

Device For Recognizing Interference

The invention concerns a device for recognizing high-frequency interference on board an aircraft, particularly a passenger aircraft. The electronic systems of an aircraft, such as radio systems and control systems, are increasingly based on complex electronic processes. Therefore, the timely recognition and subsequent prevention of interference which could impair the function of the aircraft's own systems is required. Such interference originates primarily from portable electronic appliances used by passengers on board an aircraft. These appliances include electronic games, CD-players as well as lap-top computers and portable telephones.

Accordingly, it is the task of the invention to design a device according to the generic terms in such a way that by means of this device the frequency bands can be monitored with regard to interference influencing the pertinent aircraft systems, and that the relevant sources of interference can be localised due to the interference signals received by the device.

This task is implemented for a device according to the generic terms by means of the characterising marks of claim 1.

It is a particular advantage of the invention that the sources of interference, emitting signals located within a sensitive frequency band, can be recognised pre-flight, during the flight as well as post-flight at the very moment of their activation, so that measures can be

taken to de-activate them, and that the essential functions of the device are carried out without additionally burdening the crew of the aircraft.

Further advantageous developments of the invention are specified in the sub-claims.

The invention is represented by means of the drawings, and is further explained below.

- Fig. 1 shows the body of an aircraft with a passenger cabin,
- Fig. 2 shows a partial view of the cabin according to Fig. 1, in a plan view,
- Fig. 3 shows a cross-section of the cabin according to Fig. 1,
- Fig. 4 shows a block circuit diagramme of the device with a central monitoring unit and several receiving units, and
- Fig. 5 shows the internal circuit of the monitoring unit and the receiving unit.

An aircraft body 1 with a passenger cabin 2 is shown schematically in Fig. 1. Several receiving units 3, interacting with a central monitoring unit 5 via a connection for the transmission of digital signals, are distributed in the upper area of the cabin, in its longitudinal direction. For the design shown, the connection consists of a data bus 4.

Fig. 2 shows a partial view of the cabin according to Fig. 1, in a plan view, with passenger seats 6 and further cabin fittings 7 and 8. The receiving units 3 are arranged vertically, above the aircraft body axis 9. Each of the receiving units 3 shown is able to measure at least the frequency and the field strength of an interference. Each measured value is conveyed to the central monitor unit 5 via the data bus 4.

Fig. 3 shows a cross-section of the cabin 2 according to Fig. 1, with the passenger seats 6 and a receiving unit 3. The upper lining of the cabin consists of the cabin ceiling 10. For visual reasons, the receiving units 3 are positioned above the ceiling 10. Due to the fact that the ceiling is made of plastic material, the functioning of the receiving units is in no way obstructed by the ceiling material.

Fig. 4 shows a block circuit diagramme of the device with the central monitoring unit 5 and several receiving units 3a to 3n, connected to the central monitoring unit 5 via the data bus 4. The monitoring unit 5 is further connected via a data line 11 to an indicator unit 12, located in the cockpit, and via a data line 13 to an indicator unit 14, located in the

cabin. An image of the seating arrangement is stored within monitoring unit 5, as well as the positions of the individual receiving units 3a to 3n. A passenger seat, designated 6n, is shown schematically, whereby a person (not shown here) occupying this seat is using a lap-top computer 15 which is supplied with energy via a lead 16 from the electric network on board the aircraft. The receiving units 3a to 3n are able to pick up any interference located within a sensitive frequency area and conduct a corresponding signal to the monitor unit 5. Each of these signals contains identification of the particular receiving unit wherein the signal originates, as well as information regarding frequency and local field strength of the received interference. From these data, the monitor unit 5 can detect with sufficient accuracy the location of the center of an interference field. In this way the monitor unit 5 is able to detect the row of seats including seat no. 6n, for example, as the area where the source of interference is located. Subsequently, a corresponding video signal is conducted by the monitor unit 5 via data lines 11 and 13 to the indicator unit 12 located in the cock pit and to the indicator unit 14 located in the cabin. These indicator units now sound an audio-warning signal indicating that information concerning an interference and ready to be recalled, is contained within the indicator unit. This information can then be recalled by the crew of the aircraft via a means of operation such as activating a switch, for example. Thereupon an image of the seating arrangement provided with the seat numbers will appear on the relevant indicator field, whereby the row of seats containing seat no. 6n is clearly marked. Due to the information provided, the

user of the lap-top computer is targeted accurately and can then be requested to switch off his appliance.

The data and information paths present within the device are shown in Fig. 5 by means of the internal function units of the receiving units 3 and the monitor unit 5. The receiving unit 3 includes an antenna 17, a frequency scanner 18, a bus transmitter 19 and a bus receiver 20. According to the total width of the frequency area to be monitored, several antennae, each tuned to an individual partial frequency area, may be provided. The signal received by antenna 17 is conducted to the frequency scanner 18; based on a corresponding pre-set value, the frequency scanner 18 then checks the field strength of an interference received in order to determine whether a pre-set threshold value has been exceeded and whether the field strength of this interference is located within a sensitive frequency area. If this is the case, a corresponding signal is conducted by frequency scanner 18 to the bus transmitter 19 which thereupon sends a signal via data bus 4 to the monitoring unit 5. This signal contains identification of the respective receiving unit 3 as well as information regarding frequency and field strength of the interference. The bus receiver 20, also connected to the data bus 4, then receives signals originating from the monitoring unit 5 and consisting of pre-set values conveyed to the frequency scanner 18, concerning the above-mentioned threshold values, the selection of frequency areas, and if necessary, instructions with regard to termination of the scanning process.

The monitoring unit 5 includes a level matrix 21, an interference computer 22, a scan-control unit 23 and a scan-input unit 24. The level matrix 21 actually represents a data bank and contains data regarding the threshold values associated with the individual frequency areas, as well as data regarding the frequency bands wherein the individual frequency areas are to be scanned. In addition, the conditions for changing the above-mentioned threshold values are stored within level matrix 21. Thus it is possible, for example, that relatively low threshold values are set during take-off and landing, and that these values are then increased during the flight itself. The information supplied by receiving unit 3 is processed by the scan-input unit 24 and is kept ready for input into the interference computer 22. This information is then compared by interference computer 22 with information supplied by the level matrix 21; subsequently, interference computer 22 produces the resulting signals which are then conducted via the respective data lines 11 and 13 to the indicator unit 12 located in the cockpit and the indicator unit 14 located in the cabin, where these signals then cause the effects described in conjunction with Fig. 4.

The functions of the device are fully automatic, so that sources of interference on board the aircraft can be recognised and localised without the assistance of the aircraft's crew. The only activities to be carried out by the crew merely consist of taking notice of the warning signals supplied by the device and then taking the appropriate action.

The stored threshold values represent corresponding permissible limits. Thus any interference located below these limits, i.e. non-harmful interference, is disregarded.

According to one design of the invention, the data bus 4 is a definite part of the device and is installed together with the device.

According to another design of the invention, the receiving units 3 and the monitoring unit 5 are designed in such a way that they are able to interact without any problems with an already-present data bus, such as a data bus according to standard ARINC 429, for example.

According to a further design of the invention, the traffic of data between the receiving units 3 and the monitoring unit 5 is wireless and occurs via radio operation. For this purpose the receiving units 3 and the monitoring unit 5 are equipped with the appropriate transmitters/receivers. This method offers the advantage that there are no data lines to be installed during the installation of the device.

According to another design of the invention, the antenna 17 of the receiving unit 3 - 3n is designed as a direction-finding antenna able to rotate via a drive around an approximately vertical axis. In this way, not only the frequency and the field strength, but also the direction of incidence of an interference can be determined by the receiving unit 3 - 3n.

Although this design involves greater expenditure, its advantage lies in the fact that fewer receiving units $3 - 3n$ are needed, and the position of a source of interference can be determined with greater accuracy.

Claims

1. Device for recognising high-frequency interference on board an aircraft, particularly a passenger aircraft, provided with one or several receiving units and one monitoring unit for the evaluation of the measured values,

characterised by the fact that the receiving units (3) are each provided with at least one antenna (17) and that the monitoring unit (5) includes an interference computer (22), whereby the monitoring unit (5) interacts with the receiving units (3) via a connection for the transmission of digital signals and whereby the interference computer (22) is connected to at least one indicator unit (12, 14).
2. Device according to claim 1,

characterised by the fact that the receiving unit (3) further includes a frequency scanner (18), a bus transmitter (19) and a bus receiver (20).
3. Device according to claim 1 or 2,

characterised by the fact that the monitoring unit (5) further includes a level matrix (21), a scan-control unit (23) and a scan-input unit (24).



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4. Device according to one of the claims 1 to 3,

characterised by the fact that the connection for the transmission of digital signals consists of a data bus (4).

5. Device according to one of the claims 1 to 4,

characterised by the fact that the receiving units (3) and the monitoring unit (5) are designed in such a way that they interact with an already-present data bus (4).

6. Device according to one of the claims 1 to 5,

characterised by the fact that the data bus (4) is a definite part of the device and can be installed together with the device.

7. Device according to one of the claims 1 to 6,

characterised by the fact that the receiving units (3) and the monitoring unit (5) are provided with transmitters/receivers for the wireless traffic of data.

8. Device according to one of the claims 1 to 7,

characterised by the fact that the antenna (17) of the receiving unit (3 - 3n) is designed as a direction-finding antenna able to rotate via a drive around an approximately vertical axis.

