



**Notice of Proposed Rule Making  
NPRM 19/07-43  
8 November 2019**

**Part 171  
Aeronautical Telecommunications  
Service Organisation - Certification**

**Docket 19/07/CAR171/43  
2019 Rules Review**

Proposed Rule Applicable 8<sup>th</sup> November 2019

## Background to the Civil Aviation Rules

The Civil Aviation Rules establish the minimum regulatory safety boundary for participants to gain entry into, operate within, and exit the Papua New Guinea civil aviation system. The Rules are structured in a manner similar to the Civil Aviation Rules of New Zealand and the Federal Aviation Regulations of the USA. Where practicable the Rules also align with the International Civil Aviation Organization Annexes and the regulatory code of the Civil Aviation Safety Authority of Australia.

Rules are divided into Parts and each Part contains a series of individual rules that relate to a particular aviation activity. Advisory Circulars accompany many rule Parts and contain information about standards, practices and procedures that the Director has established to be an Acceptable Means of Compliance (AMC) with the associated rule. An Advisory Circular may also contain guidance material (GM) to facilitate compliance with the rule requirements.

The objective of the Civil Aviation Rules system is to strike a balance of responsibility between, on the one hand, the State and regulatory authority (CASA) and, on the other hand, those who provide services and exercise privileges in the civil aviation system. This balance must enable the State and regulatory authority to set standards for, and monitor performance of, aviation participants while providing the maximum flexibility for the participants to develop their own means of compliance within the safety boundary.

Section 45 of the Civil Aviation Act 2000 prescribes general requirements for participants in the civil aviation system and requires, among other things, participants to carry out their activities safely and in accordance with the relevant prescribed safety standards and practices.

Section 72 of the Act allows the Minister to make ordinary rules for any of the following purposes:

- (a) The implementation of Papua New Guinea's obligations under the Convention;
- (b) To provide for a safe, sustainable, effective and efficient aviation services;
- (c) The provision of aviation meteorological services, search and rescue services and civil aviation security programmes and services;
- (d) Assisting aviation safety and security, including but not limited to personal security;
- (e) Assisting economic development;
- (f) Improving access and mobility;
- (g) Protecting and promoting public health;
- (h) Ensuring environmental sustainability;
- (i) Any matter related or reasonably incidental to any of the following:
  - (1) The Minister's functions and role under section 8 of the Act;
  - (2) The Authority's general objects and functions under section 11 of the Act;
  - (3) The Authority's functions in relation to safety under section 12 of the Act; and
  - (4) The Director's functions and powers under section of 17 the Act
  - (5) The Director's powers under section 52A, 53 and 54 of the Act
- (j) Any other matter contemplated by any provision of the Act.

## Contents

<b>1. Purpose of this NPRM.....</b>	<b>4</b>
<b>2. Background to the Proposal.....</b>	<b>4</b>
General Summary .....	4
NPRM Development.....	4
Key Stakeholders .....	4
<b>3. Issues Addressed during Development.....</b>	<b>4</b>
Consequential Amendments .....	4
Exemptions .....	4
ICAO SARPS and Level of Risk to Papua New Guinea Aviation Safety .....	4
Compliance Costs .....	4
<b>4. Summary of Change.....</b>	<b>5</b>
<b>5. Legislative Analysis.....</b>	<b>5</b>
Power to Make Rules.....	5
Matters to be taken into account .....	7
<b>6. Submissions on the NPRM .....</b>	<b>7</b>
Submissions are invited .....	7
Examination of Submissions.....	7
Disclosure.....	8
<b>7. How to make a submission .....</b>	<b>8</b>
Final date for submissions .....	8
Availability of the NPRM:.....	8
Further information.....	8
<b>Proposed Rule Amendments.....</b>	<b>10</b>

## 1. Purpose of this NPRM

The purpose of this NPRM is to put forward for consideration the proposed amendments to capture amendments in ICAO Annex 10 Volumes 1 and 2 - Amendment 91, Volumes 3 and 4 - Amendment 90 and Volume 5 – Amendment 89.

## 2. Background to the Proposal

### 2.1 General Summary

Part 171 was last reviewed in 2016 to capture requirements of Annex 10 Volumes 1 to 5. The current review is a result of further assessment of ICAO Compliance Checklists and recent amendments which require further updating of the rule Part to align with Annex 10. It also captures editorials and minor amendments. New definitions arising from Annex 10 Compliance Checklist review will be published in a Part 171 Advisory Circular (AC).

### 2.2 NPRM Development

This NPRM development is to incorporate the ICAO Annex 10 amendments in all the 5 volumes.

### 2.3 Key Stakeholders

The Civil Aviation Safety Authority identifies the following as key stakeholders for the proposed rule amendments contained in this NPRM:

- (1) The Civil Aviation Safety Authority
- (2) The Minister for Transport
- (3) The Minister for Civil Aviation
- (4) Aviation Document Holders
- (5) Other interested stakeholders

## 3. Issues Addressed during Development

There were no major issues addressed during the development of this NPRM.

### 3.1 Consequential Amendments

No consequential amendments.

### 3.2 Exemptions

There were no exemptions

### 3.3 ICAO SARPS and Level of Risk to Papua New Guinea Aviation Safety

No level of risk as the services coming on line would improve safety on the baseline of current systems.

### 3.4 Compliance Costs

No direct compliance costs are expected.

## 4. Summary of changes

Changes to this Part comprise the following services GNSS, ADS-B, ADS-C, CPDLC, AIDC and AMHS. Additional specifications and Requirements of these services under CA Rule 171.201 Subpart D are also included.

### a) Navigational Aids

Additional specifications and requirements as in Subpart D Rule 171.201 are provided in Appendix A for VHF OMNI RANGE (VOR), Instrument Landing System (ILS) and Global Navigation Satellite System (GNSS).

### b) Surveillance

Additional Specifications and requirements as in Subpart D Rule 171.201 are provided in Appendix B for Secondary Surveillance Radar (SSR), Human Factors, Airborne Collision Avoidance System (ACAS), Mode S Extended Squitter Receiving System Characteristics (ADS-B IN and TIS-B IN).

### c) Communication

Additional Specifications and Requirements as in Subpart D Rule 171.201 are provided in Appendix C for Aeronautical Telecommunications Network (ATN), SSR Mode S Air Ground Data Link, VHF Air Ground Data Link, Aircraft Addressing System, Single Sideband (SSB) HF communicating System Characteristics for use in the aeronautical mobile service, Selective calling system (SELCAL), Aeronautical Speech Circuits and Emergency Locator Transmitter (ELT) for Search and Rescue.

## 5. Legislative Analysis

### 5.1 Power to Make Rules

The Minister may make ordinary rules under sections 69, 70, 71 and 72 of the Civil Aviation Act 2000, for various purposes including implementing Papua New Guinea's obligations under the Convention, assisting aviation safety and security, and any matter contemplated under the Act.

These proposed rules are made pursuant to:

- (a) Section 69(1)(a) which allows the Minister to make rules for the purpose of the implementation of Papua New Guinea's obligations under the Convention:
- (b) Section 69(b) which allows the Minister to make rules for the purpose of assisting aviation safety and security, including (but not limited to) personal security:
- (c) Section 69(5) which allows the Minister to make rules that provide for matters to be determined or approved by the Authority, the Director, or any other person or empower the Authority, the Director or any other person to impose requirements, or conditions on the performance of any activity including but not limited to procedures to be followed:
- (d) Section 70(c) which allows the Minister to make rules providing for general operating rules, air traffic rules, and flight rules, including but not limited to the following:
  - (1) the conditions under which aircraft may be used or operated, or under which any act may be performed in or from an aircraft:

- (2) the prevention of aircraft endangering persons or property.
- (e) Section 72(a) which allows the Minister to make rules for the designation, classification, and certification of all or any of the following:
- (1) aircraft:
  - (2) aircraft pilots:
  - (3) flight crew members:
  - (4) air traffic service personnel:
  - (5) aviation security service personnel:
  - (6) aircraft maintenance personnel:
  - (7) aviation examiners or medical examiners:
  - (8) air services:
  - (9) air traffic services:
  - (10) aerodromes and aerodrome operators:
  - (11) aeronautical navigation service providers:
  - (12) aviation training organisations:
  - (13) aircraft design, manufacture, and maintenance organisations:
  - (14) aeronautical procedures:
  - (15) aviation security services:
  - (16) aviation meteorological services:
  - (17) aeronautical communication services:
  - (18) any other person who provides services in the civil aviation system, and any aircraft, aeronautical products, aviation related services, facilities, and equipment operated in support of the civil aviation system, or classes of such persons, aircraft, aeronautical products, aviation related services, facilities, and equipment operated in support of the civil aviation system:
- (f) Section 70(b) which allows the Minister to make rules for the setting of standards, specifications, restrictions, and licensing requirements for all or any of those persons or things specified in paragraph 70(a) including the specifications of standards of design, construction, manufacture, processing, testing, supply, approval, and identification of aircraft and aeronautical products:
- (g) Section 70(c) which allows the Minister to make rules setting the conditions of operation of foreign aircraft and international flights to, from, or within Papua New Guinea:
- (h) Section 70(d) which allows the Minister to make rules for the definitions, abbreviations, and units of measurement to apply within the civil aviation system.

The proposed amendment of Part 43 complies with the requirements of the Civil Aviation Act and does not contravene the Constitution, the Aerodrome (Business Concession) Act, Civil Aviation (Aircraft Operator Liability) Act, Aircraft Charges Act, Airport Departure Tax Act, the Explosive Act, Firearms Act, Customs Act, Plant and Disease Control Act and the Environmental Act.

The proposed Rule has been checked for language and compliance with the legal conventions of Papua New Guinea.

## **5.2 Matters to be taken into account**

The development of this NPRM and the proposed rule changes take into account the matters under section 75 of the Act that the Minister must take into account when making ordinary rules including the following:

### **5.2.1 ICAO Standards and Recommended Practices**

As per the states obligation, as signatory to the ICAO Chicago Convention to adopt all the applicable SARPS in Annex 10 Volumes 1 to 5.

### **5.2.2 Assisting Economic Development**

The proposed rule amendments will have no detrimental impact on economic development, and in some cases will reduce costs incurred by the aviation industry.

### **5.2.3 Assisting Safety and Personal Security**

The proposed rule amendments will maintain safety levels in respect to clarifying and maintaining common standards of definitions, abbreviations and units of measurements used throughout the industry.

### **5.2.4 Improving Access and Mobility**

The proposed rule amendments will have no impact on access and mobility.

### **5.2.5 Protecting and Promoting Public Health**

The proposed rule amendments will have no impact on protecting and promoting public health.

### **5.2.6 Ensuring Environmental Sustainability**

The proposed rule amendments will have no impact on environmental sustainability.

## **6. Submissions on the NPRM**

### **6.1 Submissions are invited**

Interested persons are invited to participate in the making of the proposed rules by submitting written data, views, or comments. All submissions will be considered before final action on the proposed rulemaking is taken. If there is a need to make any significant change to the rule requirements in this proposal as a result of the submissions received, then interested persons may be invited to make further submissions.

### **6.2 Examination of Submissions**

All submissions will be available in the rules docket for examination by interested persons both before and after the closing date for submissions. A consultation summary will be published on the CA web site and provided to each person who submits a written submission on this NPRM. Submissions may be examined by application to the Docket Clerk at the Civil Aviation Safety Authority Headquarter Building 1, Level 1, Morea Tobo Road, Six Mile, NCD Port Moresby between 8:30 am and 3:30 pm on weekdays, except statutory holidays.

### 6.3 Disclosure

Submitters should note that any information attached to submissions will become part of the docket file and will be available to the public for examination at the CASA office.

Submitters should state clearly if there is any information in their submission that is commercially sensitive or for some other reason the submitter does not want the information to be released to other interested parties.

## 7. How to make a submission

Submissions may be sent by the following methods:

- |            |  |
|------------|--|
| by Mail:   | Docket Clerk (NPRM 19/07-43)<br>Civil Aviation Safety Authority<br>PO Box 1941<br><b>BOROKO</b><br>National Capital District         |
| delivered: | Docket Clerk (NPRM 19/07-43)<br>Civil Aviation Safety Authority<br>Morea-Tobo Road<br>Six Mile, Jacksons Airport<br>Port Moresby NCD |
| by Fax:    | Docket Clerk (NPRM 19/07-43)<br>3251789 / 325 1919   |
| by Email:  | Docket Clerk (NPRM 19/07-43)<br><a href="mailto:rules@casapng.gov.pg">rules@casapng.gov.pg</a>                                       |

### 7.1 Final date for submissions

Comments must be received before **COB 27<sup>th</sup> September, 2019**

### 7.2 Availability of the NPRM

Any person may obtain a copy of this NPRM from-

CASA web site: [www.casapng.gov.pg](http://www.casapng.gov.pg)

*or at a cost from*

Docket Clerk  
Civil Aviation Safety Authority Headquarter  
Building 1, Level 1  
Morea-Tobo Road  
Six Mile, Jacksons Airport  
Port Moresby NCD

### 7.3 Further information

For further information, contact:

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## Subpart A — General

### 171.1 Purpose

This Part prescribes rules governing—

- (1) the certification and operation of organisations providing aeronautical telecommunication services in support of IFR flight or an air traffic service; and
- (2) the operating and technical standards for facilities operated by those organisations.

### 171.3 Definitions

In this Part—

**Aeronautical Telecommunication Service** means—

- (1) a telecommunication service provided to support the following services as defined in Annex 10, Volume II, Chapter 1:
  - (i) aeronautical broadcasting service:
  - (ii) aeronautical fixed service (AFS):
  - (iii) aeronautical mobile service:
  - (iv) aeronautical radio navigation service; and
- (2) any other telecommunication service provided specifically to support the Papua New Guinea air navigation system:

**Annex 10** means Annex 10 to the Convention as amended from time to time:

**Critical Performance Parameter** means a performance parameter that has a direct effect on the operational integrity of a facility:

**Facility** means—

- (1) the following types of communication systems for the aeronautical broadcast service (as that service is defined in Annex 10, Volume II, Chapter 1):
  - Meteorological information for aircraft in flight (VOLMET):
  - Automatic terminal information service (ATIS); and
- (2) the following types of communication systems for the aeronautical fixed service (as at service is defined in Annex 10, Volume II, Chapter 1):
  - ATS direct speech circuits:
  - Aaeronautical fixed telecommunication network (AFTN):
  - Ground-ground data interchange; and
- (3) the ground elements of the following types of communication systems for the aeronautical mobile service (as that service is defined in Annex 10, Volume II, Chapter 1):
  - HF air-ground communication:
  - VHF air-ground communication:
  - UHF air-ground communication:
  - Selective calling system (SELCAL):
  - Aair-ground data interchange; and

- (4) the following types of radio navigation aids for the aeronautical radio navigation service (as that service is defined in Annex 10, Volume II, Chapter 1 and Volume I, Chapter 1):

Instrument Landing System (ILS):  
 Microwave Landing System (MLS):  
Global Navigation Satellite System GNSS:  
 VHF Omni-directional radio range VOR):  
 Distance Measuring Equipment (DME):  
 Non-directional Radio Beacon (NDB):  
 Precision Approach Radar (PAR):  
 Secondary Surveillance Radar (SSR):  
 Primary Surveillance Radar (PSR);  
Automatic Dependent Surveillance (ADS-B):  
Automatic Dependent Surveillance Contract (ADS-C): and

- (5) the following types of telecommunication systems that support an air traffic service:

Flight data processing system (FDPS):  
~~R~~adar data processing system (RDPS):  
~~R~~adar and flight data processing system (RFDPS).

- (6) the types of Communication Navigation Surveillance/Air Traffic Management (CNS/ATM) services acceptable to the Director.

#### **171.5 Requirement for certificate**

- (a) Except as provided in paragraph (c), no person shall provide an aeronautical telecommunication service or operate a facility except under the authority of, and in accordance with the provisions of, a telecommunication service certificate issued under this Part.
- (b) The Director may grant a certificate authorising aeronautical telecommunication services varying from the operation of a single private facility to a network of facilities required for the Papua New Guinea air navigation system.
- (c) A person may operate a facility on an aeronautical radio frequency without holding a telecommunication service certificate if—
- (1) the facility—
    - (i) is a radio-communication facility that does not support an air traffic service; or
    - (ii) is a radio navigation aid that does not support IFR flight or an air traffic service; and
  - (2) the facility does not interfere with any other aeronautical telecommunication service or facility; and
  - (3) where applicable—
    - (i) the National Information Technology Authority (NICTA) has granted a written radio apparatus licence for the facility; and
    - (ii) the Director has allocated an identification code or call sign for the facility.

**171.7 Application for certificate**

An applicant for the grant of a telecommunication service certificate shall complete form CAA 171/01 and submit it to the Director with—

- (1) the exposition required by 171.77; and
- (2) a payment of the appropriate application fee prescribed by regulations made under the Act.

**171.9 Issue of certificate**

An applicant is entitled to a telecommunication service organisation certificate if the Director is satisfied that—

- (1) the applicant meets the requirements of Subpart B; and
- (2) the applicant, and the applicant's senior person or persons required by 171.51(a)(1) and (2) are fit and proper persons; and
- (3) the granting of the certificate is not contrary to the interests of aviation safety.

**171.11 Privileges of certificate holder**

- (a) A telecommunication service certificate specifies the types of facilities that the certificate holder is authorised to operate.
- (b) Subject to 171.111, the holder of a telecommunication service certificate may operate any of the facility types listed on the holder's certificate provided that—
  - (1) each facility operated is listed in the holder's exposition; or
  - (2) if the facility is not listed in the exposition, its operation is for site test purposes controlled by the procedures required by 171.53(b).

**171.13 Duration of certificate**

- (a) A telecommunication service certificate may be granted or renewed for a period of up to 5 years.
- (b) A telecommunication service certificate remains in force until it expires or is suspended or revoked.
- (c) The holder of a telecommunication service certificate that expires or is revoked shall forthwith surrender the certificate to the Director.
- (d) The holder of a telecommunication service certificate that is suspended, shall forthwith produce the certificate to the Director for appropriate endorsement.

**171.15 Renewal of certificate**

- (a) An application for the renewal of a telecommunication service certificate shall be made on form CAA 171/01.
- (b) The application shall be submitted to the Director before the application renewal date specified on the certificate or, if no such date is specified, not less than 30 days before the certificate expires.

**171.17 Identification of codes and call signs**

(a) No person may operate-

- (1) a radio navigation aid, unless it has been allocated an identification code by the Director under paragraph (c); or
- (2) a radio communication transmitter on an aeronautical radio frequency other than one operated under 171.5(c), unless it has been allocated a call sign by the Director under paragraph (c).

(b) An applicant for the allocation of an identification code or a call sign under paragraph (a), must complete form CAA 171/02 and submit it to the Director with, if applicable, a payment of the appropriate application fee prescribed by regulations made under the Act.

(c) The Director may allocate an identification code for a radio navigation aid or a call sign for a radio communication transmitting aeronautical facility if the Director is satisfied that the allocation of a code or call sign is not contrary to the interest of aviation safety.

**171.19 Notification of aeronautical facility information**

A person operating an aeronautical facility must, as soon as practicable-

- (1) forward to the provider of the AIS-
  - (i) information on the operational details of the aeronautical facility, for publication in the PNGAIP; and
  - (ii) information concerning any change in the operational status of the aeronautical facility, for the issue of a NOTAM; and
- (2) check, if applicable, that the information forwarded under paragraph (1) has been accurately published; and
- (3) notify the Director of a promulgated information incident in accordance with Part 12.

**171.21 Information provided by an aeronautical facility**

A person operating an aeronautical facility must not permit the facility to continue in operational service if that person suspects or has any cause to suspect that the information being provided by that facility is erroneous.

**Subpart B — Certification Requirements****171.51 Personnel requirements**

- (a) An applicant for the grant of a telecommunication service certificate shall engage, employ or contract:
  - (1) A senior person identified as the Chief Executive who has the authority within the applicant's organisation to ensure that all activities undertaken by the organisation can be financed and carried out to meet applicable operational requirements, and in accordance with the requirements prescribed by this Part:

- (2) A senior person or group of senior persons who are responsible for ensuring that the applicant's organisation complies with the requirements of this Part. Such nominated person or persons shall be ultimately responsible to the Chief Executive:
  - (3) Sufficient personnel to inspect, supervise, and maintain the facilities listed in the applicant's exposition.
- (b) The applicant shall—
- (1) establish a procedure to assess the competence of those personnel who are authorised by the applicant to place any of the facilities listed in the applicant's exposition into operational service; and
  - (2) establish a procedure to maintain the competence of those authorised personnel; and
  - (3) provide those authorised personnel with written evidence of the scope of their authorisation.

### **171.53 Facility requirements**

- (a) An applicant for the grant of a telecommunication service certificate shall establish procedures to ensure that—
- (1) each facility listed in their exposition—
    - (i) is designed, installed and commissioned to meet the applicable operational specification; and
    - (ii) conforms with the applicable system characteristics and specification standards prescribed in Volume I, III and IV of Annex 10; and
  - (2) information on the operational status of any of the radio navigation aids listed in the applicant's exposition that are essential for the approach, landing and take-off at an aerodrome, is provided without delay—
    - (i) to the aerodrome control tower if that aerodrome has one; and
    - (ii) to the air traffic control unit providing an approach control service for that aerodrome if such a service is being provided; and
  - (3) each facility listed in their exposition is installed with suitable power supplies and means to ensure continuity of operation appropriate to the needs of the operational service being supported; and
  - (4) each facility listed in their exposition is installed in accordance with the security programme required by 171.55 to minimise the risk of destruction, damage or interference with the operation of the facility; and
  - (5) any critical site area of any facility listed in their exposition is—
    - (i) clearly identified on the site drawings for the facility; and
    - (ii) physically protected by suitable signposts on the site; and
    - (iii) protected by written agreements with the site owner, aerodrome operator and air traffic control unit as appropriate, to ensure that site restrictions are not infringed by buildings, fences, vehicles, machinery or aircraft.

- (b) Where an applicant intends to operate a temporary facility for the purpose of carrying out site tests, the applicant shall establish a procedure for conducting those tests. The procedure shall ensure that there is no possible interference to any other operating facility and that appropriate information is forwarded to the Aeronautical Information Service (AIS) for the issue of a NOTAM or the publication of a Supplement to the Aeronautical Information Publication.

#### **171.55 Security programme**

- (a) An applicant for the grant of a telecommunication service certificate shall establish a security programme for the facilities listed in their exposition.
- (b) The security programme required by paragraph (a) shall specify the physical security requirements, practices and procedures that may be necessary—
- (1) to minimise the risk of destruction, damage, or interference, to the certificate holder's facilities if such an act to a facility is likely to endanger the safety of air navigation; and
  - (2) to prevent unauthorised access to a facility; and
  - (3) for personnel to follow in the event of a bomb threat or other threat of violence at a facility; and
  - (4) to monitor unattended facilities to detect unauthorised intrusion or interference at a facility.
  - (5) To protect critical information and communications technology systems from interference that may jeopardise the safety of air navigation services.
- (c) The security programme required under paragraph (a) shall include procedures to notify, investigate and report security incidents to the Director in accordance with rule Part 12.

#### **171.57 Documentation**

- (a) An applicant for the grant of a telecommunication service certificate shall hold copies of relevant equipment manuals, relevant technical standards and practices (including Annex 10) and any other documentation (including technical instructions) that is necessary for the provision and operation of the facilities listed in their exposition.
- (b) An applicant shall establish a procedure to control all the documentation required by paragraph (a). The procedure shall ensure that—
- (1) all documentation is reviewed and authorised by appropriate personnel before issue; and
  - (2) current issues of all relevant documentation are available to staff at all locations where they need access to such documentation for the provision and operation of facilities; and
  - (3) all obsolete documentation is promptly removed from all points of issue or use; and
  - (4) changes to documentation are reviewed and approved by appropriate personnel; and
  - (5) the current version of each item of documentation can be identified to preclude the use of out of date editions.

**171.59 Periodic inspection and testing**

- (a) An applicant for the grant of a telecommunication service certificate shall establish procedures for the periodic inspection and testing of the facilities listed in their exposition to verify that they meet the applicable operational requirements and performance specifications.
- (b) These procedures shall—
  - (1) cover ground inspections and ground tests, and where necessary flight tests; and
  - (2) include the criteria for establishing or changing the period between the periodic tests for a facility having regard to—
    - (i) any applicable information published by the International Civil Aviation Organisation (ICAO) or any other aeronautical authority; and
    - (ii) any applicable reliability data for the facility; and
    - (iii) information on the proven reliable performance of the facility, the proven performance of other similar facilities, and the stability of the facility's operating environment; and
  - (3) ensure that the grounds for establishing or changing the period between the periodic tests for a facility are documented.
- (c) In addition, the applicant shall establish—
  - (1) a programme of periodic ground inspections for each facility; and
  - (2) a programme of periodic ground tests for each facility; and
  - (3) a programme of periodic flight tests for each radio navigation aid unless the applicant can establish from the criteria in paragraph (b)(2) that periodic ground tests can replace the periodic flight tests for a facility without affecting the safety of air navigation.
- (d) The programmes required by paragraph (c)(2) and (3) for the periodic ground and flight tests shall be based on the criteria in paragraph (b)(2) and shall specify the maximum period between the tests for each facility.
- (e) The applicant shall notify the Director within seven days of any radio navigation aid that is not subjected to periodic flight tests required.

**171.61 Certification of facility performance**

An applicant for the grant of a telecommunication service certificate shall establish a procedure to ensure that no facility listed in their exposition is placed into operational service unless—

- (1) the person placing the facility into operational service is authorised and is assessed as competent under the procedures required by 171.51(b); and
- (2) the appropriate checks have been carried out to verify the performance of the facility; and
- (3) the facility record has been completed in accordance with the procedures required by 171.71.

**171.63 Inspection measuring and test equipment**

- (a) An applicant for the grant of a telecommunication service certificate shall ensure that appropriate inspection, measuring and test equipment is available for their personnel to maintain the safe operation of each facility listed in their exposition.
- (b) An applicant shall establish a procedure to control, calibrate and maintain all of the applicant's inspection, measuring and test equipment to ensure that each item of equipment has the precision and accuracy that is necessary for the measurements and tests to be performed.
- (c) The procedure shall ensure that each item of test equipment required for the measurement of critical performance parameters is—
  - (1) calibrated before use and at prescribed intervals against certified equipment having a known valid relationship to nationally recognised standards. Where no such standards exist, the basis used for the calibration shall be documented. Records of such calibrations and the standards used shall be maintained in accordance with the procedures required by 171.71; and
  - (2) identified with a suitable indicator to show its calibration status; and
  - (3) controlled to—
    - (i) safeguard against adjustments that would invalidate the calibration setting; and
    - (ii) ensure that the handling, preservation and storage is such that the accuracy and fitness for use is maintained.
- (d) Where hardware and software systems are used as an alternative form of facility performance testing, the functions of the systems shall be checked before being released for use in order to establish that they are capable of verifying the performance of the facility. These functions shall be checked at prescribed intervals. Records of these checks shall be maintained as evidence and verification of adequate performance of the test system.

**171.65 Notification of facility information**

- (a) An applicant for the grant of a telecommunication service certificate shall establish a procedure to notify the users of the facilities listed in their exposition of the operational information for each facility and of any changes in the operational status of those facilities.
- (b) The procedure shall ensure that—
  - (1) the operational information on any facility that supports an air traffic service or the Papua New Guinea air navigation system is forwarded to the Aeronautical Information Service (AIS) for publication in the Papua New Guinea Aeronautical Information Publication; and
  - (2) the users of a facility are notified without delay of any change in the operational status of a facility if the change may affect the safety of air navigation. For those facilities published in the Papua New Guinea Aeronautical Information Publication the information concerning any change to their operational status shall be forwarded to the Aeronautical Information Service for the issue of a NOTAM.

**171.67 Facility check after accident or incident**

- (a) An applicant for the grant of a telecommunication service certificate shall establish a procedure to check and record the operating condition of any facility listed in their exposition that may have

been used by an aircraft or an air traffic service involved in an accident or incident.

- (b) The procedure shall ensure that—
- (1) the checks are carried out as soon as practicable after notification to the applicant's organisation of such an accident or incident; and
  - (2) the record of the facility's operating condition as checked and the past recorded history are kept in a secure place for possible use by any subsequent investigation.
  - (3) the records required to be secured under paragraph (b) (2) are retained for 3 years from the date of the last entry made on that record.

### **171.69 Facility malfunctions**

- (a) An applicant for the grant of a telecommunication service certificate shall establish a procedure to notify, investigate, and rectify any detected or reported malfunction of any facility listed in their exposition in accordance with the requirements of rule Part 12.
- (b) The procedure shall ensure that a report is forwarded to the Director whenever a facility malfunction investigation reveals that—
- (1) the facility has been operating outside the allowable tolerances; or
  - (2) the facility had the potential to operate outside the allowable tolerances; or
  - (3) there appears to be a recurring cause for the facility malfunction reports.
- (c) The report required in paragraph (b) shall be forwarded within 10 days of the malfunction being detected or reported and shall include full details of the malfunction, the findings of the investigation and the corrective action taken to prevent a recurrence.

### **171.71 Records**

- (a) An applicant for the grant of a telecommunication service certificate shall establish procedures to identify, collect, index, store, maintain and dispose of the records that are necessary for the safe provision and operation of the facilities listed in their exposition.
- (b) The procedures shall ensure that—
- (1) a record is kept for each facility in order to—
    - (i) document the performance of the facility; and
    - (ii) provide a history of its maintenance and the periodic inspections and tests. The history shall be traceable to the person or persons responsible for each of the recorded activities; and
  - (2) there is a record of the documentation required by 171.59(b)(3) concerning the establishment of, or change in, the periodic tests for a facility; and
  - (3) there is a record for each item of test equipment required for the measurement of critical performance parameters. The record shall provide a traceable history of the location, maintenance, and the calibration checks for such test equipment; and
  - (4) there is a record of each facility malfunction recorded and investigated under the procedures required by 171.69(a). The record shall detail the nature of the malfunction, the findings of the investigation, the follow up corrective actions, or where applicable include a copy of

the report forwarded to the Director; and

- (5) there is a record of each internal audit of the applicant's organisation carried out under the procedures required by 171.77; and
- (6) there is a record for each person who is authorised by the applicant to place facilities into operational service. The record shall include details of their experience, qualifications, training, competence assessments and current authorisations; and
- (7) all records are legible and of a permanent nature; and
- (8) all facility records are retained for a period of at least 3 years unless a longer period is required to establish a performance history for a facility.

### **171.73 Safety Management System**

An applicant for the grant of an aeronautical telecommunication service organization certificate must establish and implement a safety management system which meets the requirements of CAR Part 100.

### **171.75 Quality Management System**

An applicant for the grant of an aeronautical telecommunication service organization certificate must establish and implement a quality management system which meets the requirements of CAR Part 100.

### **171.77 Organisation exposition**

- (a) An applicant for the grant of a telecommunication service certificate shall provide the Director with an exposition which shall contain—
  - (1) a statement signed by the Chief Executive on behalf of the applicant's organisation confirming that the exposition and any included manuals—
    - (i) define the organisation and demonstrate its means and methods for ensuring ongoing compliance with this Part; and
    - (ii) will be complied with at all times; and
  - (2) the titles and names of the senior person or persons required by 171.51(a)(1) and (2); and
  - (3) the duties and responsibilities of the senior person or persons specified in paragraph (a)(2) including matters for which they have responsibility to deal directly with the Director or the Authority on behalf of the organisation; and
  - (4) an organisation chart showing lines of responsibility of the senior persons specified in paragraph (a)(2) and extending to each location listed under paragraph (a)(7); and
  - (5) a summary of the applicant's staffing structure at each location listed under paragraph (a)(7); and
  - (6) a list of the types of facilities to be covered by the certificate; and

- (7) a summary of the scope of activities at each location where personnel are based for the purpose of providing or maintaining the facilities listed under paragraph (a)(8); and
  - (8) a list providing the operational details of each facility associated with each location listed under paragraph (a)(7); and
  - (9) details of the applicant's security programme required by 171.55; and
  - (10) details of the applicant's procedures required by—
    - (i) 171.51(b)(1) and (2) regarding the competence of personnel; and
    - (ii) 171.53(a) regarding the design, installation and commissioning of facilities; and
    - (iii) 171.53(b) regarding operation of temporary facilities for site tests; and
    - (iv) 171.57 regarding the control of documentation; and
    - (v) 171.59 regarding periodic inspections and tests of facilities; and
    - (vi) 171.61 regarding the certification of facility performance; and
    - (vii) 171.63 regarding the control, calibration and maintenance of inspection, measuring and test equipment; and
    - (viii) 171.65 regarding the notification of facility information; and
    - (ix) 171.67 regarding facility checks after notification of an accident or incident; and
    - (x) 171.69 regarding facility malfunctions; and
    - (xi) 171.71 regarding the identification, collection, indexing, storage, maintenance and disposal of records; and
    - (xii) 171.73 regarding safety management system of the organisation; and
    - (xiii) 171.75 regarding quality management system of the organisation; and
    - (xiv) 171.115 regarding safety assessments; and
  - (11) procedures to control, amend and distribute the exposition.
- (b) The applicant's exposition must be acceptable to the Director.

## **Subpart C — Operating Requirements**

### **171.101 Continued compliance**

The holder of a telecommunication service certificate shall—

- (1) hold at least one complete and current copy of their exposition at each major location specified in their exposition; and
- (2) comply with all procedures detailed in their exposition; and
- (3) make each applicable part of their exposition available to personnel who require those parts to carry out their duties; and
- (4) continue to meet the standards and comply with the requirements of Subpart B

prescribed for certification under this Part; and

- (5) notify the Director of any change of address for service, telephone number, or facsimile number required by form CAA 171/01 within 28 days of the change.

### **171.103 Identification codes and call signs**

The holder of a telecommunication service certificate requiring an identification code for a radio navigation facility or a call sign for a communications facility shall apply to the Director on form CAA 171/02 with the appropriate details.

### **171.105 Communication procedures**

The holder of a telecommunication service certificate shall ensure that their procedures for operating the facilities listed in their exposition are in accordance with the applicable communication procedures prescribed in Annex 10, Volume II.

### **171.107 Operating and maintenance instructions**

The holder of a telecommunication service certificate shall provide, for the use and guidance of their personnel, operating and maintenance instructions for each facility listed in their exposition. The instructions shall be controlled by the documentation control procedures required by 171.57 and shall set out the requirements for operating and maintaining each facility. The instructions shall include a list of—

- (1) the critical performance parameters; and
- (2) the associated minimum performance levels for those parameters; and
- (3) the test equipment required for the measurement of those parameters; and
- (4) the mandatory check procedures for placing the facility into operational service; and
- (5) the mandatory inspection and test procedures for the operation and maintenance of the facility.

### **171.109 Deviations**

- (a) Subject to compliance with 171.111(a), the holder of a telecommunication service certificate may deviate from any requirement of this Part to meet an emergency situation if there is a need to take immediate action for the protection of life or property involving carriage by air.
- (b) A certificate holder who deviates from a requirement of this Part under paragraph (a) shall provide a written report to the Director as soon as practicable, but in any event not later than 14 days after the emergency. The report shall cover the nature, extent and duration of the deviation.

### **171.111 Limitations on Certificate Holder**

- (a) The holder of a telecommunication service certificate shall not operate a facility (except for site test purposes controlled by the procedures required by 171.53(b)) if there is any cause to suspect the integrity of the information being provided by the facility. A cause to suspect the integrity of the information being provided by a facility includes the infringement of any critical site area of the facility until performance checks on the facility verify that the infringement does not and will

not affect the performance of the facility.

- (b) A certificate holder shall not operate a radio transmitting facility on an aeronautical radio frequency except pursuant to a written radio apparatus licence granted by the National Information Technology Authority for the facility.
- (c) Except where a deviation under 171.109 is required or a site test is carried out under the procedures required by 171.53(b), a certificate holder shall not operate a facility unless—
  - (1) the facility is listed in the holder's exposition; and
  - (2) the performance of the facility meets the applicable published information; and
  - (3) the performance of the facility meets the applicable facility requirements in 171.53(a); and
  - (4) any integrity monitoring system for the facility is fully functional; and
  - (5) all the periodic tests for the facility are completed in accordance with the programmes established under 171.59(c)(2) and (3); and
  - (6) the facility is included in the holder's airways security programme if the destruction, damage, or interference of the facility is likely to endanger the safety of an aircraft in flight; and
  - (7) the provisions of the holder's airways security programme for the facility are being complied with.

### **171.113 Changes to certificate holder's organisation**

- (a) The holder of a telecommunication service certificate shall ensure that their exposition is amended so as to remain a current description of the holder's organisation and facilities.
- (b) The certificate holder shall ensure that any amendments made to the holder's exposition meet the applicable requirements of this Part and comply with the amendment procedures contained in the holder's exposition.
- (c) The certificate holder shall provide the Director with a copy of each amendment to the holder's exposition as soon as practicable after its incorporation into the exposition.
- (d) Where a certificate holder proposes to make a change to any of the following, prior notification to and acceptance by the Director is required:
  - (1) The Chief Executive:
  - (2) The listed senior persons:
  - (3) The security programme:
  - (4) The types of facility the holder operates.
- (e) The Director may prescribe conditions under which a certificate holder may operate during or following any of the changes specified in paragraph (d).
- (f) A certificate holder shall comply with any conditions prescribed under paragraph (e).
- (g) Where any of the changes referred to in this rule requires an amendment to the certificate, the certificate holder shall forward the certificate to the Director as soon as practicable.

- (h) The certificate holder shall make such amendments to the holder's exposition as the Director may consider necessary in the interests of aviation safety.

### **171.115 Safety Assessments**

(a) The holder of an aeronautical telecommunications service certificate must provide a safety assessment report or safety case study to the Director-

- (1) for any proposed changes to its operations; and
- (2) relocation of services or facilities and equipment; and
- (3) implementation of new communications, surveillance or other safety-significant systems and equipment, including those providing new functionality or capabilities.

(b) The holder of an aeronautical telecommunications service certificate must ensure that users of the services are consulted when carrying out the safety assessment as required under paragraph(a).

(c) The holder of an aeronautical telecommunications service certificate where appropriate, shall ensure that adequate provision is made for post-implementation monitoring to verify that the defined level of safety continues to be met.

## **Subpart D — Facility Specifications and Requirements**

### **171.201 Additional Specifications and Requirements**

The following specifications and requirements are applicable to the aeronautical facilities referred to in 171.53(a)(1)-

- (1) Each NDB listed in an aeronautical telecommunication service certificate holder's exposition must conform to the following specification standards, in addition to the specification standards prescribed in ICAO Annex 10, Volume I, section 3.4:
  - (i) the radiated signal must be either, an uninterrupted carrier amplitude modulated by the on/off keying of a 1020 Hz plus or minus 50 Hz tone, or an uninterrupted carrier identified by the on/off keying of a second carrier separated 1020 Hz plus or minus 50 Hz from the continuous carrier:
  - (ii) the monitoring functions recommended in paragraphs 3.4.8.2 and 3.4.8.4 of ICAO Annex 10, Volume I are mandatory specification requirements for each NDB aeronautical facility:
  - (iii) the monitoring system for each NDB aeronautical facility must transmit a warning to a control point and switch off the NDB upon detection of any of the conditions detailed in paragraphs 3.4.8.1 and 3.4.8.2 of ICAO Annex 10, Volume I; and
- (2) each UHF DME listed in an aeronautical telecommunication service certificate holder's exposition must conform with the following requirements, in addition to the specifications prescribed in section 3.5 of ICAO Annex 10, Volume I:
  - (iv) the beacon code identity signal prescribed in paragraph 3.5.3.6.3 of ICAO Annex 10, Volume I must be transmitted at least once but not more than twice every 40 seconds with the code groups equally spaced:
  - (v) the monitor function recommended in paragraph 3.5.4.7.2.3 of ICAO Annex 10, Volume I, is a mandatory specification requirement for each DME aeronautical facility; and
- (3) each radio navigation aid listed in an aeronautical telecommunication service certificate holder's exposition must be provided with a monitoring system that will remove the aeronautical facility from

operational service and transmit a warning to an appropriate control point upon detection of any of the following conditions:

- (vi) navigation information outside the prescribed tolerance for the facility:
  - (vii) Failure of the identification signal:
  - (viii) failure of the monitoring system.
- (4) Each VHF Omnidirectional radio range (VOR), Instrument Landing Systems (ILS) and Global Navigation System (GNSS) listed in an aeronautical telecommunication service certificate holder's exposition must comply with the additional specifications and requirements listed in Appendix A.
- (5) Each Secondary Surveillance Radar (SSR), Human Factors considerations, Airborne Collision Avoidance System (ACAS), Mode S Extended Squitter, Mode S Extended Squitter Receiving System Characteristics (ADS-B IN and TIS B IN) listed in an aeronautical telecommunication service certificate holder's exposition must comply with the additional specifications and requirements listed in Appendix B.
- (6) Each Aeronautical Telecommunication Network (ATN), SSR Mode S Air Ground Data Link, VHF Air Ground Data Link (VDL), Aircraft Addressing System, Single Sideband (SSB) High Frequency (HF) communication system, Selective Calling System (SELCAL), Aeronautical Speech Circuits and Emergency Locator Transmitter (ELT) for search and rescue listed in an aeronautical telecommunication service certificate holder's exposition must comply with the additional specifications and requirements listed in Appendix C.

## **Appendix A - Radio Navigation Aids**

### **1. Standard radio navigation aids**

1.1 The standard radio navigation aids shall be:

- a) the instrument landing system (ILS) conforming to the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.1;
- b) the microwave landing system (MLS) conforming to the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.11;
- c) the global navigation satellite system (GNSS) conforming to the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.7;
- d) the VHF omnidirectional radio range (VOR) conforming to the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.3;
- e) the non-directional radio beacon (NDB) conforming to the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.4;
- f) the distance measuring equipment (DME) conforming the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.5 and
- g) the en-route VHF marker beacon conforming to the Standards contained in ICAO Annex 10 Volume I Chapter 3, 3.6.

1.2 Differences in radio navigation aids in any respect from the Standards of ICAO Annex 10 Volume 1 Chapter 3 must be published in an Aeronautical Information Publication (AIP).

1.3 Wherever there is installed a radio navigation aid that is neither an ILS nor an MLS, but which may be used in whole or in part with aircraft equipment designed for use with the ILS or MLS, full details of parts that may be used shall be published in an Aeronautical Information Publication (AIP).

### **2. VHF Omnidirectional Radio Range (VOR)**

2.1 Each VOR listed in an aeronautical telecommunication service certificate holder's exposition must conform with the following requirements, in addition to the specifications prescribed in section 3.3 of ICAO Annex 10, Volume 1:

- (i) The VOR shall be constructed and adjusted so that similar instrumental indications in the aircraft represent equal clockwise angular deviations (bearings), degree for degree from magnetic North as measured from the location of the VOR.
- (ii) The VOR shall radiate a radio frequency carrier with which are associated two separate 30Hz modulations. One of these modulations shall be such that its phase is independent of the azimuth of the point of observation (reference phase). The other modulation (variable phase) shall be such that its phase at the point of observation with respect to the VOR.
- (iii) The reference and variable phase modulations shall be in phase along the reference magnetic meridian through the station.

### **3. Instrument Landing System (ILS)**

3.1 Each ILS listed in an aeronautical telecommunication service certificate holder's exposition must conform with the following requirements, in addition to the specifications prescribed in ICAO Annex 10, Volume 1 Chapters 2, 3 and Attachment C.

#### 3.2 Basic Requirements

The ILS shall comprise the following basic requirements:

1. VHF localizer equipment, associated monitor system, remote control and indicator equipment;
2. UHF glide path equipment, associated monitor system, remote control and indicator equipment;
3. An appropriate means to enable glide path verification checks.

3.3 Distance to threshold information to enable glide path verification shall be provided by either VHF marker beacons or distance measuring equipment (DME), together with monitor systems and remote control and indicator equipment.

3.4 If DME is used in lieu of marker beacons, the equipment shall conform to the specifications in ICAO Annex 10, Volume 1 3.1.7.6.5. and Attachment C, 2.11.

3.5 Facility Performance Categories I, II and III – ILS shall provide indications at designated remote control points of the operational status of all ILS ground systems as follows:

- (i) for all Category II and Category III ILS, the air traffic services unit involved in the control of aircraft on final approach shall be one of the designated remote control points and shall receive information on the operational status of the ILS, with a delay commensurate with the requirements of the operational environment.
- (ii) for a Category I ILS, if that ILS provides an essential radio navigation service, the air traffic services unit involved in the control of aircraft on the final approach shall be one of the designated remote control points and shall receive information on the operational status of the ILS, with a delay commensurate with the requirements of the operational environment.

3.6 The ILS shall be constructed and adjusted so that, at a specific distance from the threshold, similar instrumental indications in the aircraft represents similar displacements from the course line or ILS glide path as appropriate, irrespective of the particular ground installation in use.

3.7 The localizer and glide path components specified in 3.1.2.1 a) and b) which form part of a Facility Performance Category I- ILS shall comply at least with the Standards in 3.1.3 and 3.1.5 respectively, excepting those in which application to Facility Performance Category II- ILS is prescribed.

3.8 The localizer and glide path components specified in 3.1.2.1 a) and b) which form part of a Facility Performance Category II- ILS shall comply with the Standards applicable to these components in a Facility Performance Category I – ILS, as supplemented or amended by the Standards in 3.1.3 and 3.1.5 in which application to Facility Performance Category II – ILS is prescribed.

- 3.9 The localizer and glide path components and other ancillary equipment specified in 3.1.2.1.3, which form part of a Facility Performance Category III – ILS, shall otherwise comply with the Standards applicable to these components in Facility Performance Category I and II – ILS, except as supplemented by the Standards in 3.1.3 and 3.1.5 in which application to Facility Performance Category III – ILS is prescribed.
- 3.10 To ensure an adequate level of safety, the ILS shall be so designed and maintained that the probability of operation within the performance requirements specified is of a high value, consistent with the category of operational performance concerned.
- 3.11 At locations where ILS facilities serving opposite ends of the runway or different runways at the same airport use the same paired frequencies, an interlock shall ensure that only one facility shall radiate at a time. When switching from one ILS facility to another, radiation from both shall be suppressed for not less than 20 seconds.

#### **4. Global Navigation Satellite System (GNSS)**

- 4.1 The general functions and use of GNSS must conform with the following requirements, in addition to the specifications prescribed in ICAO Annex 10, Volume 1 Chapters 2, 3 and Attachment D.

##### 4.1.1 Functions

- 4.1.2 The GNSS shall provide position and time data to the aircraft.

These data are derived from pseudo-range measurements between an aircraft equipped with a GNSS receiver and various signal sources on satellites or on the ground.

##### 4.2 GNSS Elements

The GNSS navigation service shall be provided using various combinations of the following elements installed on the ground, on satellites and/or on board the aircraft:

- 4.2.1 Global Positioning System (GPS) that provides the Standard Positioning Service (SPS) as defined in ICAO Annex 10, Volume 1 Chapter 3.7.3.1;
- 3.2.2 Global Navigation Satellite System (GLONASS) that provides the Channel of Standard Accuracy (CSA) navigation signal as defined in ICAO Annex 10, Volume 1 Chapter 3.7.3.2;
- 3.2.3 Aircraft-based augmentation system (ABAS) as defined in 3.7.3.3;
- 3.2.4 Satellite-based augmentation system (SBAS) as defined in 3.7.3.4;
- 3.2.5 Ground-based augmentation system (GBAS) as defined in 3.7.3.5;
- 3.2.6 Aircraft GNSS receiver as defined in 3.7.3.6.

##### 4.3 GNSS Specific Provisions

- 4.3.1 A procedure for the collection and dissemination of Receiver Autonomous Integrity Monitoring (RAIM) prediction warning must be provided by the ANSP in the provision of GNSS service.
- 4.3.2 It shall be permissible to terminate a GNSS satellite service provided by one of its

elements (ICAO Annex 10 Volume I Chapter 3, Section 3.7.2) on the basis of at least a six-year advance notice by a service provider.

4.3.3 All GNSS-based operations must ensure that GNSS data relevant to those operations are recorded.

4.3.4 These recordings data are primarily intended for use in accident and incident investigations. They may also support periodic confirmation that accuracy, integrity, continuity and availability are maintained within the limits required for the operations approved.

4.3.5 Recordings shall be retained for a period of 14 days. When the recordings are pertinent to accidents and incident investigations, they should be retained for longer periods until it is evident that they will no longer be required.

## **Appendix B - Surveillance**

### **1. Secondary Surveillance Radar (SSR)**

1.1 When SSR is installed and maintained in operation as an aid to air traffic services, it must conform with the provisions of ICAO Annex 10, Volume IV chapters 2, 3 and 5.

#### 1.1.1 Interrogation modes (ground to air)

*Note.— As referred to in this Annex, Mode A/C transponders are those which conform to the characteristics prescribed in 3.1.1. Mode S transponders are those which conform to the characteristics prescribed in 3.1.2. The functional capabilities of Mode A/C transponders are an integral part of those of Mode S transponders.*

### **2. Interrogation for air traffic services shall be performed on the modes described in chapter 3.1.1.4.3 or 3.1.2. The uses of each mode shall be as follows:**

- (i) Mode A – to elicit transponder replies for identity and surveillance.
- (ii) Mode C – to elicit transponder replies for automatic pressure-altitude transmission and surveillance.
- (iii) Intermode –
  - a) Mode A/C/S all-call: to elicit replies for surveillance of Mode A/C transponder and for the acquisition of Mode S transponders.
  - b) Mode A/C-only all-call: to elicit replies for surveillance of Mode A/C transponders. Mode S transponders do not reply.
- (iv) Mode S –
  - a) Mode S-only all-call: to elicit replies for acquisition of Mode S transponders.
  - b) Broadcast: to transmit information to all Mode S transponders. No replies are elicited.
  - c) Selective: for surveillance of, and communication with, individual Mode S transponders. For each interrogation, a reply is elicited only from the transponder uniquely addressed by the interrogation.

In areas where improved aircraft identification is necessary to enhance the effectiveness of the

ATC system, SSR ground facilities having Mode S features shall include aircraft identification capability.

### **3. Side-Lobe Suppression Control Interrogation**

3.1 Side-lobe suppression shall be provided in accordance with the provisions of ICAO Annex 10, Volume IV chapter 3.1.1.4 and 3.1.1.5 on all Mode A, Mode C and intermode interrogations.

3.2 Side-lobe suppression shall be provided in accordance with the provisions of ICAO Annex 10, Volume IV Chapter 3.1.2.1.5.2.1 on all Mode S-only all-call interrogations.

### **4. Transponder reply modes (air-to-ground)**

4.1 Transponder shall respond to Mode A interrogations in accordance with the provisions of ICAO Annex 10, Volume IV Chapter 3.1.1.7.12.1 and 3.1.1.7.12.2.

4.2 The pressure-altitude reports contained in Mode S replies shall be derived as specified in 3.1.1.7.12.2.

4.3 For aircraft equipped with 7.62 m (25 ft) or better pressure-altitude information provided by Mode S transponders in response to selective interrogations (i.e. in the AC field, 3.1.2.6.5.4) shall be reported in 7.62 m (25 ft) increments.

4.4 All Mode A/C transponders shall report pressure-altitude encoded in the information pulses in Mode C replies.

4.5 All Mode S transponders shall report pressure-altitude encoded in the information pulses in Mode C replies and in the AC field of Mode S replies.

4.6 When a Mode S transponder is not receiving more pressure-altitude information from a source with a quantization of 7.62 m (25 ft) or better increments, the reported value of the altitude shall be the value obtained by expressing the measured value of the uncorrected pressure-altitude of the aircraft in 30.48 m (100 ft) increments and the Q bit (see 3.1.2.6.5.4 b) shall be set to 0.

4.7 Transponders used within airspace where the need for Mode S airborne capability has been determined shall also respond to intermode and Mode S interrogations in accordance with the applicable provisions of 3.1.2.

4.8 Requirements for mandatory carriage of SSR Mode S transponders shall be on the basis of regional air navigation agreements which shall specify the airspace and the airborne implementation timescales.

4.9 The agreements indicated in 2.1.4.8 shall provide at least five years notice.

### **5. Mode A reply codes (information pulses)**

5.1 All transponders shall be capable of generating 4 096 reply codes conforming to the characteristics given in ICAO Annex 10, Volume IV Chapter 3.1.1.6.2.

5.2 The following Mode A codes shall be reserved for special purposes:

5.3 Code 7700 to provide recognition of an aircraft in an emergency.

5.4 Code 7600 to provide recognition of an aircraft with radiocommunication failure.

- 5.5 Code 7500 to provide recognition of an aircraft which is being subjected to unlawful interference.
- 5.6 Appropriate provisions shall be made in ground decoding equipment to ensure immediate recognition of Modes A codes 7500, 7600 and 7700.
- 5.7 Mode A code 0000 shall be reserved for allocation subject to regional agreements, as a general purpose code.
- 5.8 Mode A code 2000 shall be reserved to provide recognition of an aircraft which has not received any instructions from air traffic control units to operate the transponder.

## **6. Mode S airborne equipment capability**

All mode S transponders shall conform to one of the following five levels:

- 6.1 Level 1 transponder shall have the capabilities prescribed for:
- a) Mode A identity and Mode C pressure-altitude reporting;
  - b) Intermode and Mode S all-call transaction;
  - c) Addressed surveillance altitude and identity transaction;
  - d) Lockout protocols;
  - e) Basic data protocols except data link capability reporting;
  - f) Air-air service and squitter transactions.
- 6.2 Level 2 – Level 2 transponders shall have the capabilities of 2.1.6.1.1 and also those prescribed for:
- a) standard length communications (Comm-A and Comm-B);
  - b) data link capability reporting;
  - c) aircraft identification reporting;
  - d) data parity with overlay control for equipment certified on or after 1 January 2020.
- 6.3 Level 3 – Level 3 transponders shall have the capabilities of 2.1.6.1.2 and also those prescribed for ground-to-air extended length message (ELM) communications.
- 6.4 Level 4 – Level 4 transponders shall have the capabilities of 2.1.6.1.3 and also those prescribed for air-to-ground extended length message (ELM) communications.
- 6.5 Level 5 – Level 5 transponders shall have the capabilities of 2.1.6.1.4 and also those prescribed for enhanced Comm-B and extended length message (ELM) communications.
- 6.6 Extended squitter – Extended squitter transponders shall have the capabilities of 2.1.6.2, 2.1.6.1.3, 2.1.6.4 or 2.1.6.1.5, the capabilities prescribed for extended squitter operation and the capabilities prescribed for ACAS cross-link operation. Transponder with these capabilities shall be designated with suffix “e”.
- 6.7 SI capability – Transponders with the ability to process SI codes shall have the capabilities of 2.1.6.1.1, 2.1.6.1.2, 2.1.6.1.3, 2.1.6.1.4, 2.1.6.1.5 and also those prescribed for SI code

operation. Transponders with this capability shall be designated with a suffix “s”.

6.8 Extended squitter non-transponder devices. Devices that are capable of broadcasting extended squitter’s that are not part of a Mode S transponder shall conform to all of the 1090 Mhz RF signals in space requirements specified for a Mode S transponder, except for transmit power levels for the identified equipment class as specified in 6.1.1.

6.9 All Mode S transponders used by international civil air traffic shall conform, at least, to the requirements of Level 2 prescribed in 2.1.6.1.2.

6.10 Mode S transponder installed on aircraft with gross mass in excess of 5700 kg or a maximum cruising true airspeed capability in excess of 463 km/h (250kt) shall operate with antenna diversity as prescribed in ICAO Annex 10, Volume 4 Chapter 3.1.2.10 if:

- a) The aircraft individual certificate of airworthiness is first issued on or after 1 January 1990; or
- b) Mode S transponder carriage is required on the basis of regional air navigation agreement in accordance with ICAO Annex 10, Volume 4 Chapter 2.1.3.3.1 and 2.1.3.3.2.

6.11 Capability Reporting in Mode S Squitter’s.

6.11.1 Capability reporting in Mode S acquisition squitter’s (unsolicited downlink transmissions) shall be provided in accordance with the provisions of ICAO Annex 10, Volume 4 Chapter 3.1.2.8.5.1 for all Mode S transponders installed on or after 1 January 1995.

6.12 Extended Length Message (ELM) Transmit Power

6.12.1 In order to facilitate the conversion of existing Mode S transponders to include full Mode S capability, transponders originally manufactured before 1 January 1999 shall be permitted to transmit a burst of 16 ELM segments at a minimum power level of 20dBW.

## **7. SSR Mode S address (aircraft address)**

7.1 The SSR Mode S address shall be one of 16 777 214 twenty -four-bit aircraft addresses allocated by ICAO to the State of Registry or common mark registering authority and assigned as prescribed in ICAO Annex 10, Volume 4 Chapter 3.1.2.4.1.2.3.1.1 and the Appendix to Chapter 9, Part 1, Volume III, Annex 10.

## **8. Human Factors Considerations**

8.1 Human Factors principles shall be observed in the design and certification of surveillance radar, transponder and collision avoidance systems.

8.2 Operation of Controls

8.2.1 Transponder controls which are not intended to be operated in flight shall not be directly accessible to the flight crew.

8.2.2 The operation of transponder controls, intended for use during flight, shall be evaluated to ensure they are logical and tolerant to human error. In particular, where transponder mode switching (i.e. an operational state to ‘Standby’ or ‘off’) is minimized.

8.2.3 The flight crew shall have access at all times to the information of the operational state of the transponder.

## **9. Airborne collision avoidance system (ACAS)**

The general functions and use of ACAS must conform with the following requirements, in addition to the specifications prescribed in ICAO Annex 10, Volume 4 Chapters 3 and 4.

### 9.1 ACAS I General provisions and characteristics

#### 9.2 Functional requirements

ACAS 1 shall perform the following functions:

- a) surveillance of nearby SSR transponder- equipped aircraft; and
- b) provide indications to the flight crew identifying the approximate position of aircraft as an aid to visual acquisition.

#### 9.3 Signal format

9.3.1 The RF characteristics of all ACAS I signals shall conform to the provisions of Chapter 3, 3.1.1.1 through 3.1.1.6 and 3.1.2.1 through 3.1.2.4.

#### 9.4 General provisions relating to ACAS II and ACAS III

##### 9.4.1 Functional requirements

9.4.2 ACAS functions. ACAS shall perform the following functions:

- a) surveillance;
- b) generation of TAs;
- c) threat detection;
- d) generation of Ras;
- e) coordination; and
- f) communication with ground stations.

The equipment shall execute functions b) through e) on each cycle of operation.

9.4.3 The duration of a cycle shall not exceed 1.2 s.

#### 9.5 Surveillance performance requirements

##### 9.5.1 General surveillance requirements.

ACAS shall interrogate SSR Mode A/C and Mode S transponders in other aircraft and detect the transponder replies. ACAS shall measure the range and relative bearing of responding aircraft. Using these measurements and information conveyed by transponder replies, ACAS shall estimate the relative positions of each responding aircraft. ACAS shall include provisions for achieving such position determination in the presence of ground reflections, interference and variations in signal strength.

### 9.5.2 Track establishment probability

ACAS shall generate an established track, with at least a 0.90 probability that the track is established 30 s before closest approach, on aircraft equipped with transponders when all of the following conditions are satisfied:

- a) the elevation angles of these aircraft are within  $\pm 10$  degrees relative to the ACAS aircraft pitch plane;
- b) the magnitudes of these aircrafts rates of change of altitude are less than equal to 51m/s (10 000 ft/min);
- c) the transponder and antennas of these aircraft meet the Standards of Chapter 3, 3.1.1 and 3.1.2;
- d) the closing speeds and directions of these aircraft, the local density of SSR transponder-equipped aircraft and the number of other ACAS interrogators in the vicinity (as determined by monitoring ACAS broadcasts, 4.3.7.1.2.4) satisfy the conditions specified in Table 4-1; and
- e) the minimum slant range is equal to or greater than 300m (1 000 ft).

9.5.3 ACAS shall continue to provide surveillance with no abrupt degradation in track establishment probability as any one of the condition bounds defined in 2.3.5.2 is exceeded.

9.5.4 ACAS shall not track Mode S aircraft that report that they are on the ground.

9.5.5 ACAS shall achieve the required tracking performance when the average SSR Mode A/C asynchronous reply rate from transponders in the vicinity of the ACAS aircraft is 240 replies per second and when the peak interrogation rate received by the individual transponders under surveillance is 500 per second.

### 9.5.6 False track probability

The probability that an established Mode A/C track does not correspond in range and altitude, if reported, to an actual aircraft shall be less than  $10^{-2}$ . For an established Mode S track this probability shall be less than  $10^{-6}$ . These limits shall not be exceeded in any traffic environment.

## **10. Mode S Extended Squitter**

The general functions and use of Mode S Extended Squitter must conform with the following requirements, in addition to the specifications prescribed in ICAO Annex 10, Volume 4 Chapters 2, 3, 4 and 5.

### 10.1 Mode S Extended Squitter Transmitting System Characteristics

#### 10.1.1 ADS-B out requirements

10.1.2 Aircraft, surface vehicles and fixed obstacles supporting ADS-B message generation function and the ADS-B message exchange function (transmit) as depicted in Figure 5-1.

10.1.3 ADS-B transmissions from aircraft shall include position, aircraft identification and type, airborne velocity, periodic status and event driven messages including emergency/priority information.

10.1.4 Extended squitter transmitting equipment shall use formats and protocols of the latest version available.

10.1.5 Extended squitter ADS-B transmitting requirements. Mode S extended squitter transmitting equipment shall be classified according to the units range capability and the set of parameters that it is capable of transmitting consistent with the following definition of general equipment classes and the specific equipment classes defined in Tables 5-1 and 5-2;

- a) Class A extended squitter airborne systems support an interactive capability incorporating both an extended squitter reception capability (i.e. ADS-B IN) in support of onboard ADS-B applications;
- b) Class B extended squitter systems provide a transmission only (i.e. ADS-B OUT without an extended squitter reception capability) for use on aircraft, surface vehicles, or fixed obstructions; and
- c) Class C extended squitter systems have only a reception capability and thus have no transmission requirements.

10.1.6 Class A extended squitter system requirements. Class A extended squitter airborne systems shall have transmitting and receiving subsystem characteristics of the same class (i.e. A0, A1, A2, or A3) as specified in 2.4.1.1 and 2.4.2.1.2

10.1.7 Control of ADS-B Out Operations.

Protection against reception of corrupted data from the source providing the position shall be satisfied by error detection on the data inputs and the appropriate maintenance of the installation.

If an independent control of the ADS-B OUT function is provided, then the operational state of the ADS-B OUT function shall be provided to the flight crew, at all times.

## **11 Mode S Extended Squitter Receiving System Characteristics (ADS-B IN And TIS-B IN)**

As referred to in paragraph 2.4 on general functions and in addition to the use of Mode S Extended Squitter, detailed technical provisions for Mode S extended squitter receivers can be found within RTCA DO-260B/EUROCAE ED-102A, “Minimum Operational Performance Standards for 1 090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS B)”.

## **Appendix C - Communications**

### **A. Digital Data Communication Systems**

#### 1. Aeronautical Telecommunication Network (ATN)

##### 1.1 Introduction

The ATN is specifically and exclusively intended to provide digital data communications services to air traffic service provider organizations and aircraft operating agencies in support of:

- a) air traffic services communications (ATSC) with aircraft;
- b) air traffic services communications between ATS units;
- c) aeronautical operational control communications (AOC); and
- d) aeronautical administrative communications (AAC).

- 1.2 The general requirements set out below and the Standards and Recommended Practices in sections 3.4 to 3.8 of ICAO Annex 10 Volume III Part I Chapter 3 define the minimum required protocols and services that will enable the global implementation of the aeronautical telecommunications network (ATN).
- 1.3 ATN communication services must support ATN applications.
- 1.4 Requirements for implementation of the ATN shall be made on the basis of regional air navigation agreements. These agreements shall specify the area in which the communication standards for the ATN/OSI or the ATN/IPS are applicable.
- 1.5 ATN communication services shall support ATN applications.
- 1.6 Requirements for implementation of the ATN shall be made on the basis of regional air navigation agreements. These agreements shall specify the area in which the communication standards for the ATN/OSI or the ATN/IPS are applicable.

## **2. General Requirements**

- 2.1 The ATN must either use International Organization for Standardization (ISO) communication standards for open systems interconnection (OSI) or use the Internet Society (ISOC) communications standards for the Internet Protocol Suite (IPS).

*Note 1. — ATN/IPS implementation is preferred for ground-ground networks. While ATN/OSI continues to be supported in air-ground networks, particularly when using VDL Mode 2, it is expected that future air-ground implementations will use the ATN/IPS.*

*Note 2. — Interoperability between interconnecting OSI/IPS networks is expected to be arranged prior to implementation.*

*Note 3. — Guidance material on interoperability between ATN/OSI and ATN/IPS is contained in Doc 9896.*
- 2.2 The AFTN/AMHS gateway shall ensure the interoperability of AFTN and CIDIN stations and networks with the ATN.
- 2.3 An authorized path(s) shall be defined on the basis of a predefined routing policy.
- 2.4 The ATN shall transmit, relay and deliver messages in accordance with the priority classifications and without discrimination or undue delay.
- 2.5 The ATN shall provide means to define data communications that can be carried only over authorized paths for the traffic type and category specified by the user.

2.6 The ATN shall provide communication in accordance with the prescribed required communication performance (RCP).

*Note. — The Manual on Required Communication Performance (RCP) (Doc 9869) contains the necessary information on RCP.*

2.7 The ATN shall operate in accordance with the communication priorities defined in Table 3-1\* and Table 3-2.

2.8 The ATN shall enable exchange of application information when one or more authorized paths exist.

2.9 The ATN shall notify the appropriate application processes when no authorized path exists.

2.10 The ATN shall make provisions for the efficient use of limited bandwidth subnetworks.

2.11 The ATN shall enable an aircraft intermediate system (router) to connect to a ground intermediate system (router) via different subnetworks.

2.12 The ATN shall enable an aircraft intermediate system (router) to connect to different ground intermediate systems (routers).

2.13 The ATN shall enable the exchange of address information between applications.

2.14 Where the absolute time of day is used within the ATN, it shall be accurate to within 1second of coordinated universal time (UTC).

*Note. — The time accuracy value results in synchronization errors of up to two seconds.*

### **3. SSR Mode S Air-Ground Data Link**

#### 3.1 General provisions

The general requirements set out below and the Standards and Recommended Practices in sections 5.2.2 to 5.3 of ICAO Annex 10 Volume III Part I Chapter 5 define the protocols and services that will enable the global provision of the Mode S Air-Ground Data links.

3.2 *Message categories.* The Mode S subnetwork shall only carry aeronautical communications classified under categories of flight safety and flight regularity as specified in Annex 10, Volume II, Chapter 5, 5.1.8.4 and 5.1.8.6.

3.3 *Signals in space.* The signal-in-space characteristics of the Mode S subnetwork shall conform to the provisions contained in Annex 10, Volume IV, Chapter 3, 3.1.2.

3.4 *Code and byte independency.* The Mode S subnetwork shall be capable of code and byte independent transmission of digital data.

3.5 *Data transfer.* Data shall be conveyed over the Mode S data link in segments using either standard length message (SLM) protocols or extended length message (ELM) protocols as defined in 3.1.2.6.11 and 3.1.2.7 of Annex 10, Volume IV.

3.6 *Bit numbering.* In the description of the data exchange fields, the bits shall be numbered in the order of their transmission, beginning with bit 1. Bit numbers shall continue

through the second and higher segments of multi-segment frames. Unless otherwise stated, numerical values encoded by groups (fields) of bits shall be encoded using positive binary notation and the first bit transmitted shall be the most significant bit (MSB) (3.1.2.3.1.3 of Annex 10, Volume IV).

3.7 Unassigned bits. When the length of the data is not sufficient to occupy all bit positions within a message field or subfield, the unassigned bit positions shall be set to 0.

#### **4. VHF Air-Ground Digital Link (VDL)**

##### 4.1 General provisions

4.1.1 The very high frequency (VHF) Digital Link (VDL) Mode 2 and the VDL Mode 4 provide data service capabilities. The VDL Mode 3 provides both voice and data service capabilities. The data capability is a constituent mobile subnetwork of the aeronautical telecommunication network (ATN). In addition, the VDL may provide non-ATN functions.

4.1.2 Standards and Recommended Practices are prescribed in ICAO Annex 10, Volume III Chapter 6 with Technical Specifications in Docs 9776, 9805 and 9816.

4.1.3 Sections 6.1.2 to 6.8.2 contain Standards and Recommended Practices for VDL Modes 2 and 3. Section 6.9 contains Standards and Recommended Practices for VDL Mode 4.

##### 4.2 Radio channels and functional channels.

4.2.1 Aircraft station radio frequency range. An aircraft station shall be capable of tuning to any of the channels in the range specified in ICAO Annex 10 Volume III Section 6.1.4.1 within 100 milliseconds after the receipt of an autotune command. In addition, for VDL Mode 3, an aircraft station shall be able to tune to any channel in the range specified in ICAO Annex 10 Volume III Section 6.1.4.1 within 100 milliseconds after the receipt of any tuning command.

4.2.2 Ground station radio frequency range. A ground station shall be capable of operating on its assigned channel within the radio frequency range detailed in 6.1.4.1.

4.2.3 Common signalling channel. Frequency 136.975MHz shall be reserved as a worldwide common signalling channel (CSC) for VDL Mode 2.

##### 4.3 System capabilities

4.3.1 Data transparency. The VDL system shall provide code-independent, byte-independent transfer of data.

4.3.2 Broadcast. The VDL system shall provide link layer data broadcast services (Mode 2) and/or voice and data broadcast services (Mode 3). For VDL Mode 3, the data broadcast service shall support network multicasting capability originating from the ground.

4.3.3 Connection management. The VDL system shall establish and maintain a reliable communications path between the aircraft and the ground system while allowing but not requiring manual intervention.

Note.— In this context “reliable” is defined by the BER requirement specified in 6.3.5.1.

4.3.4 Ground network transition. A VDL-equipped aircraft shall transition from one ground station to another when circumstances dictate.

4.3.5 Voice capability. The VDL Mode 3 system shall support a transparent, simplex voice operation based on a “Listen-Before-Push-To-Talk” channel access.

#### 4.4 Air-ground VHF digital link communications system characteristics

4.4.1 The radio frequencies used shall be selected from the radio frequencies in the band 117.975–137 MHz. The lowest assignable frequency shall be 118.000 MHz, and the highest assignable frequency shall be 136.975 MHz. The separation between assignable frequencies (channel spacing) shall be 25 kHz.

Note.— ICAO Annex 10 Volume V specifies that the block of frequencies from 136.9 – 136.975 MHz inclusive is reserved for VHF air-ground digital communications.

4.4.2 The design polarization of emissions shall be vertical.

### **5. Aircraft Addressing system**

#### 5.1 General

The provisions of ICAO Annex 10 Volume III Chapter 9 prescribes the Aircraft addressing system as provided for by ICAO for States of Registry.

5.1.1 Global communications, navigation and surveillance systems shall use an individual aircraft address composed of 24 bits. At any one time, no address shall be assigned to more than one aircraft. The assignment of aircraft addresses requires a comprehensive scheme providing for a balanced and expandable distribution of aircraft addresses applicable worldwide.

5.1.2 The aircraft address shall be one of 16 777 214 twenty-four-bit aircraft addresses allocated by ICAO to the State of Registry or common mark registering authority and assigned as prescribed in the Appendix to this chapter.

5.1.3 Non-aircraft transponders that are installed on aerodrome surface vehicles, obstacles or fixed Mode S target detection devices for surveillance and/or radar monitoring purposes shall be assigned 24-bit aircraft addresses.

Note.— Under such specific conditions, the term “aircraft” can be understood as “aircraft (or pseudo-aircraft) or vehicle (A/V)” where a limited set of data is generally sufficient for operational purposes.

5.1.4 Mode S transponders used under specific conditions stated in 3.5.1.1 shall not have any negative impact on the performance of existing ATS surveillance systems and ACAS.

### **B. Voice Communication Systems**

#### **1. General requirements Aeronautical Mobile Service.**

1.1 The general requirements for Air-Ground VHF communication system and characteristics are as set out below in addition to the Standards and Recommended Practices in sections 2.2 to 2.3.3.4 of ICAO Annex 10 Volume III Part II chapter 2.

- 1.2 The characteristics of the air-ground VHF communication system used in the International Aeronautical Mobile Service shall be in conformity with the following specifications:
- 1.3 Radiotelephone emissions shall be double sideband (DSB) amplitude modulated (AM) carriers. The designation of emission is A3E, as specified in the ITU Radio Regulations.
- 1.4 Spurious emissions shall be kept at the lowest value which the state of technique and the nature of the service permit.

*Note.— Appendix S3 to the ITU Radio Regulations specifies the levels of spurious emissions to which transmitters must conform.*

- 1.5 The radio frequencies used shall be selected from the radio frequencies in the band 117.975 – 137 MHz. The separation between assignable frequencies (channel spacing) and frequency tolerances applicable to elements of the system shall be as specified in Volume V.

*Note.— The band 117.975 – 132 MHz was allocated to the Aeronautical Mobile (R) Service in the ITU Radio Regulations (1947). By subsequent revisions at ITU World Administrative Radio Conferences the bands 132 – 136 MHz and 136 – 137 MHz were added under conditions which differ for ITU Regions, or for specified countries or combinations of countries (see RRs S5.203, S5.203A and S5.203B for additional allocations in the band 136 – 137 MHz, and S5.201 for the band 132 – 136 MHz).*

- 1.6 The design polarization of emissions shall be vertical.

## **2. Single sideband (SSB) HF communication system characteristics for use in the aeronautical mobile service.**

- 2.1 The characteristics of the air-ground HF SSB system, where used in the Aeronautical Mobile Service, shall be in conformity with the ICAO Annex 10 Volume III Part II Chapter 2 Section 2.4.1.1.1 to 2.4.1.9.

## **3. Selective calling system (SELCAL)**

- 3.1 Where a SELCAL system is installed, the following system characteristics shall be applied:

- a) Transmitted code. Each transmitted code shall be made up of two consecutive tone pulses, with each pulse containing two simultaneously transmitted tones. The pulses shall be of 1.0 plus or minus 0.25 seconds duration, separated by an interval of 0.2 plus or minus 0.1 second.
- b) Stability. The frequency of transmitted tones shall be held to plus or minus 0.15 per cent tolerance to ensure proper operation of the airborne decoder.
- c) Distortion. The overall audio distortion present on the transmitted RF signal shall not exceed 15 per cent.

- d) Per cent modulation. The RF signal transmitted by the ground radio station shall contain, within 3 dB, equal amounts of the two modulating tones. The combination of tones shall result in a modulation envelope having a nominal modulation percentage as high as possible and in no case less than 60 per cent.
- e) Transmitted tones. Tone codes shall be made up of various combinations of the tones listed in the following table and designated by colour and letter as indicated:

<u>Designation</u>	<u>Frequency (Hz)</u>
<u>Red A</u>	<u>312.6</u>
<u>Red B</u>	<u>346.7</u>
<u>Red C</u>	<u>384.6</u>
<u>Red D</u>	<u>426.6</u>
<u>Red E</u>	<u>473.2</u>
<u>Red F</u>	<u>524.8</u>
<u>Red G</u>	<u>582.1</u>
<u>Red H</u>	<u>645.7</u>
<u>Red J</u>	<u>716.1</u>
<u>Red K</u>	<u>794.3</u>
<u>Red L</u>	<u>881.0</u>
<u>Red M</u>	<u>977.2</u>
<u>Red P</u>	<u>1 083.9</u>
<u>Red Q</u>	<u>1 202.3</u>
<u>Red R</u>	<u>1 333.5</u>
<u>Red S</u>	<u>1 479.1</u>

Note 1.— It shall be noted that the tones are spaced by Log-1 0.045 to avoid the possibility of harmonic combinations.

Note 2.— In accordance with the application principles developed by the Sixth Session of the Communications Division, the only codes at present used internationally are selected from the red group.

Note 3.— Guidance material on the use of SELCAL systems is contained in the Attachment to Part II.

Note 4.— The tones Red P, Red Q, Red R, and Red S are applicable after 1 September 1985, in accordance with 4.3.2.

3.2 As from 1 September 1985, aeronautical stations which are required to communicate with SELCAL-equipped aircraft shall have SELCAL encoders in accordance with the red group in the table of tone frequencies of 3.1. After 1 September 1985, SELCAL codes using the tones Red P, Red Q, Red R, and Red S may be assigned.

#### **4. Aeronautical Speech Circuits**

4.1 Technical provisions relating to international aeronautical speech circuit switching and signalling for ground-ground applications is as prescribed in ICAO Annex 10 Volume III Part II Chapter 4 and Doc 9804.

- 4.2 The use of circuit switching and signalling to provide speech circuits to interconnect ATS units not interconnected by dedicated circuits shall be by agreement between the Administrations concerned.
- 4.3 The application of aeronautical speech circuit switching and signalling shall be made on the basis of regional air navigation agreements.
- 4.4 The ATC communication requirements defined in Annex 11, Section 6.2 shall be met by implementation of one or more of the following basic three call types:
- a) instantaneous access;
  - b) direct access; and
  - c) indirect access.
- 4.5 In addition to the ability to make basic telephone calls, the following functions shall be provided in order to meet the requirements set out in Annex 11:
- a) means of indicating the calling/called party identity;
  - b) means of initiating urgent/priority calls; and
  - c) conference capabilities.
- 4.6 The characteristics of the circuits used in aeronautical speech circuit switching and signalling shall conform to appropriate ISO/IEC international standards and ITU-T recommendations.
- 4.7 Digital signalling systems shall be used wherever their use can be justified in terms of any of the following:
- a) improved quality of service;
  - b) improved user facilities; or
  - c) reduce costs where quality of service is maintained.
- 4.8 The characteristics of supervisory tones to be used (such as ringing, busy, number unobtainable) shall conform to appropriate ITU-T recommendations.
- 4.9 To take advantage of the benefits of interconnecting regional and national aeronautical speech networks, the international aeronautical telephone network numbering scheme shall be used.

## **5. Emergency Locator Transmitter (ELT) For Search and Rescue**

### 5.1 General

Technical provisions relating to Emergency Locator Transmitter (ELT) for search and rescue application is as prescribed in ICAO Annex 10 Volume III Part II Chapter 5 and Appendix.

- 5.2 Until 1 January 2005, emergency locator transmitters must operate either on both 406 MHz and 121.5 MHz or on 121.5 MHz.

Note.— From 1 January 2000, ELTs operating on 121.5 MHz will be required to meet the improved technical characteristics contained in section 5.2.1.8 of ICAO Annex 10 Volume III Part II Chapter 5.

- 5.3 All installations of emergency locator transmitters operating on 406 MHz shall meet the provisions of ICAO Annex 10 Volume III Part II Chapter 5.3.
- 5.4 All installations of emergency locator transmitters operating on 121.5 MHz shall meet the provisions of ICAO Annex 10 Volume III Part II Chapter 5.2.
- 5.5 From 1 January 2005, emergency locator transmitters shall operate on 406 MHz and 121.5 MHz simultaneously.
- 5.6 All emergency locator transmitters installed on or after 1 January 2002 shall operate simultaneously on 406 MHz and 121.5 MHz.
- 5.7 The technical characteristics for the 406 MHz component of an integrated ELT shall be in accordance with 5.3.
- 5.8 The technical characteristics for the 121.5 MHz component of an integrated ELT shall be in accordance with 5.2.
- 5.9 States shall make arrangements for a 406 MHz ELT register. Register information regarding the ELT shall be immediately available to search and rescue authorities. States shall ensure that the register is updated whenever necessary.
- 5.10 ELT register information shall include the following:
- a) transmitter identification (expressed in the form of an alphanumerical code of 15 hexadecimal characters);
  - b) transmitter manufacturer, model and, when available, manufacturer's serial number;
  - c) COSPAS-SARSAT\* type approval number;
  - d) name, address (postal and e-mail) and emergency telephone number of the owner and operator;
  - e) name, address (postal and e-mail) and telephone number of other emergency contacts (two, if possible) to whom the owner or the operator is known;
  - f) aircraft manufacturer and type; and
  - g) colour of the aircraft.

Note 1.— Various coding protocols are available to States. Depending on the protocol adopted, States may, at their discretion, include one of the following as supplementary identification information to be registered:

- a) aircraft operating agency designator and operator's serial number; or
- b) 24-bit aircraft address; or

c) aircraft nationality and registration marks.

The aircraft operating agency designator is allocated to the operator by ICAO through the State administration, and the operator's serial number is allocated by the operator from the block 0001 to 4096.