

**UK Aeronautical Information Service**

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COMPATIBILITY OF AIRBORNE VHF RECEIVERS WITH OFFSET CARRIER SYSTEMS

- 1** Within the United Kingdom, the majority of VHF RTF channels provided by NATS Ltd for en-route air traffic control and those used for emergency, flight information services and VOLMET are operated from between two and four ground stations using the off-set carrier technique in accordance with the standards set down in ICAO Annex 10. The offsets employed are; ± 5 kHz for a two station system, ± 7.5 kHz and 0 Hz for a three station system and ± 7.5 kHz and ± 2.5 kHz for a four station system.

- 2** When an aircraft is operating within the range of two or more stations, individual transmissions combine in the aircraft receiver to cause one or more audio heterodynes having a minimum frequency of approximately 5 kHz. These heterodynes appear above the normal audio pass band of the receiver and are not heard by the flight crew.

- 3** When airborne receivers are fitted with muting or squelch circuits, it is common practice for these to operate on the basis of a received noise measurement obtained by sampling part of the audio band above 4 kHz. In areas where off-set carriers are used, the heterodynes will therefore be measured as noise and may cause the audio output of the receiver to be muted even though a perfectly adequate wanted signal is present. In general, airborne receiver manufacturers recognise this possibility and provide additional circuitry which either detects the presence of heterodynes or operates directly on the level of the received carrier signal (carrier over-ride) to lift the mute.

- 4** An examination of some commonly used aircraft receivers which employ the carrier over-ride technique has revealed that they are set to operate at carrier input levels of typically -81dBm ($20\mu\text{V PD}^*$). This level is far in excess of that required to provide an adequate audio output and effectively causes the receiver to be de-sensitised when operating in an off-set carrier environment and communications from ATC are lost.

- 5** With the high density of air traffic now being experienced in UK airspace, it is essential for the safe operation of aircraft that reliable radio communications are provided. Operators are therefore requested to note that off-set carrier systems are used extensively for the provision of VHF RTF services within the UK and that aircraft receivers must be compatible with these systems. In choosing aircraft receivers, preference should be given to those designs which maintain a high sensitivity when operating with off-set carrier transmissions. Where a carrier over-ride is provided within the mute circuitry (to overcome the failure of noise operated mute circuits to function satisfactorily in the presence of audio heterodynes) it is recommended that the carrier over-ride level be set as low as possible with an upper limit of -85dBm ($12\mu\text{V PD}^*$). It is further recommended that the level of -85dBm operates the over-ride throughout the range ± 8 kHz of nominal receiver frequency. This level is compatible with the certification requirements contained in Eurocae Minimum Operational Performance Specification ED23B.

Note: * when measured across a 50 ohms load

This Circular is issued for information, guidance and necessary action.