



GUIDANCE MATERIAL FOR VOICE COMMUNICATION SYSTEMS

SECTION 1 GENERAL

1.1 PURPOSE

This Advisory Circular (AC) provides guidance to air navigation service provider (Communications, Navigation and Surveillance Services) on how to satisfy the requirements specified in CAR-ANS Part 8, 8.2 and 8.3.

1.2 STATUS OF THIS ADVISORY CIRCULAR

This is an original issuance of this AC.

CAAP acknowledges the valuable information contained in ICAO Annex 10 — *Aeronautical Telecommunications*, Volume III — *Communication Systems* and Aviation Spectrum Resources, Inc. from which this Advisory Circular is derived.

1.3 APPLICABILITY

This Advisory Circular is applicable to air navigation service provider (Communications, Navigation and Surveillance Services) operating in the Philippines.

1.4 RELATED REGULATIONS

The following regulations and standards are directly applicable to the guidance contained in this advisory circular—

- CAR-ANS Part 10;
- CAR-ANS Part 8

Copies of the regulatory instrument and guidance material (Advisory Circular) may be downloaded from CAAP Website or obtained from Aerodrome and Air Navigation Safety Oversight Office (AANSOO).

1.5 RELATED PUBLICATIONS

For further information on this topic, each stakeholder concerned are invited to read the following publication—

Radio Technical Commission for Aeronautics

- ◆ RTCA DO-93A Minimum Performance Standards – Airborne Selective Calling Equipment

- Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.
- Where a regulation contains the words “prescribed by the Authority,” the AC may be considered to “prescribe” a viable method of compliance, but status of that “prescription” in the AC is always “guidance” and never as a regulation.

1.6 ACRONYMS

The following acronyms are used in this advisory circular—

- ARINC Aeronautical Radio, Inc.
- ASRI Aviation Spectrum Resources, Inc.
- COM Communications

HF	High Frequency
RTCA	Radio Technical Commission for Aeronautics
SELCAL	Selective Calling
SELCAL 32	Selective Calling (32 audio tones, expanded SELCAL code pool)
VHF RTF	Very High Frequency Radio Telephone

SECTION 2 VHF COMMUNICATIONS

2.1 AUDIO CHARACTERISTICS OF VHF COMMUNICATION SYSTEMS

- 2.1.1 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.
- 2.1.2 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.

Refer to CAR-ANS Part 8, 8.2.2.2.4 and 8.2.3.2.6.

2.2 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 CAR-ANS Part 8, 8.2.2.1.1.1.

- 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);,
- 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 of 4- and 5-carrier systems which meet the requirements of CAR-ANS Part 8, 8.2.2.1.1.1.

- 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).
- 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 spacings 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 CAR-ANS Part 8, 8.2.3.2.2, 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.

2.3 IMMUNITY PERFORMANCE OF COM RECEIVING SYSTEMS IN THE PRESENCE OF VHF FM BROADCAST INTERFERENCE

2.3.1 With reference to the *Note* of CAR-ANS Part 8, 8.2.3.3.2, 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 CAR-ANS Part 8, 8.2.3.3.1 and 8.2.3.3.2 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.

SECTION 3 SELCAL SYSTEM

3.1 This material is intended to provide information and guidance relating to the operation of the SELCAL system. It is associated with the practices contained in CAR-ANS Part 8, 8.3.

a) *General information*

Selective Calling (SELCAL) is an aircraft signalling method transmitted over either HF or VHF RTF that is first introduced in 1957 and is still widely used today. Each aircraft is assigned with a distinct 4-character SELCAL code that allows contact between an aeronautical ground station and a specific aircraft on a common radio frequency. SELCAL relieves the flight crew from having to listen continuously for hours to messages for other aircraft on annoyingly static-filled HF voice channels. Traditional radio communications with SELCAL remain in use for delivering Air Traffic Control messages and other communications to aircraft in spite of the increasing capability of aircraft satellite communications. SELCAL codes, which in the past were assigned and plated to an aircraft, are now assigned to aircraft operators and not to individual aircrafts. ASRI is the registrar of SELCAL codes worldwide, a role previously served by ARINC since SELCAL was introduced for use by civil aviation.

b) *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 minimal 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.

c) *Principles of operation*

Selective calling is accomplished by the encoder of the ground transmitter sending a single group of coded tone pulses to the aircraft receiver and decoder. The

AC CNS 01-2022 GUIDANCE MATERIAL FOR VOICE COMMUNICATION SYSTEMS

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 SELCAL 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 which may consist of a lamp, a chime or any combination of such indicating devices.

d) *SELCAL32 Implementation guide*

Air Navigation Service Providers (CNS) operating aeronautical HF radio stations need to upgrade the SELCAL encoder in order to be in conformity with SELCAL32 standards. Implementation of the new SELCAL system options include, but are not limited, to the following:

- *contact the SELCAL encoder manufacturer to include the extra tones in the existing encoder;*
- *update to a new encoder on existing HF transmitters; and*
- *install a PC based encoder*

Ground infrastructure software and/or hardware solutions are currently available from the following sources which support the upgraded SELCAL system:

- *AVTECHTYEE – for upgraded SELCAL Encoders and Ramp Test Equipment*
- *COMTEKK – for upgraded Encoders and Decoders*
- *INVELCOV – for upgraded Radios*
- *SELCAL.CH – for upgraded SELCAL Coders*

Additional specific information for ground stations which ANSPs should be aware of is also available in RTCA DO-93A.

----- END OF ADVISORY CIRCULAR -----


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