CAASL Doc No: SLCAIS 040

Democratic Socialist Republic of Sri Lanka

Civil Aviation Authority of Sri Lanka

Implementing Standards

(Issued under Sec. 120, Civil Aviation Act No. 14 of 2010)

Title: Conformance to Annex-10-Aeronautical Telecommunications Vol. III (Part II) (Voice communication Systems)

Reference No. : IS-10-(iii)-II-all **Date**: 30th April 2021

Pursuant to Sec.120 of the Civil Aviation Act No.14 of 2010 which is hereinafter referred to as the CA Act, Director General of Civil Aviation shall have the power to issue, whenever he considers it necessary or appropriate to do so, such Implementing Standards for the purpose of giving effect to any provision in the CA Act, Regulations or Rules made thereunder including the Articles of the Convention on International Civil Aviation specified in the Schedule to the CA Act.

Accordingly, I, being the Director General of Civil Aviation do hereby issue the Implementing Standards on Voice communication Systems as mentioned in the Attachment hereto (Ref: IS-10-(iii)-II-all-Att) elaborating the requirements to be satisfied for the effective implementation of the International Standards and Recommended Practices on 'Voice communication Systems' contained in Annex-10 Volume III (Part II) "Aeronautical Telecommunications" to the Convention.

This Implementing Standard shall be applicable to Airport & Aviation Services (SL) Ltd and all aircraft operating agencies**,** and shall come in to force with immediate effect and remain in force unless revoked.

Attention is also drawn to Sec. 103 of the Act, which states inter alia that failure to comply with Implementing Standard is an offence.

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Director General of Civil Aviation and
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Enclosure: Attachment No. IS-10-(iii)-II-all-Att

Implementing Standards
SLCAIS- 040: Voice communication Systems

Notice to the Recipient

1.1. The requirements in this Implementing Standard are based on the Standards and Recommended Practices (SARPs) adopted by the International Civil Aviation Organization (ICAO) and incorporated in the Amendment No. 91 to Annex 10 –Volume III (Part II) Voice communication Systems.

1.2. In pursuance of the obligation cast under Article 38 of the Convention which requires the Contracting States to notify the ICAO of any differences between the national regulations of the States and practices and the International Standards contained in the respective Annex and any amendments thereto, the CAASL will be taking steps to notify ICAO of such differences relating to either a Standard or a Recommended Practice, if any. The CAASL will also keep the ICAO currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. Furthermore, the CAASL will take steps for the publication of differences between the national regulations and practices and the related ICAO Standards and Recommended Practices through the Aeronautical Telecommunications, which is published in accordance with the provisions in the Annex-10 Volume III (Part II) to the Convention.

1.3. Taking into account of the ICAO council resolution dated 13 April 1948 which invited the attention of Contracting States of the desirability of using in the State's national regulations, as far as is practicable, the precise language of those ICAO Standards that are of a regulatory character, to the greatest extent possible the CAASL has attempted to retain the ICAO texts in the Annex in drafting this Implementing Standard.

1.4 The requirements contained in this document are applicable to Airport & Aviation Services (SL) Ltd. and all aircraft operating agencies utilizing the Voice communication Systems.

1.5 Airport & Aviation Services (SL) Ltd. and all aircraft operating agencies shall strictly comply with the requirements published in this Document when operating within Sri Lanka airspace.

1.6 This Implementing Standard supersedes the Implementing Standards on **Voice communication Systems** 03rd Edition Revision 00 issued by the Director General of Civil Aviation dated on 20th July 2020.

1.7. The components in this Implementing Standard are defined as follows and they have the status as indicated:

1.7.1. **Standard:** Any specification for physical characteristics, configuration, materiel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety and regularity of national and international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38. The

ICAO Standards are reflected in the Implementing Standards if they are locally implemented using the normal fonts and recipients are required to conform to such requirements invariably and the DGCA will take appropriate enforcement action when those requirements are not complied with.

1.7.2. **Recommended Practice:** Any specification for physical characteristics, configuration, materiel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity, efficiency or environmentally responsiveness of international air navigation, and to which Contracting States will endeavor to conform in accordance with the Convention. The ICAO Recommended Practices are reflected in the Implementing Standards in italic fonts and the Recipients are encouraged to implement them to the greatest extent possible. However, DGCA will not take enforcement action when a Recommended Practice is not satisfied by the recipient.

1.7.3. **Appendices:** Comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council. Enforcement action on such matters will be as in the case of Standards or Recommended Practices.

1.7.4. **Definitions:** A definition does not have independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.

1.7.5. **Tables and Figures:** add to or illustrate a Standard or Recommended Practice, and which are referred to therein, form part of the associated Standard or Recommended Practice and have the same status.

Record of Revision

Rev. Number	Date	Entered by
Edition 01 - Rev 00	15.03.2015	
Edition 02 - Rev 00	25.01.2017	ANSI
Edition 03 - Rev 00	20.07.2020	DSCAI ATM-TECH/ CAI ATM TECH
Edition 03 - Rev 01	30.04.2021	DSCAI ATM-TECH/ CAI ATM TECH

List of Effective Pages

Page	Eff. Date	Page	Eff. Date	Page	Eff. Date	Page	Eff. Date
1	30.04.2021						
2	20.07.2020						
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6	30.04.2021						
7	20.07.2020						
8	30.04.2021						
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10	20.07.2020						
11	30.04.2021						
12	30.04.2021						
13	20.07.2020						
14	30.04.2021						
15	20.07.2020						
16	20.07.2020						
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History of Revision

Revision Number	Source	Areas subjected to Change	Effective date
IS 040 Edition 01 - Rev 00		Replacing ASN 116	15.03.2015
IS 040 Edition 02 - Rev 00	ICAO Annex 10 Volume III – Part II- up to Amendment 90	Replacing IS 040 – Edition 01- Rev 00	25.01.2017
IS 040 Edition 03 - Rev 00	ICAO Annex 10 Volume III – Part II- up to Amendment 90	1. Replacing IS 040 – Edition 02- Rev 00 2. Inco-operating Appendix to Chapter 5 3. Inco-operating Attachment to Part II	20.07.2020
IS 040 Edition 03 - Rev 01	ICAO Annex 10 Volume III – Part II- up to Amendment 91	1. Replacing IS 040 – Edition 03- Rev 00 2. Inco-operating ICAO Annex 10 Volume III – Part II- Amendment 91	30.04.2021

Table of Contents

CHAPTER 1 DEFINITIONS

Material on secondary power supply and guidance material concerning reliability and availability for communication systems is contained in Attachment F of ICAO Annex 10 Volume I.

Facility availability. The ratio of actual operating time to specified operating time.

Facility failure. Any unanticipated occurrence which gives rise to an operationally significant period during which a facility does not provide service within the specified tolerances.

Facility reliability. The probability that the ground installation operates within the specified tolerances. This definition refers to the probability that the facility will operate for a specified period of time.

Note.— This definition refers to the probability that the facility will operate for a specified period of time.

Mean time between failures (MTBF). The actual operating time of a facility divided by the total number of failures of the facility during that period of time. The operating time is in general chosen so as to include at least five, and preferably more, facility failures in order to give a reasonable measure of confidence in the figure derived.

Note.— The operating time is in general chosen so as to include at least five, and preferably more, facility failures in order to give a reasonable measure of confidence in the figure derived.

Signal reliability. The probability that a signal-in-space of specified characteristics is available to the aircraft. This definition refers to the probability that the signal is present for a specified period of time.

Note.— This definition refers to the probability that the signal is present for a specified period of time.

CHAPTER 2 AERONAUTICAL MOBILE SERVICE

2.1 AIR-GROUND VHF COMMUNICATION SYSTEM CHARACTERISTICS

2.1.1 The characteristics of the air-ground VHF communication system used in the Aeronautical Mobile Service shall be in conformity with the following specifications:

2.1.1.1 Radiotelephone emissions shall be double sideband (DSB) amplitude modulated (AM) carriers. The designation of emission is A3E, as specified in the ITU Radio Regulations.

2.1.1.2 Spurious emissions shall be kept at the lowest value which the state of technique and the nature of the service permit.

2.1.1.3 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 IS 044.

2.1.1.4 The design polarization of emissions shall be vertical.

2.2 SYSTEM CHARACTERISTICS OF THE GROUND INSTALLATION

2.2.1 Transmitting function

2.2.1.1 Frequency stability – The radio frequency of operation shall not vary more than plus or minus 0.005 per cent from the assigned frequency. Where 25 kHz channel spacing is introduced in accordance with the aeronautical frequency spectrum utilization, the radio frequency of operation shall not vary more than plus or minus 0.002 per cent from the assigned frequency. Where 8.33 kHz channel spacing is introduced in accordance with IS 044, the radio frequency of operation shall not vary more than plus or minus 0.0001 per cent from the assigned frequency.

2.2.1.1.1 Offset carrier systems in 8.33 kHz, 25 kHz, 50 kHz and 100 kHz channel spaced environments. The stability of individual carriers of an offset carrier system shall be such as to prevent first-order heterodyne frequencies of less than 4 kHz and, additionally, the maximum frequency excursion of the outer carrier frequencies from the assigned carrier frequency shall not exceed 8 kHz. Offset carrier systems for 8.33 kHz channel spacing shall be limited to two-carrier systems using a carrier offset of plus and minus 2.5 kHz.

2.2.1.2 Power

On a high percentage of occasions, the effective radiated power should be such as to provide a field strength of at least 75 microvolts per meter (minus 109 dB/m^2) within the defined operational coverage of the facility, on the basis of free-space propagation.

2.2.1.3 Modulation – A peak modulation factor of at least 0.85 shall be achievable.

2.2.1.4 *Means should be provided to maintain the average modulation factor at the highest practicable value without over modulation.*

2.2.2 Receiving function

2.2.2.1 N/A

2.2.2.2 Sensitivity – After due allowance has been made for feeder loss and antenna polar diagram variation, the sensitivity of the receiving function shall be such as to provide on a high percentage of occasions an audio output signal with a wanted/unwanted ratio of 15 dB, with a 50 per cent amplitude modulated (A3E) radio signal having a field strength of 20 microvolts per meter (minus 120 dBW/m^2) or more.

2.2.2.3 Effective acceptance bandwidth – When tuned to a channel having a width of 25 kHz, 50 kHz or 100 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal specified at 2.2.2.2 has a carrier frequency within plus or minus 0.005 per cent of the assigned frequency.

The effective acceptance bandwidth includes Doppler shift.

2.2.2.4 Adjacent channel rejection. The receiving system shall ensure an effective rejection of 60 dB or more at the next assignable channel.

2.3 SYSTEM CHARACTERISTICS OF THE AIRBORNE INSTALLATION

2.3.1 Transmitting function

2.3.1.1 Frequency stability – The radio frequency of operation shall not vary more than plus or minus 0.005 per cent from the assigned frequency. Where 25 kHz channel spacing is introduced, the radio frequency of operation shall not vary more than plus or minus 0.003 per cent from the assigned frequency. Where 8.33 kHz channel spacing is introduced, the radio frequency of operation shall not vary more than plus or minus 0.0005 per cent from the assigned frequency.

2.3.1.2 Power – On a high percentage of occasions, the effective radiated power shall be such as to provide a field strength of at least 20 microvolts per meter (minus 120 dB/m^2) on the basis of free space propagation, at ranges and altitudes appropriate to the operational conditions pertaining to the areas over which the aircraft is operated.

2.3.1.3 Adjacent channel power – The amount of power from a 8.33 kHz airborne transmitter under all operating conditions when measured over a 7 kHz channel bandwidth centered on the first 8.33 kHz adjacent channel shall not exceed -45 dB below the transmitter carrier power. The above adjacent channel power shall take into account the typical voice spectrum.

2.3.1.4 Modulation – A peak modulation factor of at least 0.85 shall be achievable.

2.3.1.5 *Means should be provided to maintain the average modulation factor at the highest practicable value without over modulation.*

2.3.2 Receiving function

2.3.2.1 Frequency stability – Where 8.33 kHz channel spacing is introduced in accordance with IS 044, the radio frequency of operation shall not vary more than plus or minus 0.0005 per cent from the assigned frequency.

2.3.2.2 Sensitivity

2.3.2.2.1 *After due allowance has been made for aircraft feeder mismatch, attenuation loss and antenna polar diagram variation, the sensitivity of the receiving function should be such as to provide on a high percentage of occasions an audio output signal with a wanted/unwanted ratio of 15 dB, with a 50 per cent amplitude modulated (A3E) radio signal having a field strength of 75 microvolts per meter (minus 109 dBW/m^2).For planning extended range VHF facilities, an airborne receiving function sensitivity of 30 microvolts per meter may be assumed.*

2.3.2.3 Effective acceptance bandwidth for 100 kHz, 50 kHz and 25 kHz channel spacing receiving installations. When tuned to a channel designated according to the aeronautical frequency spectrum utilization in IS 044 as having a width of 25 kHz, 50 kHz or 100 kHz, the receiving function shall ensure an effective acceptance bandwidth as follows:

a) in areas where offset carrier systems are employed, the receiving function shall provide an adequate audio output when the signal specified at 2.3.2.2 has a carrier frequency within 8 kHz of the assigned frequency;

b) in areas where offset carrier systems are not employed, the receiving function shall provide an adequate audio output when the signal specified at 2.3.2.2 has a carrier frequency of plus or minus 0.005 per cent of the assigned frequency.

2.3.2.4 Effective acceptance bandwidth for 8.33 kHz channel spacing receiving installations. When tuned to a channel designated in IS 044, as having a width of 8.33 kHz, the receiving function shall ensure an effective acceptance bandwidth as follows:

a) in areas where offset carrier systems are employed, the receiving function shall provide an adequate audio output when the signal specified in 2.3.2.2 has a carrier frequency of plus or minus 2.5 kHz of the assigned frequency; and

b) in areas where offset carrier systems are not employed, the receiving function shall provide an adequate audio output when the signal specified in 2.3.2.2 has a carrier frequency within plus or minus 0.0005 per cent of the assigned frequency. Further information on the effective acceptance bandwidth is contained in Part II, Attachment A.

2.3.2.5 Adjacent channel rejection – The receiving function shall ensure an effective adjacent channel rejection as follows:

a. 8.33 kHz channels: 60 dB or more at plus or minus 8.33 kHz with respect to the assigned frequency, and 40 dB or more at plus or minus 6.5 kHz;

b. 25 kHz channel spacing environment: 50 dB or more at plus or minus 25 kHz with respect to the assigned frequency and 40 dB or more at plus or minus 17 kHz;

c. 50 kHz channel spacing environment: 50 dB or more at plus or minus 50 kHz with respect to the assigned frequency and 40 dB or more at plus or minus 35 kHz;

d. 100 kHz channel spacing environment: 50 dB or more at plus or minus 100 kHz with respect to the assigned frequency.

2.3.2.6 *Whenever practicable, the receiving system should ensure an effective adjacent channel rejection characteristic of 60 dB or more at plus or minus 25 kHz, 50 kHz and100 kHz from the assigned frequency for receiving systems intended to operate in channel spacing environments of 25 kHz, 50 kHz and 100 kHz, respectively.*

2.3.2.7 *In the case of receivers complying with 2.3.2.3 or 2.3.2.4 used in areas where offset carrier systems are in force, the characteristics of the receiver should be such that:*

a. the audio frequency response precludes harmful levels of audio heterodynes resulting from the reception of two or more offset carrier frequencies;

b. the receiver muting circuits, if provided, operate satisfactorily in the presence of audio heterodynes resulting from the reception of two or more offset carrier frequencies.

2.3.2.8 VDL—Interference Immunity Performance

2.3.2.8.1 For equipment intended to be used in independent operations of services applying DSB-AM and VDL technology on board the same aircraft, the receiving function shall provide an adequate and intelligible audio output with a desired signal field strength of not more than 150 microvolts per meter (minus 102 dBW/m^2) and with an undesired VDL signal field strength of at least 50 dB above the desired field strength on any assignable channel 100 kHz or more away from the assigned channel of the desired signal.

2.3.2.8.2 N/A

2.3.2.8.3 The receiving function of all installations intended to be used in independent operations of services applying DSB-AM and VDL technology on board the same aircraft shall meet the provisions of 2.3.2.8.1, subject to the conditions of 2.3.2.8.4.

2.3.2.8.4 Requirements for mandatory compliance of the provisions of 2.3.2.8.3 shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales.

2.3.2.8.4.1 The agreement indicated in 2.3.2.8.4 shall provide at least two years' notice of mandatory compliance of airborne systems.

2.3.3 Interference Immunity Performance

2.3.3.1 The VHF communications receiving system shall provide satisfactory performance in the presence of two signal, third-order intermodulation products caused by VHF FM broadcast signals having levels at the receiver input of minus 5 dBm.

2.3.3.2 The VHF communications receiving system shall not be desensitized in the presence of VHF FM broadcast signals having levels at the receiver input of minus 5 dBm.

2.3.3.3 N/A

2.3.3.4 *Airborne VHF communications receiving systems meeting the immunity performance Standards of 2.3.3.1 and 2.3.3.2 should be placed into operation at the earliest possible date.*

2.4 SINGLE SIDEBAND HF (SSB) COMMUNICATION SYSTEM CHARACTERISTICS FOR USE IN THE AERONAUTICAL MOBILE SERVICE

2.4.1 The characteristics of the air-ground HF SSB system, where used in the Aeronautical Mobile Service, shall be in conformity with the following specifications.

2.4.1.1 Frequency Range

2.4.1.1.1 HF SSB installations shall be capable of operation at any SSB carrier (reference) frequency available to the Aeronautical Mobile (R) Service in the band 2.8 MHz to 22 MHz and necessary to meet the approved assignment plan for the region(s) in which the system is intended to operate, and in compliance with the relevant provisions of the Radio Regulations.

2.4.1.1.2 The equipment shall be capable of operating on integral multiples of 1 kHz.

2.4.1.2 Sideband Selection

2.4.1.2.1 The sideband transmitted shall be that on the higher frequency side of its carrier (reference) frequency.

2.4.1.3 Carrier (Reference) Frequency

2.4.1.3.1 Channel utilization shall be in conformity with the table of carrier (reference) frequencies at 27/16 and the Allotment Plan at 27/186 to 27/207 inclusive (or frequencies established on the basis of 27/21, as may be appropriate) of Appendix S27 of ITU Regulations.

2.4.1.4 Classes of Emission and Carrier Suppression

2.4.1.4.1 The system shall utilize the suppressed carrier class of emission J3E (also J7B and J9B as applicable). When SELCAL is employed as specified in Chapter 3, the installation shall utilize class H2B emission.

2.4.1.4.2 N/A

2.4.1.4.3 N/A

2.4.1.4.4 *For stations directly involved in coordinated search and rescue operations using the frequencies 3 023 kHz and 5 680 kHz, the class of emission J3E should be used; however, since maritime mobile and land mobile services may be involved, A3E and H3E classes of emission may be used.*

2.4.1.4.5 N/A

2.4.1.4.6 Aircraft station transmitters shall be capable of at least 26 dB carrier suppression with respect to peak envelope power (P_p) for classes of emission J3E, J7B or J9B.

2.4.1.4.7 Aeronautical station transmitters shall be capable of 40 dB carrier suppression with respect to peak envelope power (P_p) for classes of emission J3E, J7B or J9B.

2.4.1.5 Audio Frequency Bandwidth

2.4.1.5.1 For radiotelephone emissions the audio frequencies shall be limited to between 300 and 2 700 Hz and the occupied bandwidth of other authorized emissions shall not exceed the upper limit of J3E emissions. In specifying these limits, however, no restriction in their extension shall be implied in so far as emissions other than J3E are concerned, provided that the limits of unwanted emissions are met (Ref. 2.4.1.7, Figures 2-1 and 2-2.)

2.4.1.5.2 For other authorized classes of emission the modulation frequencies shall be such that the required spectrum limits of 2.4.1.7 will be met.

2.4.1.6 Frequency Tolerance

2.4.1.6.1 The basic frequency stability of the transmitting function for classes of emission J3E, J7B or J9B shall be such that the difference between the actual carrier of the transmission and the carrier (reference) frequency shall not exceed:

- 20 Hz for airborne installations;
- 10 Hz for ground installations.

2.4.1.6.2 The basic frequency stability of the receiving function shall be such that, with the transmitting function stabilities specified in 2.4.1.6.1, the overall frequency difference between ground and airborne functions achieved in service and including Doppler shift, does not exceed 45 Hz. However, a greater frequency difference shall be permitted in the case of supersonic aircraft.

2.4.1.7 Spectrum Limits

2.4.1.7.1 N/A

2.4.1.7.2 For aircraft station transmitters and for aeronautical station transmitters using single sideband classes of emission H2B, H3E, J3E, J7B or J9B, the peak envelope power (P_p) of any emission on any discrete frequency shall be less than the peak envelope power (P_p) of the transmitter in accordance with the following:

- on any frequency removed by 1.5 kHz or more up to 4.5 kHz from the assigned frequency: at least 30 dB;

- on any frequency removed by 4.5 kHz or more up to 7.5 kHz from the assigned frequency: at least 38 dB;

- on any frequency removed from the assigned frequency by 7.5 kHz or more:

a) aircraft station transmitters: 43 dB;

b) aeronautical station transmitters: for transmitter power up to and including 50 W:

$$[43 + 10 \log_{10} P_p\ (W)]\ dB$$

For transmitter power more than 50 W: 60 dB

2.4.1.8 Power

2.4.1.8.1 Aeronautical station installation – Except as permitted by the relevant provisions of Appendix S27 to the ITU Radio Regulations, the peak envelope power (*Pp*) supplied to the antenna transmission line for H2B, H3E, J3E, J7B or J9B classes of emissions shall not exceed a maximum value of 6 kW.

2.4.1.8.2 Aircraft station installations – The peak envelope power supplied to the antenna transmission line for H2B, H3E, J3E, J7B or J9B classes of emission shall not exceed 400 W except as provided for in Appendix S27 of the ITU Radio Regulations as follows:

S27/68 It is recognized that the power employed by aircraft transmitters may, in practice, exceed the limits specified in No. 27/60. However, the use of such increased power (which normally should not exceed 600 $W\ P_p$) shall not cause harmful interference to stations using frequencies in accordance with the technical principles on which the Allotment Plan is based.

S27/60 Unless otherwise specified in Part II of this Appendix, the peak envelope powers supplied to the antenna transmission line shall not exceed the maximum values indicated in the table below; the corresponding peak effective radiated powers being assumed to be equal to two-thirds of these values:

Class of emission	***Stations***	***Max. peak envelope power (P_p)***
H2B, J3E, J7B, J9B, A3E*, H3E* (100% modulation)	Aeronautical stations Aircraft stations	6 kW 400 W
Other emission such as A1A, F1B	Aeronautical stations Aircraft stations	1.5 kW 100 W

* A3E and H3E to be used only on 3 023 kHz and 5 680 kHz.

2.4.1.9 Method of operation. Single channel simplex shall be employed.

2.5 SATELLITE VOICE COMMUNICATION (SATVOICE) SYSTEM CHARACTERISTICS

Guidance material for the implementation of the aeronautical mobile satellite service is contained in the Manual of aeronautical Mobile satellite (Route) Service (Doc. 9925). Additional guidance for SATVOICE systems is contained in the Satellite Voice Operations Manual (Doc. 10038), and the Performance – based Communication and Surveillance (PBCS) Manual (Doc. 9869)

2.5.1 For ground – to - air calls, the SATVOICE system shall be capable of contacting the aircraft and enabling the ground party/system to provide, as a minimum, the following,

a) secure calling
b) priority level as defined in Table 2-1, and
c) aircraft SATVOICE number, which is the aircraft address expressed as an 8-digit octal number.

2.5.2 For ground-to- air calls, the SATVOICE the system shall be capable of locating the aircraft in the appropriate airspace regardless of the satellite and ground earth station (GES) to which the aircraft is logged on.

2.5.3 For air-to- ground calls, the SATVOICE system shall be capable of:

a) contacting the aeronautical station via an assigned SATVOICE number, which is a unique6-digit number or public switched telephone network (PSTN) number, and

b) allowing the flight crew and/or aircraft system to specify the priority level for the call as defined in Table 2-1.

TABLE FOR CHAPTER 2

Table 2-1. Priority levels for SATVOICE calls (air-to-ground/ground-to-air)

Priority level	Application category
1 / EMG / Q15 Emergency (highest) Safety of flight	Distress and urgency. For use by flight crew, when appropriate.
2 / HGH / Q12 Operational high (second highest) Safety of flight	Flight safety. Typically assigned to calls between aircraft and ANSPs.
3 / LOW / Q10 Operational low (third highest) Safety of flight Regularity of flight, meteorological, administrative. Typically assigned to calls between aircraft operators and their aircraft.	Regularity of flight, meteorological, administrative. Typically assigned to calls between aircraft operators and their aircraft.
4 / PUB / Q9 Non-operational (lowest) Non safety	Public correspondence.

FIGURES FOR CHAPTER 2

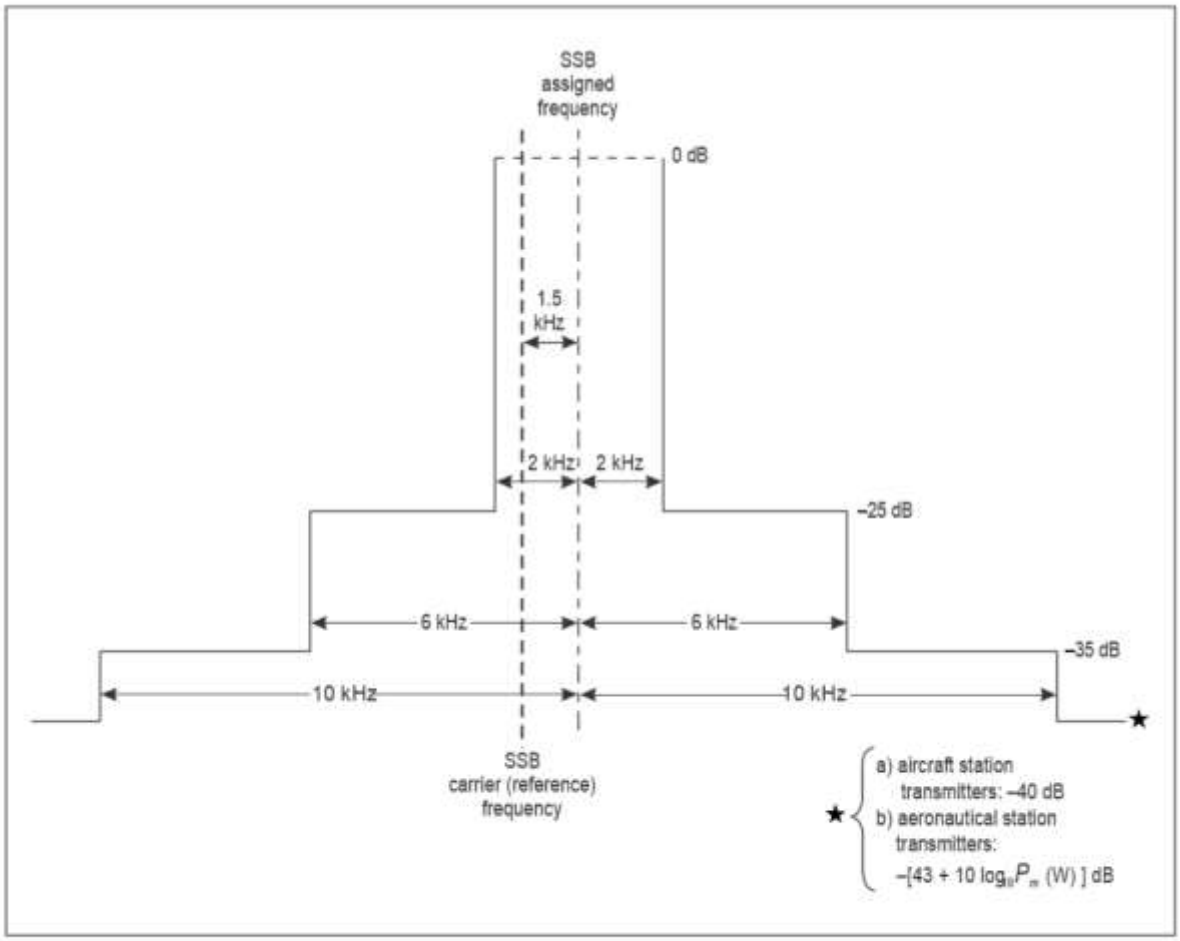

Figure 2-1. Required spectrum limits (in terms of mean power) for aircraft station transmitter types and for aeronautical station transmitters first installed before 1 February 1983

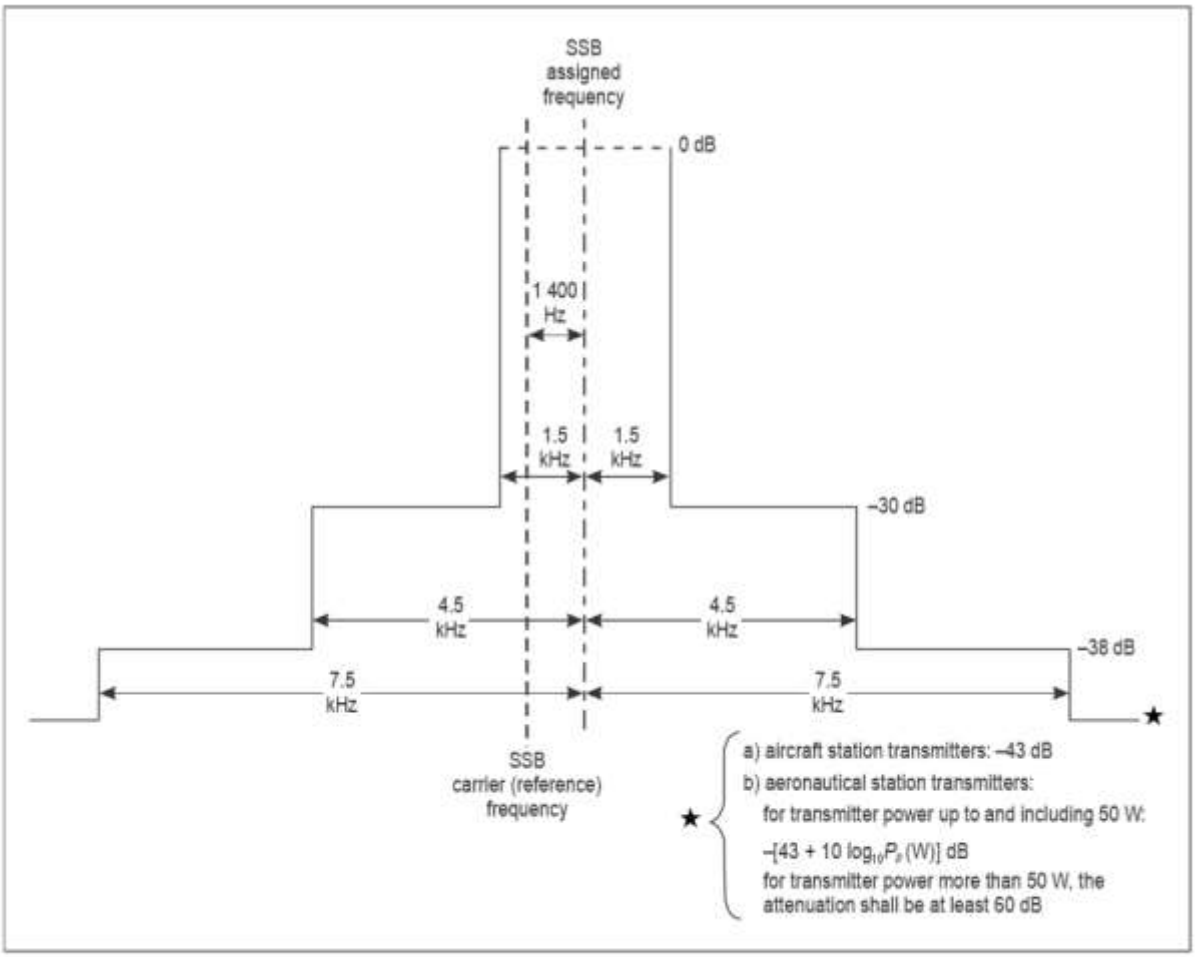

Figure 2-2. Required spectrum limits (in terms of peak power) for aircraft station transmitters first installed after 1 February 1983 and aeronautical station transmitters in use after 1 February 1983

CHAPTER 3 SELCAL SYSTEM

3.1

1) U*ntil 2 November 2022,* w*here a SELCAL system is installed, the following system characteristics should be applied:*

a. Transmitted code – Each transmitted code should be made up of two consecutive tone pulses, with each pulse containing two simultaneously transmitted tones. The pulses should 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 should 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 should not exceed 15 per cent.

d. Per cent modulation – The RF signal transmitted by the ground radio station should contain, within 3 dB, equal amounts of the two modulating tones. The combination of tones should 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 should be made up of various combinations of the tones listed in the following table and designated by colour and letter as indicated:

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

2) As of 3 November 2022, 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) Frequency 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) Level stability. The RF signal transmitted by the ground radio station shall contain, within 3 dB, equal amounts of the two modulating tones.

3.1.1 *As of 3 November 2022, modulation envelope. The combination of tones should result in a modulation envelope having a nominal modulation percentage as high as possible and not less than 60 per cent.*

3.2

1) Until 2 November 2022, 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.

2) As of 3 November 2022, the transmitted codes shall be made up of various combinations of the tones listed in Table 3-1. They are designated by colour and letter or number as indicated:

Table 3-1. SELCAL tones designated by colour and letter or number (Applicable as of 3 November 2022)

Designation	*Frequency (Hz)*
Red A	*312.6*
Red B	*346.7*
Red C	*384.6*
Red D	*426.6*
Red E	*473.2*
Red F	*524.8*
Red G	*582.1*
Red H	*645.7*
Red J	*716.1*
Red K	*794.3*
Red L	*881.0*
Red M	*977.2*
Red P	*1083.9*
Red Q	*1202.3*
Red R	*1333.5*
Red S	*1479.1*
Red T	*329.2*
Red U	*365.2*

Red V	*405.0*
Red W	*449.3*
Red X	*498.3*
Red Y	*552.7*
Red Z	*613.1*
Red 1	*680.0*
Red 2	*754.2*
Red 3	*836.6*
Red 4	*927.9*
Red 5	*1 029.2*
Red 6	*1 141.6*
Red 7	*1 266.2*
Red 8	*1 404.4*
Red 9	*1 557.8*

Note 1.— The frequencies of the tones are spaced by Log-1 0.0225 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 IS 040.

3.3 As of 3 November 2022, aeronautical stations which are required to communicate with SELCAL-equipped aircraft shall have SELCAL encoders that support all tones in accordance with Table 3-1.

3.4 As of 3 November 2022, SELCAL codes using the tones Red T through Red 9 as given in Table 3-1 shall only be assigned to SELCAL-equipped aircraft with the capability of receiving these tones.

CHAPTER 4 AERONAUTICAL SPEECH CIRCUITS

4.1 TECHNICAL PROVISIONS RELATING TO INTERNATIONAL AERONAUTICAL SPEECH CIRCUIT SWITCHING AND SIGNALING FOR GROUND-GROUND APPLICATIONS

4.1.1 The use of circuit switching and signaling to provide speech circuits to interconnect ATS units not interconnected by dedicated circuits shall be by agreement between the Administrations concerned.

4.1.2 The application of aeronautical speech circuit switching and signaling shall be made on the basis of regional air navigation agreements.

4.1.3 A*TC communication requirements defined in Implementing Standard 025 Section 6.2 should 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.

4.1.4 I*n addition to the ability to make basic telephone calls, the following functions should be provided in order to meet the requirements set out in IS 025:*

a) means of indicating the calling/called party identity;

b) means of initiating urgent/priority calls; and

c) conference capabilities.

4.1.5 *The characteristics of the circuits used in aeronautical speech circuit switching and signaling should conform to appropriate ISO/IEC international standards and ITU-T recommendations.*

4.1.6 D*igital signaling systems should 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) reduced costs where quality of service is maintained.

4.1.7 *The characteristics of supervisory tones to be used (such as ringing, busy, number unobtainable) should conform to appropriate ITU-T recommendations.*

4.1.8 *To take advantage of the benefits of interconnecting regional and national aeronautical speech networks, the international aeronautical telephone network numbering scheme should be used.*

CHAPTER 5 EMERGENCY LOCATOR TRANSMITTER (ELT) FOR SEARCH AND RESCUE

5.1 GENERAL

5.1.1 Emergency locator transmitters (ELTs) shall operate on 406 MHz except all Sri Lanka registered aircrafts authorized to carry 19 passengers or less or maximum certificated take-off mass of less than 5 700 kg with the certificate of airworthiness issued by CAASL.

5.1.2 All installations of emergency locator transmitters operating on 406 MHz shall meet the provisions of 5.3.

5.1.3 All installations of emergency locator transmitters operating on 121.5 MHz shall meet the provisions of 5.2.

5.1.4 N/A

5.1.5 N/A

5.1.6 The technical characteristics for the 406 MHz component of an integrated ELT shall be in accordance with 5.3.

5.1.7 The technical characteristics for the 121.5 MHz component of an integrated ELT shall be in accordance with 5.2.

5.1.8 All Civilian aircraft operators shall register their 406 MHz ELTs with Telecommunications Regulatory Authority of Sri Lanka (TRCSL). TRCSL is delegated by Director General of Civil Aviation (DGCA), to maintain the 406 MHz ELT register for all Civilian Aircrafts registered in Sri Lanka.

5.1.9 The ELT register shall include the following information:

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) operator’s Air Operator Certificate (AOC) number;

f) 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;

g) aircraft manufacturer and type;

h) ICAO 24 bit Aircraft Address; and

i) colour of the aircraft.

* COSPAS = Space system for search of vessels in distress;

SARSAT = Search and rescue satellite-aided tracking.

5.1.10 From 01st January 2021, all Sri Lanka registered aircrafts authorized to carry more than 19 passengers or maximum certificated take-off mass of over 5 700 kg with the certificate of airworthiness issued by CAASL shall carry at least one (01) 406 MHz Emergency locator transmitter (ELT) which is registered with TRCSL.

5.1.11 All aircraft registering after 01st January 2021, authorized to carry more than 19 passengers or maximum certificated take-off mass of over 5 700 kg with the certificate of airworthiness issued by CAASL shall carry at least one (01) 406 MHz Emergency locator transmitter (ELT) with GPS capability which is registered with TRCSL.

5.1.12 All Sri Lanka registered aircrafts engaged in international operations with the certificate of airworthiness issued by CAASL shall carry at least one (01) 406 MHz Emergency locator transmitter (ELT) which is registered with TRCSL.

5.1.13 All aircraft registering after 01st January 2021, to be engaged in international operations with the certificate of airworthiness issued by CAASL shall carry at least one (01) 406 MHz Emergency locator transmitter (ELT) with GPS capability which is registered with TRCSL.

5.1.14 In an event that aircraft in the Sri Lankan registry, not being technically capable of installing a 406 MHz ELT or if the craft is Ultra-Light Weight, Glider or Manned Hot Air Balloon, it is recommended to carry a serviceable Personal Locator Beacon (PLB) on 406 MHz with GPS capability, registered to the entity holding the AOC. Serial Number of the PLB shall be included in other information (cage number 18) of the Flight Plan.

5.2 SPECIFICATION FOR THE 121.5 MHz COMPONENT OF EMERGENCY LOCATOR TRANSMITTER (ELT) FOR SEARCH AND RESCUE

5.2.1 Technical characteristics

5.2.1.1 Emergency locator transmitters (ELT) shall operate on 121.5 MHz. The frequency tolerance shall not exceed plus or minus 0.005 per cent.

5.2.1.2 The emission from an ELT under normal conditions and attitudes of the antenna shall be vertically polarized and essentially omnidirectional in the horizontal plane.

5.2.1.3 Over a period of 48 hours of continuous operation, at an operating temperature of minus 20°C, the peak effective radiated power (PERP) shall at no time be less than 50 mW.

5.2.1.4 The type of emission shall be A3X. Any other type of modulation that meets the requirements of 5.2.1.5, 5.2.1.6 and 5.2.1.7 may be used provided that it will not prejudice precise location of the beacon by homing equipment.

5.2.1.5 The carrier shall be amplitude modulated at a modulation factor of at least 0.85.

5.2.1.6 The modulation applied to the carrier shall have a minimum duty cycle of 33 per cent.

5.2.1.7 The emission shall have a distinctive audio characteristic achieved by amplitude modulating the carrier with an audio frequency sweeping downward over a range of not less than 700 Hz within the range 1 600 Hz to 300 Hz and with a sweep repetition rate of between 2 Hz and 4 Hz.

5.2.1.8 The emission shall include a clearly defined carrier frequency distinct from the modulation sideband components; in particular, at least 30 per cent of the power shall be contained at all times within plus or minus 30 Hz of the carrier frequency on 121.5 MHz.

5.3 SPECIFICATION FOR THE 406 MHz COMPONENT OF EMERGENCY LOCATOR TRANSMITTER (ELT) FOR SEARCH AND RESCUE

5.3.1 Technical characteristics

5.3.1.1 Emergency locator transmitters shall operate on one of the frequency channels assigned for use in the frequency band 406.0 to 406.1 MHz.

5.3.1.2 The period between transmissions shall be 50 seconds plus or minus 5 per cent.

5.3.1.3 Over a period of 24 hours of continuous operation at an operating temperature of –20°C, the transmitter power output shall be within the limits of 5 W plus or minus 2 db.

5.3.1.4 The 406 MHz ELT shall be capable of transmitting a digital message.

5.3.2 Transmitter identification coding

5.3.2.1 Emergency locator transmitters operating on 406 MHz shall be assigned a unique coding for identification of the transmitter or aircraft on which it is carried.

5.3.2.2 The emergency locator transmitter shall be coded in accordance with either the aviation user protocol or one of the serialized user protocols described in the Appendix to this chapter, and shall be registered with the Telecommunications Regulatory Authority of Sri Lanka.

APPENDIX TO CHAPTER 5. - EMERGENCY LOCATOR TRANSMITTER CODING

(see Chapter 5, 5.3.2)

A detailed description of beacon coding is contained in Specification for COSPAS-SARSAT 406 MHz Distress Beacons (C/S T.001). The following technical specifications are specific to emergency locator transmitters used in aviation.

1. GENERAL

1.1. The emergency locator transmitter (ELT) operating on 406 MHz shall have the capacity to transmit a programmed digital message which contains information related to the ELT and/or the aircraft on which it is carried.

1.2. The ELT shall be uniquely coded in accordance with 1.3 and be registered with the Telecommunications Regulatory Authority of Sri Lanka.

1.3. The ELT digital message shall contain either the transmitter serial number or one of the following information elements:

a) aircraft operating agency designator and the serial number;
b) 24-bit ICAO aircraft address;
c) aircraft nationality and registration marks.

1.4. All ELTs shall be designed for operation with the COSPAS-SARSAT* system and be type approved.

2. ELT CODING

2.1 The ELT digital message shall contain information relating to the message format, coding protocol, country code, identification data and location data, as appropriate.

2.2 For ELTs with no navigation data provided, the short message format C/S T.001 shall be used, making use of bits 1 through 112. For ELTs with navigation data, if provided, the long message format shall be used, making use of bits 1 through 144.

2.3 PROTECTED DATA FIELD

2.3.1 The protected data field consisting of bits 25 through 85 shall be protected by an error correcting code and shall be the portion of the message which shall be unique in every distress ELT.

2.3.2 A message format flag indicated by bit 25 shall be set to “0” to indicate the short message format or set to “1” to indicate the long format for ELTs capable of providing location data.

COSPAS = Space system for search of vessels in distress;

SARSAT = Search and rescue satellite-aided tracking.

2.3.3 A protocol flag shall be indicated by bit 26 and shall be set to "1" for user and user location protocols, and "0" for location protocols.

2.3.4 A country code, which indicates the State where additional data are available on the aircraft on which the ELT is carried, shall be contained in bits 27 through 36 which designate a three-digit decimal country code number expressed in binary notation.

2.3.5 Bits 37 through 39 (user and user location protocols) or bits 37 through 40 (location protocols) shall designate one of the protocols where values "001" and "011" or "0011", "0100", "0101", and "1000" are used for aviation as shown in the examples contained in this appendix.

2.3.6 The ELT digital message shall contain either the transmitter serial number or an identification of the aircraft or operator as shown below.

2.3.7 In the serial user and serial user location protocol (designated by bit 26=1 and bits 37 through 39 being "011"), the serial identification data shall be encoded in binary notation with the least significant bit on the right. Bits 40 through 42 shall indicate type of ELT serial identification data encoded where:

- "000" indicates ELT serial number (binary notation) is encoded in bits 44 through 63;

- "001" indicates aircraft operator (3 letter encoded using modified Baudot code shown in Table 5-1) and a serial number (binary notation) are encoded in bits 44 through 61 and 62 through 73, respectively;

- "011" indicates the 24-bit aircraft address is encoded in bits 44 through 67 and each additional ELT number (binary notation) on the same aircraft is encoded in bits 68 through 73.

2.3.8 In the aviation user or user location protocol (designated by bit 26=1 and bits 37 through 39 being "001"), the aircraft nationality and registration marking shall be encoded in bits 40 through 81, using the modified Baudot code shown in Table 5-1 to encode seven alphanumeric characters. This data shall be right justified with the modified Baudot "space" ("100100") being used where no character exists.

2.3.9 Bits 84 and 85 (user or user location protocol) or bit 112 (location protocols) shall indicate any homing transmitter that may be integrated in the ELT.

2.3.10 In standard and national location protocols, all identification and location data shall be encoded in binary notation with the least significant bit right justified. The aircraft operator designator (3 letter code) shall be encoded in 15 bits using a modified Baudot code (Table 5-1) using only the 5 right most bits per letter and dropping the left most bit which has a value of 1 for letters.

Table 5-1. Modified Baudot code

Letter	*Code* MSB LSB	*Figure*	*Code* MSB LSB
A	111000	(-)*	011000
B	110011		
C	101110		
D	110010		
E	110000	3	010000
F	110110		
G	101011		
H	100101		
I	101100		
J	111010	8	001100
K	111110		
L	101001		
M	100111		
N	100110		
O	100011	9	000011
P	101101	0	001101
Q	111101	1	011101
R	101010	4	001010
S	110100		
T	100001	5	000001
U	111100	7	011100
V	101111		
W	111001	2	011001
X	110111	/	010111
Y	110101	6	010101
Z	110001		
( )**	100100		

MSB = most significant bit
LSB = least significant bit
* = hyphen
** = space

EXAMPLES OF CODING

ELT serial number

25		27 36	37			40				44 63	64 73	74 83	85	
F	1	COUNTRY	0	1	1	T	T	T	C	SERIAL NUMBER DATA (20 BITS)	SEE NOTE 1	SEE NOTE 2	A	A

Aircraft address

25		27 36	37			40				44 67	68 73	74 83	85	
F	1	COUNTRY	0	1	1	T	T	T	C	AIRCRAFT ADDRESS (24 BITS)	SEE NOTE 3	SEE NOTE 2	A	A

Aircraft operator designator and serial number

25		27 36	37			40				44 61	62 73	74 83	85	
F	1	COUNTRY	0	1	1	T	T	T	C	OPERATOR 3-LETTER DESIGNATOR	SERIAL NUMBER 1-4096	SEE NOTE 2	A	A

Aircraft registration marking

25		27 36	37			40 81	83		85	
F	1	COUNTRY	0	0	1	AIRCRAFT REGISTRATION MARKING (UP TO 7 ALPHANUMERIC CHARACTERS) (42 BITS)	0	0	A	A

T = Beacon type TTT: = 000 indicates ELT serial number is encoded;
= 001 indicates operating agency and serial number are encoded;
= 011 indicates 24-bit aircraft address is encoded.

C = Certificate flag bit: 1 = to indicate that COSPAS-SARSAT Type Approval Certificate number is encoded in bits 74 through 83 and
0 = otherwise

F = Format flag: 0 = Short Message
1 = Long Message

A = Auxiliary radio-locating device: 00 = no auxiliary radio-locating device
01 = 121.5 MHz
11 = other auxiliary radio-locating device

Note 1.— 10 bits, all 0s or National use.

Note 2.— COSPAS-SARSAT Type Approval Certificate number in binary notation with the least significant bit on the right, or National use.

Note 3.— Serial number, in binary notation with the least significant bit on the right, of additional ELTs carried in the same aircraft or default to 0s when only one ELT is carried.

EXAMPLE OF CODING (USER LOCATION PROTOCOL)

25	26	←27 36→	←37 39→	←40 83→	85→	←86 106→	←107 112→	←113 132→					←133 144→
1	1	10	3	44	2	21	1	12			13			12
1	1	CC	T	IDENTIFICATION DATA (AS IN ANY OF USER PROTOCOLS ABOVE)	A	21-BIT BCH ERROR CORRECTING CODE	E	LATITUDE			LONGITUDE			12-BIT BCH ERROR CORRECTING CODE
								1	7	4	1	8	4	
								N / S	DEG 0–90 (1 d)	MIN 0–56 (4m)	E / W	DEG 0–180 (1 d)	MIN 0–56 (4m)	

CC = Country Code;
E = Encoded position data source: 1 = Internal navigation device, 0 = External navigation device

EXAMPLE OF CODING (STANDARD LOCATION PROTOCOL)

25	26	←27 36→	←37 40→	←41	85→	←86 106→	107 112	←113	132→	←133 144→
← 61 BITS →							← 26 BITS →			
1	1	10	4	45		21	6	20		12
1	0	CC	PC	IDENTIFICATION DATA	LATITUDE LONGITUDE		SD	Δ LATITUDE	Δ LONGITUDE	
				24	1 9 1 10			1 5 4	1 5 4	
			0011	AIRCRAFT 24 BIT ADDRESS	N = 0 LAT DEG E = 0 LON DEG	21-BIT BCH CODE		– = 0 + = 1 MINUTES SECONDS	– = 0 + = 1 MINUTES SECONDS	12-BIT BCH CODE
			0101	15 AIRCRAFT OPER. DESIGNATOR	9 SERIAL No 1–511					
					S = 1 0–90 W = 1 0–180			0–30 0–56	0–30 0–56	
			0100	10 C/STA No 1–1023	14 SERIAL No 1–16383			(1 m) (4 s)	(1 m) (4 s)	
					(1/4 d) (1/4 d)					

CC = Country Code;
PC = Protocol Code 0011 indicates 24-bit aircraft address is encoded;
0101 indicates operating agency and serial number are encoded;
0100 indicates ELT serial number is encoded.
SD = Supplementary Data bits 107 – 110 = 1101;
bit 111 = Encoded Position Data Source (1 = internal; 0 = external)
bit 112: 1 = 121.5 MHz auxiliary radio locating device;
0 = other or no auxiliary radio locating device.

Note 1.— Further details on protocol coding can be found in Specification for COSPAS-SARSAT 406 MHz Distress Beacon (C/S T.001).

Note 2. — All identification and location data are to be encoded in binary notation with the least significant bit on the right except for the aircraft operator designator (3 letter code).

Note 3. — For details on BCH error correcting code see Specification for COSPAS-SARSAT 406 MHz Distress Beacon (C/S T.001).

EXAMPLE OF CODING (NATIONAL LOCATION PROTOCOL)

25	26	←27 36→	←37 40→|←41												←86 106→	107 112	←113								←133 144→
← 61 BITS PDF-1 →															BCH-1	← 26 BITS PDF-2 →									BCH-2
1	1	10	4	45											21	6	7			7			6	12	
1	0	CC	1000	18 bits ID	27 bits LATITUDE					LONGITUDE					21-BIT BCH CODE	SD	Δ LATITUDE			Δ LONGITUDE			NU	12-BIT BCH CODE	
				18	1	7	5	1	8	5							1	2	4	1	2	4			
				NATIONAL ID NUMBER	N = 0 S = 1	DEGREES 0–90 (1 d)	MINUTES 0–58 (2 m)	E = 0 W = 1	DEGREES 0–180 (1 d)	MINUTES 0–58 (2 m)							– = 0 + = 1	MINUTES 0–3 (1 m)	SECONDS 0–56 (4 s)	– = 0 + = 1	MINUTES 0–3 (1 m)	SECONDS 0–56 (4 s)			

CC = Country Code;
ID = Identification Data = 8-bit identification data consisting of a serial number assigned by the appropriate national authority
SD = Supplementary Data = bits 107 – 109 = 110;
bit 110 = Additional Data Flag describing the use of bits 113 to 132:
1 = Delta position; 0 = National assignment;
bit 111 = Encoded Position Data Source: 1 = internal, 0 = external;
bit 112: 1 = 121.5 MHz auxiliary radio locating device;
0 = other or no device
NU = National use = 6 bits reserved for national use (additional beacon type identification or other uses).

Note 1.— Further details on protocol coding can be found in Specification for COSPAS-SARSAT 406 MHz Distress Beacon (C/S T.001).

Note 2.— All identification and location data are to be encoded in binary notation with the least significant bit on the right.

Note 3.— For details on BCH error correcting code see Specification for COSPAS-SARSAT 406 MHZ Distress Beacon (C/S T.001).

ATTACHMENT 01 - GUIDANCE MATERIAL FOR COMMUNICATION SYSTEMS

1. VHF COMMUNICATIONS

1.1. Audio characteristics of VHF communication equipment

1.1.1 The aeronautical radiotelephony services represent a special case of the application of radiotelephony, in that the requirement is for the transmission of messages in such a way that fidelity of wave form is of secondary importance, emphasis being upon fidelity of basic intelligence. This means that it is not necessary to transmit those parts of the wave form which are solely concerned with individuality, accent and emphasis.

1.1.2 The effective acceptance bandwidth for 8.33 kHz equipment is required to be at least plus and minus 3 462 Hz. This value considers the general case, i.e. air-to-ground transmissions and consists of 2 500 Hz audio bandwidth, 685 Hz for an aircraft transmitter instability of 5 ppm, 137 Hz for a ground receiver instability of 1 ppm and 140 Hz due to Doppler shift (2.2.2.4 and 2.3.2.6 of Part II refer).

1.2. Offset carrier system in 25 kHz, 50 kHz and 100 kHz spaced channels

The following are examples of offset carrier systems which meet the requirements of 2.2.1.1.1.

a) 2-carrier system. Carriers should be spaced at plus and minus 5 kHz. This requires a frequency stability of plus or minus 2 kHz (15.3 parts per million at 130 MHz).

b) 3-carrier system. Carriers should be spaced at zero and plus and minus 7.3 kHz. This requires a frequency stability of plus or minus 0.65 kHz (5 parts per million at 130 MHz).

The following are examples or 4- and 5-carrier systems which meet the requirements of 2.2.1.1.1.

c) 4-carrier system. Carriers should be spaced at plus and minus 2.5 kHz and plus and minus 7.5 kHz. This requires a frequency stability of plus or minus 0.5 kHz (3.8 parts per million at 130 MHz).

d) 5-carrier system. Carriers should be spaced at zero, plus and minus 4 kHz and plus and minus 8 kHz. A frequency stability in the order of plus or minus 40 Hz (0.3 parts per million at 130 MHz) is an achievable and practicable interpretation of the requirement in this case.

Note 1.— The carrier frequency spacing referred to above are with respect to the assigned channel frequency.

Note 2.— In aircraft receivers which employ a measurement of the received carrier-to-noise ratio to operate the mute, the audio heterodynes caused by the reception of two or more off-set carriers can be interpreted as noise and cause the audio output to be muted even when an

adequate wanted signal is present. In order that the airborne receiving system can conform with the sensitivity recommendations contained in Part II, 2.3.2.2, the design of the receivers may need to ensure that their sensitivity is maintained at a high level when receiving off-set carrier transmissions. The use of a carrier level override is an unsatisfactory solution to this requirement, but where it is employed, setting the override level as low as possible can ameliorate the problem.

1.3. Immunity performance of COM receiving systems in the presence of VHF FM broadcast interference

1.3.1 With reference to the Note of 2.3.3.2 of Part II, the immunity performance defined there must be measured against an agreed measure of derogation of the receiving system's normal performance, and in the presence of, and under standard conditions for the input wanted signal. This is necessary to ensure that the checking of receiving station equipment on bench test can be performed to a repeatable set of conditions, and results, and to facilitate their subsequent approval. An adequate measure of immunity performance may be obtained by the use of wanted signal of minus 87 dBm into the receiving equipment and the signal modulated with a 1 kHz tone at 30 per cent modulation depth. The signal-to-noise ratio should not fall below 6 dB when the interfering signals specified at Part II, 2.3.3.1 and 2.3.3.2 are applied. The broadcast signals should be selected from frequencies in the range between 87.5 and 107.9 MHz and should be modulated with a representative broadcast type signal.

Note 1.— The signal level of minus 87 dBm assumes a combined antenna and feeder gain of 0 dB.

Note 2.— The reduction in the signal-to-noise ratio quoted above is for the purpose of standardization when checking that receiving station equipment on bench measurements meet the required immunity. In the planning of frequencies and in the assessment of protection from FM broadcast interference, a value not less than this, and in many cases higher, depending on the operational circumstances in individual cases, should be chosen as the basis of the interference assessment.

2. SELCAL SYSTEM

2.1 This material is intended to provide information and guidance relating to the operation of the SELCAL system. It is associated with the Recommended Practices contained in Chapter 3.

a) Function. The purpose of the SELCAL system is to permit the selective calling of individual aircraft over radiotelephone channels linking the ground station with the aircraft, and is intended to operate on en-route frequencies with existing HF and VHF ground-to-air communications transmitters and receivers with a minimum of electrical and mechanical modification. The normal functioning of the ground-to-air communications link should be unaffected, except at such time as the selective calling function is being formed.

b) Principles of operation. Selective calling is accomplished by the coder of the ground transmitter sending a single group of coded tone pulses to the aircraft receiver and decoder. The airborne receiver and decoder equipment is capable of receiving and interpreting, by means of an indicator, the correct code and rejecting all other codes in the presence of random noise and interference. The

ground portion of the coding device (ground selective calling unit) supplies coded information to the ground-to-air transmitter. The airborne selective calling unit is the special airborne equipment which operates with existing communications receivers on the aircraft to permit decoding of the ground-to-air signals for display on the signal indicator. The type of signal indicator can be chosen to suit operational requirements of the user and may consist of a lamp, a bell, a chime or any combination of such indicating devices.