

DESCRIPTION

Title of the invention: Passive interface device

5 **[0001]** The invention relates to a passive and hardened (resistant to electromagnetic and environmental, climatic and mechanical stresses) interface device for a set of communication protocols and services afforded by functions of radiocommunications equipment. This information is made available to the user, from a socket available on the front face of a radio apparatus. The various signals are distributed and made available via this interface on sockets specific to each function. By virtue of their
10 physical characteristics, these sockets make it possible to satisfy compatibility with the interconnection technological standards inherent in each function (USB, RS232, Ethernet).

[0002] The invention can be used for the interconnection of radio apparatuses on carriers or embedded and mobile systems.

15 **[0003]** The need to interface one or more radios 1, 2 (Figure 1) with one or more external equipments, such as a positioning system of GPS (Global Positioning System) type, 3, an ERS-p charger 4 for mobile radios, keys of USB type 5, a tablet 6, or radios with one another, through an interface box, is a recurrent and very real need in the field of the integration of communications systems on carriers.

20 **[0004]** When it is sought to connect one or more radio apparatuses on carriers, the use of complex octopus cable P, illustrated in Figure 1, which comprises more than two ends, is frequent. These octopus cables P customized to the user carrier turn out to be expensive and difficult to produce and to integrate.

25 **[0005]** Moreover, in case of malfunctioning of a function of such a cable, it is often necessary to dismantle it entirely. This entails the total shutdown of the services.

[0006] At the present time a need exists to have available a simple connection interface, which can be put in place rapidly and which enables the system to be kept functioning at least partially in case of intervention on this interface when one of the connections has failed.

30 **[0007]** The invention relates to an interface box for interfacing between at least one first radio apparatus and one or more external items of equipment, characterized in that it comprises at least the following elements:

- A first socket dedicated to the first radio apparatus,
- A second socket adapted to ensure the link between the first apparatus and a geolocation device,
- A third socket adapted to ensure the link between the first radio apparatus and an exterior Ethernet peripheral,
- A fourth socket adapted to ensure an Ethernet link with a charger,
- A fifth socket adapted to ensure a link with a first USB peripheral,
- A sixth socket adapted to ensure a link with a second USB peripheral,
- An eighth socket adapted to ensure the connection between the first radio apparatus and a test device,
- A seventh socket dedicated to a second radio apparatus and to the loopback of an Ethernet link of the first radio apparatus to an "EthA1/ B2" Ethernet connector, via a dedicated plug.

[0008] The sockets are, for example, assigned in the following manner:

- The socket of the geolocation device comprises two contacts assigned to transmission TX, reception RX signals of an RS232 link and one contact assigned to a 1 PPS signal and a contact assigned to the electrical earth,
- The socket of the charger comprises four contacts assigned to two pairs of an Ethernet line Channel of the first radio apparatus, a contact assigned to a signal allowing TOP_H_Cluster time keeping, four other contacts for the electrical earth,
- The fifth socket comprises two contacts assigned to a pair of the differential serial Data link, a contact for the electrical earth and a contact for the power supply of a USB peripheral,
- The sixth socket possessing the same characteristics as the fifth socket,
- The "EthA1/ B2" Ethernet socket comprises four contacts assigned to two pairs of an Ethernet line Channel A1, a contact assigned to a signal, TOP_H_Cluster, four contacts for the electrical earth,
- The loopback plug is placed on the second socket in the absence of a second radio apparatus,

- The contact pairs assigned to the Ethernet are linked to channel A1 of the Ethernet line of the first socket,
- In the case of use with two radio apparatuses, the socket of the second apparatus comprises four contacts assigned to the two pairs of an active Ethernet line Channel B2, in the absence of the second radio apparatus and after application of the loopback plug on this socket,
- The "discreet offset" socket S8 comprises a contact assigned to an On/Off control of a radio apparatus, four contacts assigned to a control of the "black discreets" platform, a contact assigned to the TOP_H_Cluster signal, a contact for the electrical earth.

[0009] The sockets can also be assigned in the following manner:

- The socket DA1 of the first radio apparatus comprises four contacts assigned to two pairs of an Ethernet line Channel A1 which are connected by the interface to channel A2 of the socket DA2 of the second radio apparatus,
- The socket for the geolocation device comprises two contacts assigned to transmission TX, reception RX signals of an RS232 link, one contact assigned to a 1_PPS signal and a contact assigned to the electrical earth,
- The socket of the charger comprises four contacts assigned to the two pairs of the Ethernet line Channel B of the first apparatus, a contact assigned to the TOP_H_Cluster signal, four contacts for the electrical earth,
- The socket for a first USB connection comprises two contacts assigned to a pair of the differential serial Data link, another contact for the electrical earth and another for the power supply of the USB peripheral,
- The socket for the second USB connection comprises two contacts assigned to a pair of the differential serial Data link, and another contact for the electrical earth and another for the power supply of the USB peripheral,
- The "EthA1/ B2" Ethernet socket comprises four contacts assigned to the two pairs of an Ethernet line Channel B2, one contact assigned to the TOP_H_Cluster signal, four other contacts for the electrical earth,

- The socket DA2 of the second radio apparatus comprises four contacts assigned to the two pairs of an Ethernet line Channel A2 which are connected by the interface to channel A1 of the socket DA1 of the first radio apparatus,

- The "discreet offset" socket comprises a contact assigned to the On/Off control of the first and of the second radio apparatus, four contacts assigned to the control of the "black discreets" platforms of the first radio apparatus and of the second radio apparatus, a contact assigned to the TOP_H_Cluster signal, a contact for the electrical earth.

[0010] The appended drawings illustrate the invention:

[0011] [Fig.1] represents an interconnection view according to the prior art,

[0012] [Fig.2] represents an electrical schematic of the interconnection box according to the invention,

[0013] [Fig.3] illustrates a basic unifilar electrical diagram of the interconnection box according to the invention, and

[0014] [Fig.4] is a 2D interconnection view of two radio and peripheral apparatuses with the interconnection box according to the invention.

[0015] Figure 2 represents an exemplary electrical schematic of the interface box. In this representation the detail of the connections per protocol is not represented. It is based on the Bus link symbolics. For example, in this example, the Ethernet channel A1 of the socket DA1 of a first radio apparatus communicates with Channel A2 of the socket DA2 of a second radio apparatus, the Ethernet channel B1 of the socket DA1 communicates with the charger and the Ethernet channel B2 of the socket DA2 communicates with an Ethernet socket B2. This diagram also clearly identifies that the signal allowing time keeping within a radio apparatus and disembarked apparatus cluster, customarily referred to by the expression "Top Horaire Cluster" ("Cluster Time Pip" in English), is common to all the sockets linked to the ERS-p charger, to the aforementioned Ethernet connections, to optional discreet offsets, with the exception of the sockets provided for the connection of a geolocation device such as a GPS (Global Positioning System) and for the connection of USB (Universal Serial Bus) type.

[0016] This Figure 2 makes it possible to follow the logical distribution due to the internal mechanisms of the interface box 20 according to the invention of the various protocols and signals on the various sockets. In order to properly elucidate the subject matter of the invention, the description which follows is given, by way of wholly nonlimiting illustration, for the integration of two radio apparatuses 41, 42 (Figure 4) in a communication station.

[0017] In a more detailed manner, the interface box 20 according to the invention comprises notably a first socket S1 for the connection DA1 of the first radio apparatus, a second socket S2 for the connection DA2 of the second radio apparatus, a third socket S3 for the connection of a geolocation system, a fourth socket S4 for the connection of a charger of ERS-p type, a fifth and sixth sockets S5, S6, for the connection technology of USB type, a seventh socket S7 for the Ethernet connection A1/B2, an eighth socket S8 for a connection of discreet offsets. DA1 and DA2 designate connections available at the level of the radio apparatuses, S1, S2, of the sockets of the interface box according to the invention.

[0018] Figure 3 illustrates a simplified electrical diagram of the principle of the interface box according to the invention. Initially, the functions of the sockets of the interconnection box are described in the case where a single radio is connected.

[0019] Through its various sockets, the interface box allows distribution and access to the various protocols and services on the following sockets:

- Socket S1: Hardened link which prolongs all the signals of the socket DA1 of the first radio apparatus 41 to the passive distribution circuitry of the interface box, an expression known to the person skilled in the art,
- Socket S2: this socket has two purposes:
 - Connecting a second radio apparatus via its own socket DA2,
 - In the absence of a second radio apparatus, this socket S2 is used with a loopback plug whose role is to divert the Ethernet link Channel A of the first radio apparatus with the socket S7,
- Socket S3: RS232 hardened link and 1 PPS or one pulse per second signal between the first radio apparatus 41 (Figure 4) and a positioning system of GPS type,

- Socket S4: Ethernet hardened link Channel B (channel B1, channel B2) and Top H Cluster of the first radio apparatus with the ERS-p charger,
- Socket S5: USB2.0 hardened serial link between the first radio apparatus and USB peripherals,
- 5 - Socket S6: unavailable USB2.0 hardened serial link of the second radio apparatus and USB peripherals,
- Socket S7: Hardened Ethernet link Channel A (channel A1, channel A2) of the first radio apparatus with an Ethernet peripheral. This link is activated by the presence of a loopback plug P1 placed on the socket S2 (in the absence of a second radio
- 10 apparatus),
- Socket S8: Links for access to the discreets control box, and to the lines of tele-power supply of DNA1 Valim-DNA1; Valim-DNA2; Top_H_Cluster. The "discreet offset" socket S8 comprises a contact assigned to an On/Off control of a radio apparatus, four contacts assigned to a control of the black discreets platform, i.e.,
- 15 encrypted signals.

[0020] In Figure 3, the zones are defined as follows. Zones 1 to 5 define zones which must be decoupled from one another electromagnetically. These decouplings are put in place so as to preserve to the maximum the performance of the cables which connect to the sockets DA1 and DA2 of the two radio apparatuses. The metallic

20 Ethernet sockets S1, S2, S4 and S7 will have protection integrated into the integrated circuit PCB, against electromagnetic interference; three PCBs are used to connect the sockets and to link the flex ribbons for transport of the signals. Zones 2, 3 and 4 which correspond to the Ethernet and to the USB serial links are particularly polluting zones. Their decoupling will be ensured by appropriate techniques known to a

25 person skilled in the art. The decoupling is taken into account in the case of a multilayer PCB by a particular layout of the tracks to be isolated, the lines of the switches of the interface box are decoupled by capacitors.

[0021] The Ethernet sockets S1, S2, S4 and S7 have their pairs filtered by these RC (resistor-capacitor) cells, not represented in the figure, at each of their ends. The

30 values are, for example, with a resistance value of 3.3 ohms for the resistor and a capacitance value of 1.2 picofarads for the capacitor.

[0022]In the case of the use of the box according to the invention for interfacing two radio apparatuses, the sockets have the functionalities described hereinafter:

[0023]Through its various sockets, the interface box according to the invention allows distribution and access to the various protocols and the services on the following sockets:

- Socket S1: hardened link which prolongs all the signals of the socket DA1 of the first radio apparatus 41 (Figure 4) to the passive distribution circuitry of the interface box. It makes it possible to establish internally to the interface an Ethernet link from Channel A of this socket to channel A2 of the socket S2,
- Socket S2: hardened link which prolongs all the signals of the socket DA2 of the second radio apparatus 42 to the passive distribution circuitry of the interface box. It makes it possible to establish internally to the interface an Ethernet link from Channel A2 of this socket to channel A1 of the socket S1,
- Socket S3: RS232 hardened and 1PPS (One Pulse Per Second) link between a radio apparatus and a positioning system of GPS type,
- Socket S4: Ethernet hardened link Channel B1 and Top H Cluster of a radio apparatus with the ERS-p charger,
- Sockets S5 – S6: USB2.0 hardened serial links between the radio apparatuses and USB peripherals,
- Socket S7: hardened Ethernet link of the second radio apparatus and Channel B2 with an Ethernet peripheral and link with the Top H Cluster signal activated by one of the radio apparatuses. The available Ethernet link is illustrated by the use of a tablet or of a microcomputer PC in Figure 4,
- Socket S8: links for access to the discreets control box and to the lines Valim-DNA1; Valim-DNA2; Top_H_Cluster.

[0024]The socket DA1 of the first radio apparatus 41 is connected to the socket S1 of the interface box according to the invention and the socket DA2 of the second radio apparatus 42 is connected to the socket S2 of the interface box according to the invention when there are two radio apparatuses or to the loopback plug.

[0025]Figure 4 illustrates a first exemplary interfacing of two radio apparatuses, 41, 42 with a GPS 47 (Global Positioning System), an ERS-p charger 43, a hardened

tablet 45, a USB Key, 46, and an adaptor cable, a discrete control box 44, via the interface box according to the invention.

[0026] The two radio apparatuses 41, 42 are connected to the two sockets S1, S2, the ERS-p charger 43 is connected to the socket S4, a discrete test box is
 5 connected to the socket S4, the hardened tablet 45 is connected to the socket S1, the GPS 47 to the socket S2, and two USB keys 48 are connected respectively to the socket S5 and to the socket S6.

[0027] The electrical characteristics of the links are, for example, as follows:

- USB Links: USB 2.0 Full Speed available,
- 10 - RS232 + 1PPS Link: Serial link at 4800 bits/s Maximum; 1PPS (),
- Ethernet Link: 10/1000 BT,
- Top_H_Cluster Linkup distributed over ERSP Charger socket; EthA1/ B2; SW offset, from the socket S1/DA1 and from the socket S2/DA2,
- The PCBs and ribbons of the interface for avoiding impedance breaks in the lines
 15 (Ethernet; RS232; USB; coaxial) satisfy, for example, to $\pm 10\%$ the following impedances: USB of 90 Ohms per pair; Ethernet at 100 Ohms per pair; 50 Ohms for the 1 PPS and TOP_H_Cluster signal.

[0028] The interface box according to the invention makes it possible to dispense with the production of complex and fragile cables of "hardened specific octopus" type and
 20 to limit oneself to the use of simple and robust cables with only two ends. In an entirely passive manner, its electrical characteristics make it possible to safeguard the performance of the transmission lines assigned to the various protocols. It also offers the advantage in the case of a carrier which is more sensitive to CEM disturbances of being able to increase the filtering of the Ethernet lines.

CLAIMS

1. Interface box for interfacing between at least one first radio communication apparatus and one or more external items of equipment, said interface box being
5 passive, characterized in that it comprises at least the following elements:
- a first socket S1 dedicated to the first radio communication apparatus,
 - a second socket S2 dedicated to a second radio communication apparatus,
 - 10 - a third socket S3 adapted to ensure a link between the first apparatus and a geolocation device,
 - a fourth socket S4 adapted to ensure an Ethernet link with a charger,
 - a fifth socket S5 adapted to ensure a link with a USB peripheral,
 - a sixth socket S6 adapted to ensure a link with a USB peripheral,
 - 15 - an eighth socket S8 for a connection to discreet offsets,
 - a seventh socket S7 dedicated to a loopback of an Ethernet link of the first radio communication apparatus to an "EthA1/ B2" Ethernet connector of the interface box, via a loopback plug placed on the second socket S2 of the interface box in the absence of the second radio
20 apparatus.
2. Interface box according to Claim 1, characterized in that the said sockets comprise contacts assigned in the following manner:
- the third socket S3 comprises two contacts assigned to
25 transmission TX, reception RX signals of an RS232 link and one contact assigned to a 1 PPS signal and a contact assigned to the electrical earth,
 - the fourth socket S4 comprises four contacts assigned to an Ethernet line Channel of the first radio communication apparatus, a contact assigned to a signal allowing time keeping, four other contacts for the
30 electrical earth,

- the fifth socket S5 comprises two contacts assigned to a differential serial Data link, a contact for the electrical earth and a contact for the power supply of a USB peripheral,
- the sixth socket S6 possessing the same characteristics as the socket S5,
- the seventh socket S7 comprises four contacts assigned to an Ethernet line Channel A1, a contact assigned to the signal allowing time keeping, four contacts for the electrical earth,
- the loopback plug is placed on the socket S2 in the absence of a second radio communication apparatus,
- said contacts assigned to the Ethernet line Channel A1 are linked to channel A1 of an Ethernet line of the socket S1,
- in the case of use with two radio communication apparatuses, the second socket S2 of the second apparatus comprises four contacts assigned to an active Ethernet line Channel B2, in the absence of the second radio communication apparatus and after application of the loopback plug on this socket,
- the eighth socket S8 comprises a contact assigned to an On/Off control of a radio communication apparatus, four contacts assigned to a control of the "black discreets" platform, a contact assigned to the signal allowing time keeping, a contact for the electrical earth.

3. A system comprising an interface box according to one of Claims 1 or 2, said first radio communication apparatus connected to the first socket S1 of the interface box, said second radio communication apparatus connected to the second socket S2 of the interface box, said geolocalisation device connected to the third socket S3 of the interface box, said charger connected to the fourth socket S4 of the interface box, said first USB connected to the fifth socket S5 of the interface box, said second USB connected to the sixth socket S6 of the interface box, said Ethernet EthA1/B1 connected to the seventh socket S7 of the interface box, and a discreet control box connected to the eighth socket S8 of the interface box.

4. The system of claim 3, wherein:
- the first radio communication apparatus includes a socket DA1 comprising four contacts assigned to the Ethernet line Channel A1 which
5 are connected by the interface box to the channel A2 of the socket DA2 of the second radio communication apparatus,
 - the second radio communication apparatus comprises a socket DA2 comprising four contacts assigned to the Ethernet line Channel A2 which are connected by the interface box to channel A1 of the socket DA1
10 of the first radio communication apparatus.