actual azimuth, the angular width of the service area, and the effective radiated power would have to be taken into account in each individual case.

4.1.7 Method of operation

4.1.7.1 Single channel simplex operation shall be used in the VHF band 117.975 – 137 MHz at all stations providing for aircraft engaged in international air navigation.

4.1.7.2 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.

4.1.8 Plan of assignable VHF radio frequencies for use in the international aeronautical mobile service

Introduction

This plan designates the list of frequencies available for assignment, together with provision for the use by the aeronautical mobile (R) service of all frequencies with a channel spacing of 25 kHz, and of all frequencies with a channel width and spacing of 8.33 kHz, with the frequencies in Group A continuing to be used wherever they provide a sufficient number to meet the operational requirements.

The plan provides that the total number of frequencies required in any region would be determined regionally. The effect of this will be that frequencies assignable in any particular region may be restricted to a limited number of the frequencies in the list, the actual number being selected as outlined herein.

In order that the assignable frequencies may be coordinated between regions as far as practicable, the plan requires that, whenever the number of frequencies contained in Group A of 4.1.8.1.2 is sufficient to meet the requirements of a region, the frequencies of this Group be used in a sequence commencing with 118 MHz. This ensures that all regions will have in common the frequencies used in the region requiring the least number of frequencies and, in respect to any two regions, the region with the greater number will have in use all the frequencies used by the other.

Group A provides for frequency planning based on 100 kHz channel spacing.

Group B of the list at 4.1.8.1.2 contains the frequencies in the band 117.975 – 132 MHz ending in 50 kHz. Together with the frequencies in Group A, they provide for frequency planning based on 50 kHz channel spacing. In Group C are listed the frequency channels in the band 132 – 137 MHz based upon 50 kHz channel spacing. Group D contains the frequency channels in the band 132 – 137 MHz ending in 25 kHz, and Group E similarly lists the frequency channels in the band 117.975 – 132 MHz. The utilization of channels in Groups B, C, D and E is explained below.

Group F of the list at 4.1.8.1.2 contains the frequencies in the band 117.975 – 137 MHz when 8.33 kHz channel width is used. The utilization of the channels in this Group is explained below.

Whenever the number of frequencies required in a particular region exceeds the number in Group A, frequencies may be selected from the other Groups taking into account the provisions of 4.1.8.1 with respect to the use of channels based on 25 kHz channel spacing and, with regard to

the band 132 – 137 MHz, the provisions of the Radio Regulations (see Introduction to 4.1). Although for Groups B, C, D and E a preferred order of selection is not indicated, regional planning may require a particular selection of frequencies from these Groups in order to cater for specific regional circumstances. This may apply particularly to the utilization of frequencies from the band 132 – 137 MHz for reasons of available airborne equipment and/or availability of particular frequency channels for the aeronautical mobile (R) service. It may also be found that, in a particular region, it is desirable to select frequencies from Group B first, before selecting frequencies from Groups C, D or E.

Where all the channels of Groups A, B, C, D and E of the list at 4.1.8.1.2 are insufficient to meet the requirements of a region, a part or parts of the band may be designated as containing 8.33 kHz width channels or designated as supporting VDL Mode 3. For parts of the band containing 8.33 kHz width channels, the appropriate frequencies from Group F should be used in accordance with 4.1.8.1.1.1 and 4.1.8.1.2. It should be noted that the designation of frequencies in Group F differs from that of the corresponding frequencies in Groups A to E to emphasize the difference in channel width. For part of the bands supporting VDL Mode 3, frequencies from Groups A, B, C, D and E are utilized on a time-division basis. A single frequency supports multiple channels, each utilizing the frequency in periodic time frames or time slots. Specific time slots for VDL Mode 3 are identified using the numeric designators of Table 4-1 (bis).

Although for Group F a preferred order of selection is not indicated, regional planning may require a particular selection of frequencies from this group in order to cater for specific regional circumstances.

In many regions particular frequencies have already been assigned for particular functions as, for instance, aerodrome or approach control. The plan does not make such assignments (except in respect to the emergency channel and ground service frequencies), such action being taken regionally if considered desirable.

4.1.8.1 The frequencies in the band 117.975 – 137 MHz for use in the aeronautical mobile (R) service shall be selected from the list in 4.1.8.1.2.

4.1.8.1.1 When the number of frequencies required in a particular region does not exceed the number of frequencies contained in Group A of 4.1.8.1.2, the frequencies to be used shall be selected in sequence, in so far as practicable, from those in Group A of 4.1.8.1.2.

4.1.8.1.1.1 When the number of frequencies required in a particular region exceeds those available in Groups A to E of 4.1.8.1.2, parts of the band shall be designated as containing 8.33 kHz width channels (voice) or as containing VDL Mode 3. Appropriate frequencies shall be selected from Group F of 4.1.8.1.2 for 8.33 kHz channel assignments or from Groups A to E in accordance with the time-slot assignments in accordance with Table 4-1 *(bis)* for VDL Mode 3. The remainder of the band shall continue to be used for 25 kHz width channels selected from the appropriate parts of Groups A to E.

Note 1.— The frequencies 121.425 – 121.575 MHz inclusive, 123.075 – 123.125 MHz inclusive and 136.500 – 136.975 MHz inclusive are not available for assignment to channels of less than 25 kHz width.

Note 2.— Services that continue operation using 25 kHz assignments will be protected in regions implementing 8.33 kHz channel spacing.

4.1.8.1.2 List of assignable frequencies

The list of assignable frequencies is shown in the Appendix to this chapter.

4.1.8.1.3 **Recommendation**.— *Frequencies for operational control communications may be required to enable aircraft operating agencies to meet the obligations prescribed in the Civil Aviation Rules 1984, Part VI, in which case they should be selected from the bands 128.825 –*

132.025 MHz. These frequencies should be chosen, in so far as practicable, from the upper end of the band and in sequential order.

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.

4.1.8.2 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. The capabilities of VHF airborne equipment known to be widely used in the region will be taken into account in this determination.

4.2 Utilization in the band 108 – 117.975 MHz

4.2.1 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 ANO (COM) A.1, 3.1.3;

b) VOR provided that:

1) no harmful adjacent channel interference is caused to ILS;

2) only frequencies ending in either *even tenths* or *even tenths plus a twentieth* of a megahertz are used.

c) GNSS ground-based augmentation system (GBAS) in accordance with ANO (COM) A.1, 3.7.3.5, provided that no harmful interference is caused to ILS and VOR.

— Band 111.975 – 117.975 MHz:

a) VOR;

b) GNSS ground-based augmentation system (GBAS) in accordance with ANO (COM) A.1, 3.7.3.5, provided that no harmful interference is caused to VOR.

4.2.2 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.

4.2.2.1 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.

4.2.3 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.

4.2.3.1 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:

a) the performance of ILS or VOR equipment not capable of operating on these frequencies will be protected from harmful interference;

b) a general requirement for the carriage of ILS or VOR airborne equipment capable of operation on these frequencies will not be imposed; and

c) operational service provided to international operators using 100 kHz airborne equipment is not derogated.

4.2.4 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 ANO (COM) A.1, 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 ANO (COM) A.1, 3.3.5.7.

4.2.5 *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.

4.2.6 **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 ANO (COM) A.1, 3.1.2.7.2 and 3.1.3.9, specify the equipment arrangements to be made.

Table 4-2

Group	DME channels	Associated paired VHF chennels	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	
2	EVEN 18Y to 56Y	ILS 50 kHz spacings		
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		
5	ODD 81Y to 119Y	VOR 50 kHz spacings Even tenths of a MHz		
6	EVEN 18W to 56W	No associated paired VHF channel		
7	EVEN 18Z to 56Z	No associated paired VHF channel		
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		
10	ODD 81Z to 119Z	No associated paired VHF channel		

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.

4.3 Utilization in the band 960 – 1 215 MHz for DME

4.3.1 DME operating channels bearing the suffix "X" or "Y" in Table A, Chapter 3 of ANO (COM) A.1 shall be chosen on a general basis without restriction.

4.3.2 DME channels bearing the suffix "W" or "Z" in Table A, Chapter 3 of ANO (COM) A.1, 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:

1) 1 January 1995; or

2) 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:

a) the performance of existing DME equipment not capable of operating on these multiplexed channels will be protected from harmful interference;

b) a general requirement for the carriage of DME airborne equipment capable of operating on these multiplexed channels will not be imposed; and

c) operational service provided to international operators using existing DME equipment without the multiplexed channel capability is not derogated.

4.3.3 For regional assignment planning, the channels for DME associated with MLS shall be selected from Table 4-2.

4.3.3.1 *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 ANO (COM) A.1, 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.

4.3.3.2 *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.

4.3.4 **Recommendation**.— *Coordination of regional DME channel assignments should be effected through ICAO.*

4.4 Utilization in the band 5 030.4 – 5 150.0 MHz

4.4.1 The MLS channels shall be selected from Table A, Chapter 3 of ANO (COM) A.1.

4.4.2 For regional planning purposes MLS channels shall be selected in accordance with the conditions specified in 4.3.3 for the associated DME facility.

4.4.3 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.

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APPENDIX TO CHAPTER 4. LIST OF ASSIGNABLE FREQUENCIES

Frequency (MHz)	Annotations	Frequency (MHz)	Annotations
121.5	Emergency frequency	121.95	Reserved for aerodrome surface communications [see Table 4-1, Item c)]
123.1	Auxiliary frequency SAR	121.625	
121.60	Reserved for aerodrome surface communications [see Table 4-1, Item c)]	121.675	
121.65		121.725	
121.70		121.775	
121.75		121.825	
121.80		121.875	
121.85		121.925	
121.90		121.975	

GROUP A
Frequencies (MHz)

118.00	118.90	119.80	120.70	123.80	124.70	125.60	126.50	127.40	128.30	129.20	131.20
118.10	119.00	119.90	120.80	123.90	124.80	125.70	126.60	127.50	128.40	129.30	131.30
118.20	119.10	120.00	120.90	124.00	124.90	125.80	126.70	127.60	128.50	129.40	131.40
118.30	119.20	120.10	121.00	124.10	125.00	125.90	126.80	127.70	128.60	129.50	131.50
118.40	119.30	120.20	121.10	124.20	125.10	126.00	126.90	127.80	128.70	129.60	131.60
118.50	119.40	120.30	121.20	124.30	125.20	126.10	127.00	127.90	128.80	130.90	131.70
118.60	119.50	120.40	121.30	124.40	125.30	126.20	127.10	128.00	128.90	131.00	131.80
118.70	119.60	120.50	121.40	124.50	125.40	126.30	127.20	128.10	129.00	131.10	131.90
118.80	119.70	120.60	123.70	124.60	125.50	126.40	127.30	128.20	129.10		

GROUP B
Frequencies (MHz)

118.05	118.95	119.85	120.75	123.95	124.85	125.75	126.65	127.55	128.45	129.25	131.25
118.15	119.05	119.95	120.85	124.05	124.95	125.85	126.75	127.65	128.55	129.35	131.35
118.25	119.15	120.05	120.95	124.15	125.05	125.95	126.85	127.75	128.65	129.45	131.45
118.35	119.25	120.15	121.05	124.25	125.15	126.05	126.95	127.85	128.75	129.55	131.55
118.45	119.35	120.25	121.15	124.35	125.25	126.15	127.05	127.95	128.85	129.65	131.65
118.55	119.45	120.35	121.25	124.45	125.35	126.25	127.15	128.05	128.95	130.95	131.75
118.65	119.55	120.45	121.35	124.55	125.45	126.35	127.25	128.15	129.05	131.05	131.85
118.75	119.65	120.55	123.75	124.65	125.55	126.45	127.35	128.25	129.15	131.15	131.95
118.85	119.75	120.65	123.85	124.75	125.65	126.55	127.45	128.35			

GROUP C
Frequencies (MHz)

132.00	132.35	132.70	133.05	133.40	133.75	134.10	134.45	134.80	135.10	135.40	135.70
132.05	132.40	132.75	133.10	133.45	133.80	134.15	134.50	134.85	135.15	135.45	135.75
132.10	132.45	132.80	133.15	133.50	133.85	134.20	134.55	134.90	135.20	135.50	135.80
132.15	132.50	132.85	133.20	133.55	133.90	134.25	134.60	134.95	135.25	135.55	135.85
132.20	132.55	132.90	133.25	133.60	133.95	134.30	134.65	135.00	135.30	135.60	135.90
132.25	132.60	132.95	133.30	133.65	134.00	134.35	134.70	135.05	135.35	135.65	135.95
132.30	132.65	133.00	133.35	133.70	134.05	134.40	134.75				

GROUP D
Frequencies (MHz)

132.025	132.525	133.025	133.525	134.025	134.525	135.025	135.525	136.000	136.250	136.500	136.750
132.075	132.575	133.075	133.575	134.075	134.575	135.075	135.575	136.025	136.275	136.525	136.775
132.125	132.625	133.125	133.625	134.125	134.625	135.125	135.625	136.050	136.300	136.550	136.800
132.175	132.675	133.175	133.675	134.175	134.675	135.175	135.675	136.075	136.325	136.575	136.825
132.225	132.725	133.225	133.725	134.225	134.725	135.225	135.725	136.100	136.350	136.600	136.850
132.275	132.775	133.275	133.775	134.275	134.775	135.275	135.775	136.125	136.375	136.625	136.875
132.325	132.825	133.325	133.825	134.325	134.825	135.325	135.825	136.150	136.400	136.650	136.900
132.375	132.875	133.375	133.875	134.375	134.875	135.375	135.875	136.175	136.425	136.675	136.925
132.425	132.925	133.425	133.925	134.425	134.925	135.425	135.925	136.200	136.450	136.700	136.950
132.475	132.975	133.475	133.975	134.475	134.975	135.475	135.975	136.225	136.475	136.725	136.975

GROUP E
Frequencies (MHz)

118.025	118.925	119.825	120.725	123.925	124.825	125.725	126.575	127.425	128.275	129.125	131.175
118.075	118.975	119.875	120.775	123.975	124.875	125.775	126.625	127.475	128.325	129.175	131.225
118.125	119.025	119.925	120.825	124.025	124.925	125.825	126.675	127.525	128.375	129.225	131.275
118.175	119.075	119.975	120.875	124.075	124.975	125.875	126.725	127.575	128.425	129.275	131.325
118.225	119.125	120.025	120.925	124.125	125.025	125.925	126.775	127.625	128.475	129.325	131.375
118.275	119.175	120.075	120.975	124.175	125.075	125.975	126.825	127.675	128.525	129.375	131.425
118.325	119.225	120.125	121.025	124.225	125.125	126.025	126.875	127.725	128.575	129.425	131.475
118.375	119.275	120.175	121.075	124.275	125.175	126.075	126.925	127.775	128.625	129.475	131.525
118.425	119.325	120.225	121.125	124.325	125.225	126.125	126.975	127.825	128.675	129.525	131.575
118.475	119.375	120.275	121.175	124.375	125.275	126.175	127.025	127.875	128.725	129.575	131.625
118.525	119.425	120.325	121.225	124.425	125.325	126.225	127.075	127.925	128.775	129.625	131.675
118.575	119.475	120.375	121.275	124.475	125.375	126.275	127.125	127.975	128.825	129.675	131.725
118.625	119.525	120.425	121.325	124.525	125.425	126.325	127.175	128.025	128.875	130.925	131.775
118.675	119.575	120.475	121.375	124.575	125.475	126.375	127.225	128.075	128.925	130.975	131.825
118.725	119.625	120.525	123.725	124.625	125.525	126.425	127.275	128.125	128.975	131.025	131.875
118.775	119.675	120.575	123.775	124.675	125.575	126.475	127.325	128.175	129.025	131.075	131.925
118.825	119.725	120.625	123.825	124.725	125.625	126.525	127.375	128.225	129.075	131.125	131.975
118.875	119.775	120.675	123.875	124.775	125.675						

GROUP F
(see also Table 4-1 *(bis)*)

118.000 – 121.400 in 8.33 kHz steps	121.600 – 123.050 in 8.33 kHz steps	123.150 – 136.475 in 8.33 kHz steps