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(54) **Vehicle unit with integrated antenna**

(57) A Vehicle Unit, VU, is provided having a front end. The front end comprises a connection port and a space where the space is covered by an access panel. The access panel comprises an integrated antenna which is arranged to be connected to a processing unit.

The integrated antenna is further arranged to be connected, via the processing unit, to the connection port, and the integrated antenna is also arranged to wirelessly send signals to and receive signals from an external device.

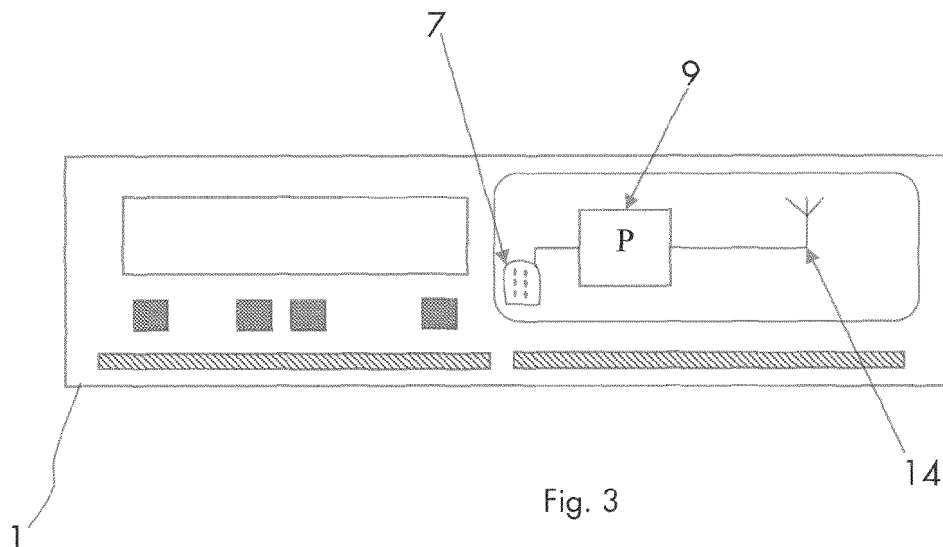


Fig. 3

Description

Technical field

[0001] The present invention relates generally to a communication arrangement in a vehicle unit and particularly to a vehicle unit having an integrated antenna.

Background art

[0002] Today, transportation by vehicle requires measurement of parameters and information relating to the driver activities. This is not exclusively done to satisfy regulations regarding road transportation, but also for fleet management to measure and increase performance and efficiency, as well as for the purpose of electronic road tolling, monitoring vehicle or engine performance parameters, monitoring data relevant for special transports e.g. dangerous goods, livestock or refrigerated food etc. Therefore, most vehicles, such as lorry trucks, carry a Vehicle Unit (VU) to measure, store and possible also report the collected data. In this document, the term "Vehicle Unit" shall mean a digital unit capable of gathering information relating to the vehicle. Examples of such information may be a geographical location, driving hours, distance traveled, start time, finish time, rest time, driver name, starting location and finishing location, exhaust measurements, fuel consumption, temperature data from vehicle or cargo sensors, opening and closing of cargo doors or operation of other vehicle systems, e.g. cranes and lifts etc. One example of a VU is a digital tachograph, capable of recording and digitally compiling and storing the vehicle data.

[0003] The VU is normally located in the cabin of the vehicle, where the VU is arranged in the instrument board, so that the vehicle operator may operate the VU in adjacency to start or stop of a journey. In order to calculate and estimate the speed and the travel distance, or other parameters for instance as listed above, of the vehicle, the VU is in connectivity to one or more sensors, where the sensors are capable of measuring for instance the motion of the wheels or other parameters.

[0004] The VU may be used by law enforcement to check whether or not the driver complies with the driving regulations. Hence, the VU is normally heavily regulated and must be certified to high standards regarding functionality, safety and security. It is therefore complicated to make changes and to add new functions. An extensive certification procedure can considerably contribute to a long time to market for changes and new functions. Although a hardware and software integrated data off-load function is desirable, such solution may not be economically feasible due to the above mentioned regulation and certification restrictions.

[0005] According to the prior art solutions, the data stored within the VU is offloaded to an external device by connecting a cable to a connection port. The term "offloading data" shall be understood to be the function

when the VU transfers the stored vehicle data to an external device.

[0006] The connection port is normally arranged, covered by an access panel, in a front end of the VU. When offloading the vehicle data, then the access panel is normally temporary removed to expose the connection port. Once the offloading operation is completed, the cable, connecting the external device to the connection port, is removed and the access panel replaced. This solution may be sub-optimal if a continuous data feed between the VU and the external device is desired. The physical arrangement exposes the VU of increased risk of damage due to physical breakage as the driver is moving around in the cabin of the vehicle. Moreover, the access panel needs to be removed during the data offloading procedure and thereafter restored in place.

[0007] According to another prior art solution, the access panel may be removed and an external "dongle" may be connected to the connection port. The dongle, being powered by the connection port, may enable a wireless connection between the VU and an external device. However, connecting a dongle to the connection port also leaves the user with the access panel which is needed for other functionalities, such as printing. Moreover, since the dongle extends perpendicularly to the front end of the VU, the risk of physical damage, such as breakage in the connection of the connection port and the dongle, increases when the driver or a passenger moves around in the cabin of the vehicle. Further, in addition to being unaesthetic in general, extending portions of e.g. a dongle increases the risk of physical trauma to the driver during for instance an accident. The dongle may also be in the way of other equipment that needs to be accessed or visible by the driver during operation of the vehicle. Since "nomadic equipment" such as a removable dongle sometimes has to be removed from the VU and inserted again such use causes irritation especially if the dongle is forgotten or lost as a result of this handling. Removable equipment with contact surfaces is also prone to cause loose connection over time which will reduce functionality.

[0008] The current prior art solutions for achieving connectivity between the VU and an external device all have significant drawbacks. As previously discussed, add-on hardware increase the VU's exposure for physical trauma when the vehicle operator is moving inside the cabin.

Summary of invention

[0009] It is an object of the invention to address at least some of the limitations, problems and issues outlined above. It is also an object to provide a solution for enabling wireless communication between a Vehicle Unit, VU, and an external device. It may be possible to achieve these objects and others by using an arrangement as defined in the attached independent claims.

[0010] According to one aspect, a Vehicle Unit, VU, having a front end which comprises a connection port

and a space. The space is covered by an access panel which comprises an integrated antenna. The integrated antenna is arranged to be connected to a processing unit and the integrated antenna is arranged to be connected, via the processing unit, to the connection port. The integrated antenna is further arranged to wirelessly send signals to and receive signals from an external device.

[0011] Having the integrated antenna and processing unit in the access panel enables retrofitting, i.e. the only part needed to be replaced is the access panel in order to enable wireless communication, compared to replacing the complete VU. Another advantage is that the access panel may be kept inserted and in a closed position enabling normal operation of the printer compared to removing the access panel to expose the connection port. Since the integrated antenna may enable wireless communication while the access panel is inserted, risk of breakage is reduced compared to if an antenna, or dongle, is connected directly to the communication port without any integration of the antenna.

[0012] The above arrangements may be configured and implemented according to different embodiments. In one example embodiment, the access panel comprises a contact device connected to the integrated antenna. The contact device is arranged to connect the integrated antenna, via the processing unit, to the connection port. According to another embodiment, the access panel may be removable.

[0013] According to another possible embodiment, the access panel may be arranged to be in at least an open position and a closed position. The contact device is adapted to be in contact with the connection port when the access panel is in a closed position and be disconnected from the connection port when the access panel is in an open position.

[0014] According to one possible embodiment, the signals sent to the external device comprise signals may be related to vehicle data stored in the VU.

[0015] According to another embodiment, the VU may be adapted to be in connection with a fleet management system via the external device, thereby enabling the fleet management system to request and/or receive vehicle data from the VU.

[0016] According to another embodiment, the processing unit may be integrated with the access panel and may be arranged in series between the integrated antenna and the contact device.

[0017] According to another possible embodiment, the antenna may be one of a, an Ultra-Wide band antenna, a Bluetooth antenna or an IEEE 802.11 antenna.

[0018] According to another possible embodiment the space may be adapted to comprise a removable printer module.

[0019] According to one possible embodiment, the processing unit may be adapted to process a first communication protocol to a second communication protocol. The first protocol being applied in the wireless interface being formed between the external device and the inte-

grated antenna, and the second communication protocol is a serial protocol for communication with the VU.

[0020] According to one possible embodiment, the access panel comprises an external surface. The integrated antenna may be integrated into the access panel by moulding such that the antenna is arranged within the external surface of the access panel.

[0021] According to one possible embodiment, the access panel comprises an external surface, wherein the integrated antenna is attached to the access panel.

[0022] According to one possible embodiment, the vehicle unit is a digital tachograph.

[0023] Further possible features and benefits of this solution will become apparent from the detailed description below.

Brief description of drawings

[0024] The invention is now described, by way of example, with reference to the accompanying drawings, in which:

[0025] Fig. 1 shows a perspective view of a Vehicle Unit (VU) with a closed access panel

[0026] Fig. 2 shows a perspective view of a Vehicle Unit (VU) with an open access panel

[0027] Fig. 3 shows a front view of the Vehicle Unit (VU)

[0028] Fig. 4a shows a side view of a removable printer unit, removed from the Vehicle Unit (VU)

[0029] Fig. 4b shows a side view of a removable printer unit arranged inside the Vehicle Unit (VU)

[0030] Fig. 4c shows a side view of a removable printer unit arranged inside the Vehicle Unit (VU)

[0031] Fig. 4d shows a side view of a removable printer unit arranged inside the Vehicle Unit (VU)

[0032] Fig. 5 illustrates a block chart of a signaling scenario involving a Vehicle Unit (VU) and a User Equipment

Description of embodiments

[0033] In the following, a detailed description of the invention will be given:

[0034] Fig. 1 illustrates a perspective view of a Vehicle Unit ,VU, 1, such as a tachograph 1, for measuring, processing, storing or reporting collected vehicle data. The outer design and form factor of the VU 1 complies with standards in the field of tachographs such as e.g. ISO 7736. The front end 4 of the VU1 comprises an access panel 2 being in a closed position, i.e. wherein the access panel is closed, thereby covering a space 6 for housing a printer, preferably a removable printer module 8. The VU 1 further comprises a display 3, a first card tray 5 and a second card tray 5', and a first side end 4' to disclose the depth of the VU 1 in a direction perpendicular to the front side 4.

[0035] Fig. 2 discloses the VU 1 of Fig. 1 wherein the access panel 2 has been brought to an open position, i.e. wherein the access panel 2 is open. Behind the access panel 2, the space 6 adapted to house the remov-

able printer module 8 is disclosed. Preferably, the access panel 2 is pivotally arranged on the removable printer module 8 on the back side 2' of the access panel 2. On one side of the space 6 a connection port 7 has been arranged, wherein the connection port is accessible from the front side of the VU 1 and the ports connection pins extend in a direction normal to the plane of the front side. The connection port 7 is covered by the access panel 2 when the access panel 2 is in a closed position. The connection port 7 is adapted for off-loading data stored in the VU 1 to an external device by connecting a cable between the connection port 7 and an external device. The connection port may be a serial connection port. During offloading of data using a cable connection between the connection port and an external device, the access panel 2 including the removable printer module 8 is removed entirely from the front end 4 of the VU 1 in order to expose the connection port 7. This may be done by a manual operation performed by for instance the driver of the vehicle, in a sequence of steps including first bringing the access panel 2 into an open position and thereafter pulling the access panel 2 in a direction normal to a plane of the access panel 2 and towards the driver.

[0036] According to one possible embodiment, the connection port 7 may be a serial data interface, i.e. a serial port. The connection port 7 may typically be arranged such that information stored or processed within the VU 1, can be offloaded to an external device. The usage and operation of serial ports exists in profusion in the prior art.

[0037] Fig. 3 shows a front view of the VU 1, wherein the Figure shows a block chart of the components of the access panel 2 as well as the area covered by the access panel 2 when the access panel is in a closed position. For the purpose of transmitting vehicle data from the VU 1 and communicating to external devices without connecting a cable there between, the access panel 2 has been equipped with an integrated antenna 14. Integration of the integrated antenna 14 into the access panel 2 may be achieved by moulding the antenna into the material of the access panel 2, such as plastic, in a way that no portion of the antenna extends beyond the surface of the access panel 2, i.e. wherein the integrated antenna is arranged within the external surface of the access panel 2. The external surface of the access panel 2 means the outermost boundary of the access panel 2. Integration of the integrated antenna 14 into the material such as plastic may also comprise moulding the antenna 14 into the material such that a portion of the antenna 14 is arranged inside the external surface of the access panel 2 and a portion of the antenna 14 is arranged to protrude from the external surface of the access panel 2. Integration of the integrated antenna 14 into the material such as plastic of the access panel 2 may also comprise attaching an antenna onto and adjacent the surface of the access panel, preferably on a back side 2' of the access panel 2. The integrated antenna is preferably a short range antenna such as a Bluetooth antenna adapted to

wirelessly send signals to, and receive signals from external devices located within or in close proximity of the vehicle. The integrated antenna 14 is further connected to a processing unit 9 for protocol processing or conversion wherein protocol processing or conversion comprises for instance protocol translation, tunneling, encapsulation, which will be described in further detail below in this description. The processing unit 9 and the integrated antenna 14 are further connectable to the connection port 7 via contact device 15. The processing unit 9 is connected in series between the integrated antenna 14 and the connection port 7. Preferably, the processing unit 9 is integrated into the material of the access panel 2 together with the integrated antenna 14 during the moulding process of the access panel 2. However, in a manner similar to that of the integrated antenna 14, the integration of the processing unit 9 may also mean that the processing unit 9 is attached onto and adjacent the surface of the access panel 2.

[0038] Fig. 4a shows a side view of the removable printer unit 8 comprising the access panel 2 with the integrated antenna 14 and a contact device 15 for connecting the integrated antenna to the connection port 7, wherein the contact device 15 is arranged at the lowermost portion of the access panel 2, preferably on the back side 2' of the access panel 2. The Figure further shows the access panel in an open position wherein the removable printer unit 8 is removed from the VU 1. Further, a left side wall 11 and a lower surface portion 12 of the removable printer module 8 is disclosed in Fig. 4a. The access panel is pivotally arranged to the left side wall 11 and a right side wall (not shown) of the printer module 8, preferably by pins arranged on each side end of the back side 2' of the access panel 2 and adapted to engage two corresponding holes in the side walls enabling pivotal movement of the access panel 2 in relation to the printer module 8. A printer roller 13 is pivotally arranged on the back side 21 of the printer module 8 for feeding printer paper during print out of vehicle data.

[0039] Fig. 4b shows the removable printer module 8 arranged in the space 6 with housing walls 20 being integrated in the VU 1 and encompassing the space 6, wherein the access panel 2 is in an open position. In this position, wherein the access panel has been rotated to its outermost position in a counterclockwise direction, the contact device 15 is in a position such that there is a distance between the contact device 15 and the connection port 7, arranged in the VU 1 to the side of both the space 6 and the printer module 8, preferably in the housing wall 20. In this position, there is no connection between the integrated antenna 14 and the connection port 7.

[0040] Fig. 4c shows the removable printer module 8 arranged in the space 6 of the VU 1, wherein the access panel is in a closed position. In this position, the access panel has been rotated to its outermost clockwise direction wherein the lowermost portion of the access panel 2 is adjacent the lower surface 12 of the printer module

8 and wherein the access panel 2 is essentially parallel to the plane of the front side 4. As can further be seen in the Figure, the connection port 7 has received the contact device 15 of the access panel 2, such that there is a connection there between, i.e. that there is a connection between the integrated antenna 14 and the connection port 7.

[0041] Fig. 4d shows a side view similar to that of Fig. 4c, wherein a cylindrically shaped paper roll 17 is arranged between the side walls of the printer module 8. Paper from the paper roll 17 is guided from the paper roll 17 towards the back of the VU 1, above and around the printer roller 13, further extending below the lower portion of the printer module in a direction towards the front side 4 of the VU 1 to finally extend outside the front side 4 to be accessible by a driver printing out vehicle data. A printer of some kind, e.g. a ink jet printer, or thermal printer, is arranged at the inner most portion of the space 6 (not shown), and prints vehicle data on the paper at a position essentially as the paper passes the printer roller 13.

[0042] With reference to Fig. 5, a block chart illustrating a signaling scenario involving a VU 1, 32 and an external device, such as a User Equipment, UE, 33 is described. Fig. 5 shows a vehicle 30 having a VU 1, 32 arranged in the operating cabin of the vehicle 30. The VU 32 is in wireless communication connectivity with a UE 33.

[0043] According to one possible example, the VU 1, 32 can transmit data using high frequency radio communication. Although the distance of such radio communication is limited, 5 meters of signal reach will normally suffice to connect the VU 1, 32 and the UE 33. According to one possible example, the VU 1, 32 comprises a Bluetooth antenna and processor, enabling a Personal Area Network, PAN, comprising the VU 1, 32 and one or more UEs 33. However, also other wireless technologies, such as Ultra-Wide Band (UWB) or Wireless Local Area Network LAN, Institute of Electrical and Electronics Engineers, IEEE, 802.11, are also possible for enabling a wireless communication between the VU 1, 32 and the UE 33.

[0044] The communication using wireless interface formed between the UE 33 and the integrated antenna of the VU 1, 32 is of a first communication protocol. The first communication protocol is defined in the prior art for WLAN, Bluetooth or any of the UWB implementations. However, the connection port may be of another interface type which requires protocol processing or conversion such as translation, tunneling or encapsulation from the first communication protocol into a second communication protocol, or vice versa, to enable the wireless communication. According to one possible embodiment, the communication port of the VU1, 32, as shown in Figs 2-4d, is a serial port having a serial communication physical interface which may require the processing unit, being connected to the integrated antenna, to process or convert, data to be sent, or which is received, to comply with the VU 1, 32 and the UE 33.

[0045] The UE 33 may further be capable of receiving

Global Positioning System, GPS, signals from one or more satellites 36. The UE 33 can thereby compile and structure information relating to the vehicle 30, provided by the VU 1, 32 using the wireless interface between the UE 33 and the VU 1, 32, based on the geographical position of the vehicle 30.

[0046] The UE 33 may be capable of communicate using a Radio Access Network, RAN, comprising a Base Station 34. The BS 34 can then communicate, using a Wide Area Network, such as Internet or a private WAN, such as a corporate network, with a back end server 35, which may comprise a fleet management system. The UE 33 may also be adapted to communicate directly with a back end server 35 using a WAN or in certain situations a Wireless Local Area Network, WLAN. The latter may be preferable in a situation wherein the vehicle and the UE 33 is located or parked close to and using the WLAN of for instance a home office, goods terminal or at a customs station. In other words, the VU 1, 32 may provide information relating to the operation of the vehicle 30 to the UE 33 using the wireless interface between the VU 1, 32 and the UE 33. Then, the UE 33 may provide parts, or all, of the information relating to the operation of the vehicle to a back end server 35. The back end server 35, according to one embodiment comprising a fleet management system may then, based on the provided information, help the vehicle operator to make decisions for a more efficient transportation.

Claims

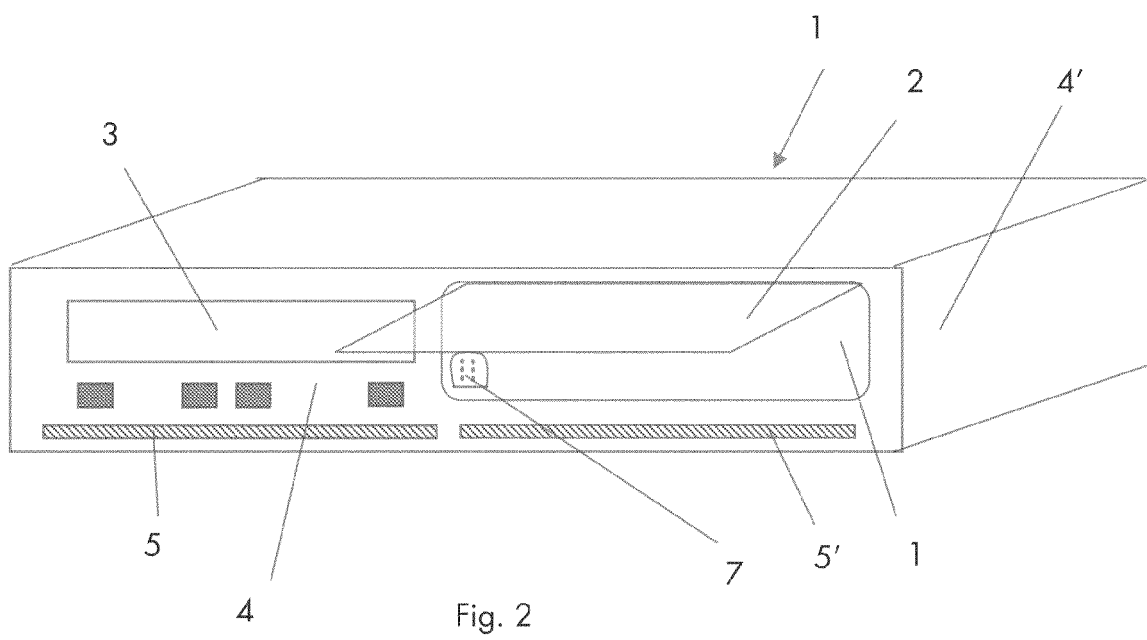
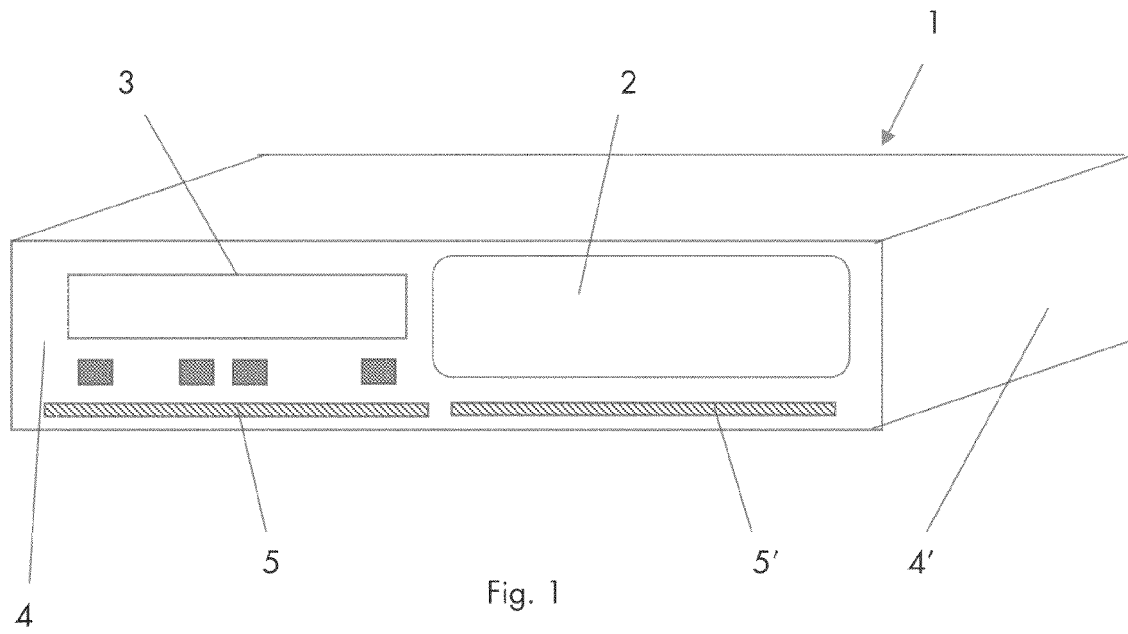
1. A Vehicle Unit, VU, (1, 32) having a front end (4), wherein the front end comprises a connection port (7) and a space (6), wherein the space is covered by an access panel (2),
characterized in that the access panel comprises an integrated antenna (14) arranged to be connected to a processing unit (9), and wherein the integrated antenna (14) is arranged to be connected, via the processing unit, to the connection port (7), and wherein the integrated antenna (14) is arranged to wirelessly send signals to and receive signals from an external device (33).
2. A VU (1, 32) according to claim 1, **characterized in that** the access panel (2) comprises a contact device (15) connected to the integrated antenna (14), wherein the contact device (15) is arranged to connect the integrated antenna (14), via the processing unit (9), to the connection port (7).
3. A VU (1, 32) according to claim 2, **characterized in that** the access panel (2) is arranged to be in at least an open position and a closed position, wherein the contact device (15) is adapted to be in contact with the connection port (7) when the access panel (2) is in a closed position and be disconnected from the

connection port (7) when the access panel (2) is in an open position.

4. A VU (1, 32) according to any one of the preceding claims, **characterized in that** the signals sent to the external device (33) comprises signals related to vehicle data stored in the VU (1, 32). 5
5. A VU (1, 32) according to claim 4, **characterized in that** the VU (1, 32) is adapted to be in connection with a back end server (35) via the external device (33). 10
6. A VU (1, 32) according to claim 5 **characterized in that** the back end server (35) comprises a fleet management system, thereby enabling the fleet management system to request and/or receive vehicle data from the VU (1, 32). 15
7. A VU (1, 32) according any one of the previous claims, **characterized in that** the processing unit (9) is integrated with the access panel (2) and arranged in series between the integrated antenna (14) and the contact device (15). 20
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8. A VU (1, 32) according to any one of the previous claims, **characterized in that** the antenna (14) is one of a, an Ultra-Wide band antenna, a Bluetooth antenna or an IEEE 802.11 antenna. 30
9. A VU (1, 32) according to any of the previous claims **characterized in that** the access panel (2) is removable. 35
10. A VU according to any of the previous claims **characterized in that** the space (6) is adapted to comprise a removable printer module (8). 40
11. A VU (1, 32) according to any of the previous claims **characterized in that** the processing unit (9) is adapted to convert a first communication protocol to a second communication protocol, wherein the first protocol is applied in the wireless interface being formed between the external device (33) and the integrated antenna (14), wherein the second communication protocol is a serial protocol for communication with the VU (1, 32). 45
12. A VU (1, 32) according to any of the previous claims, **characterized in that** the access panel (2) comprises an external surface, wherein the integrated antenna (14) is integrated into the access panel (2) by moulding such that the antenna (14) is arranged within the external surface of the access panel (2). 50
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13. A VU (1, 32) according to any one of claim 1 to 11, **characterized in that** the access panel (2) comprises an external surface, wherein the integrated an-

tenna (14) is attached to the access panel (2).

14. A VU (1, 32) according to any of the previous claims **characterized in that** the vehicle unit (1, 32) is a digital tachograph.



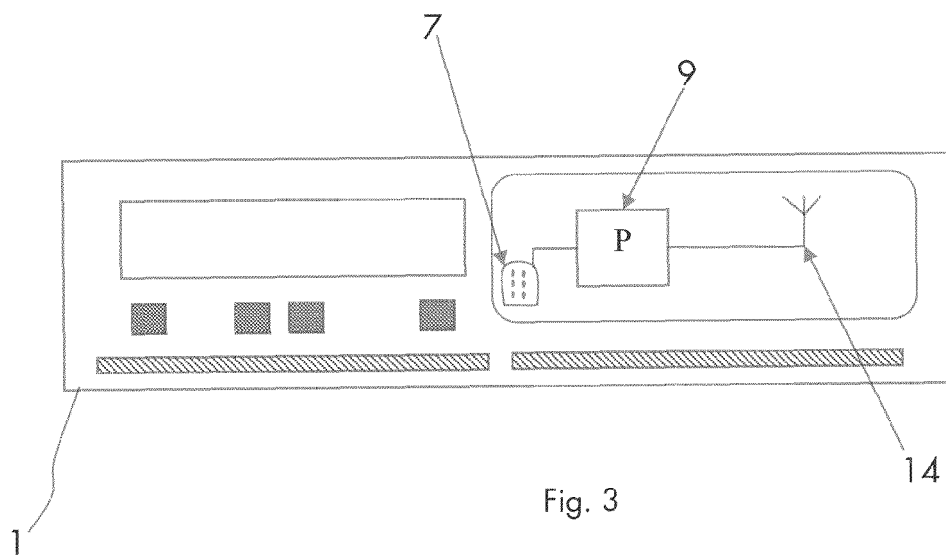


Fig. 3

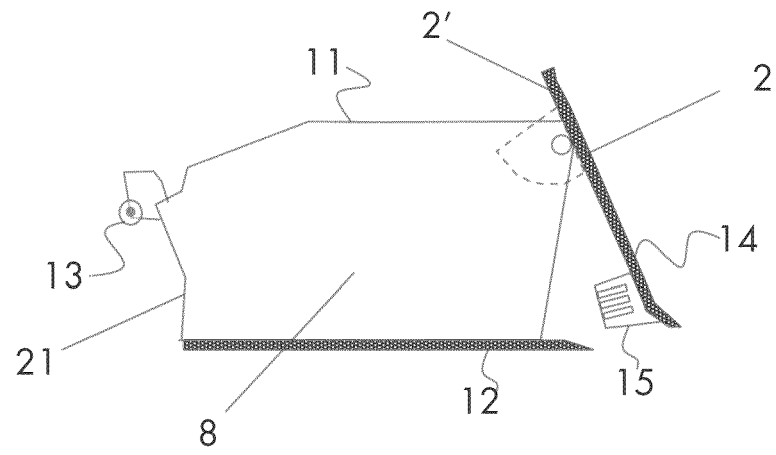


Fig. 4a

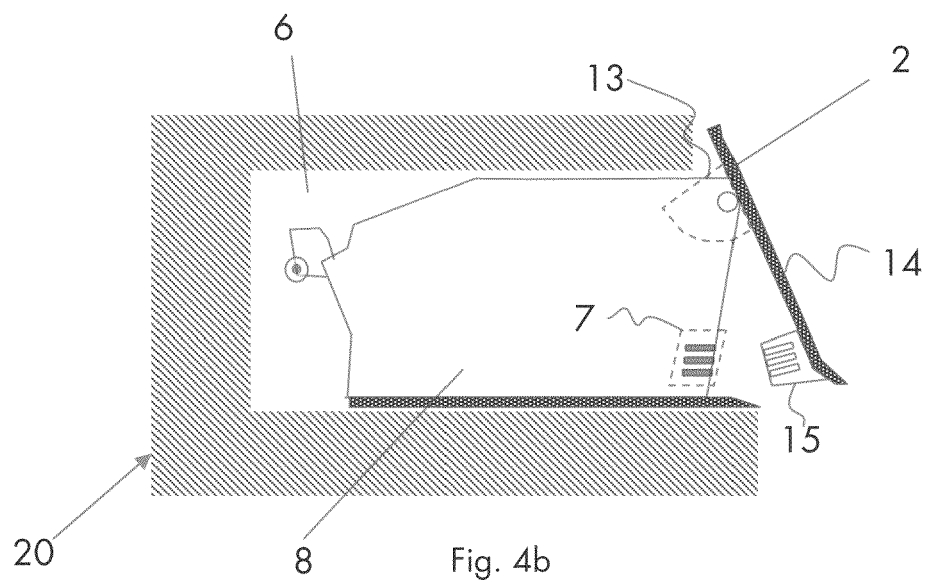
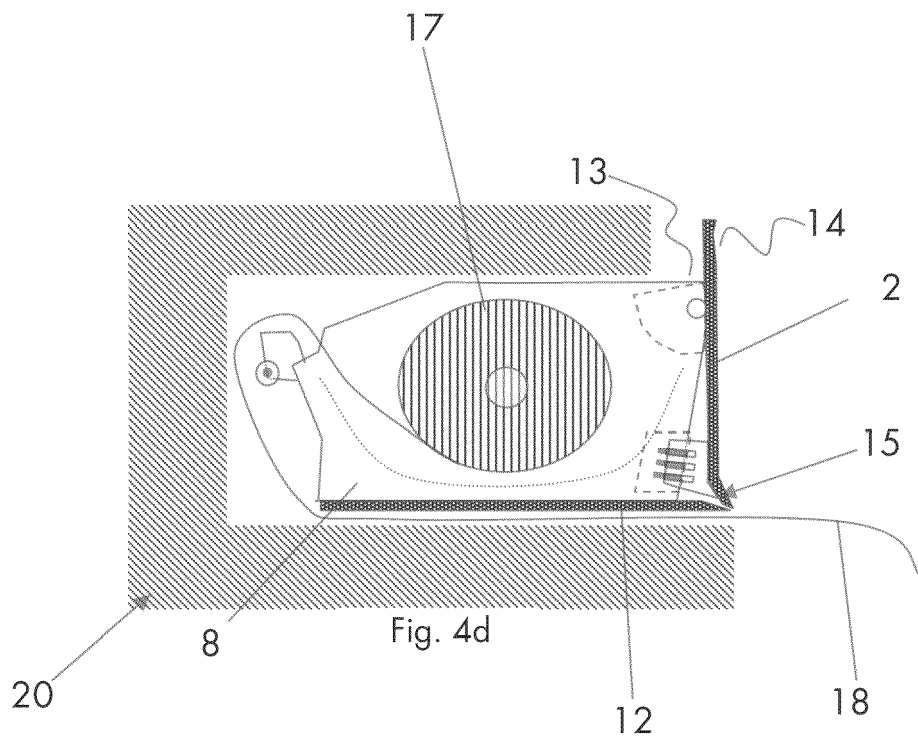
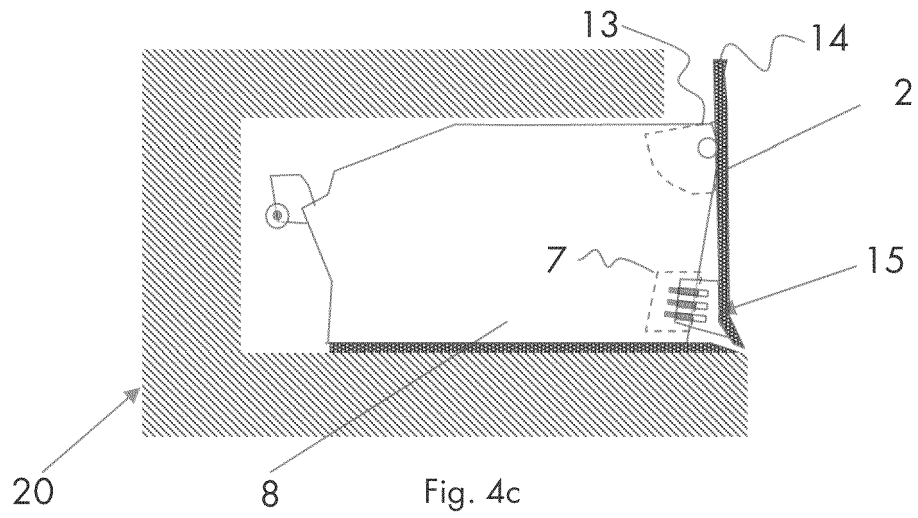


Fig. 4b



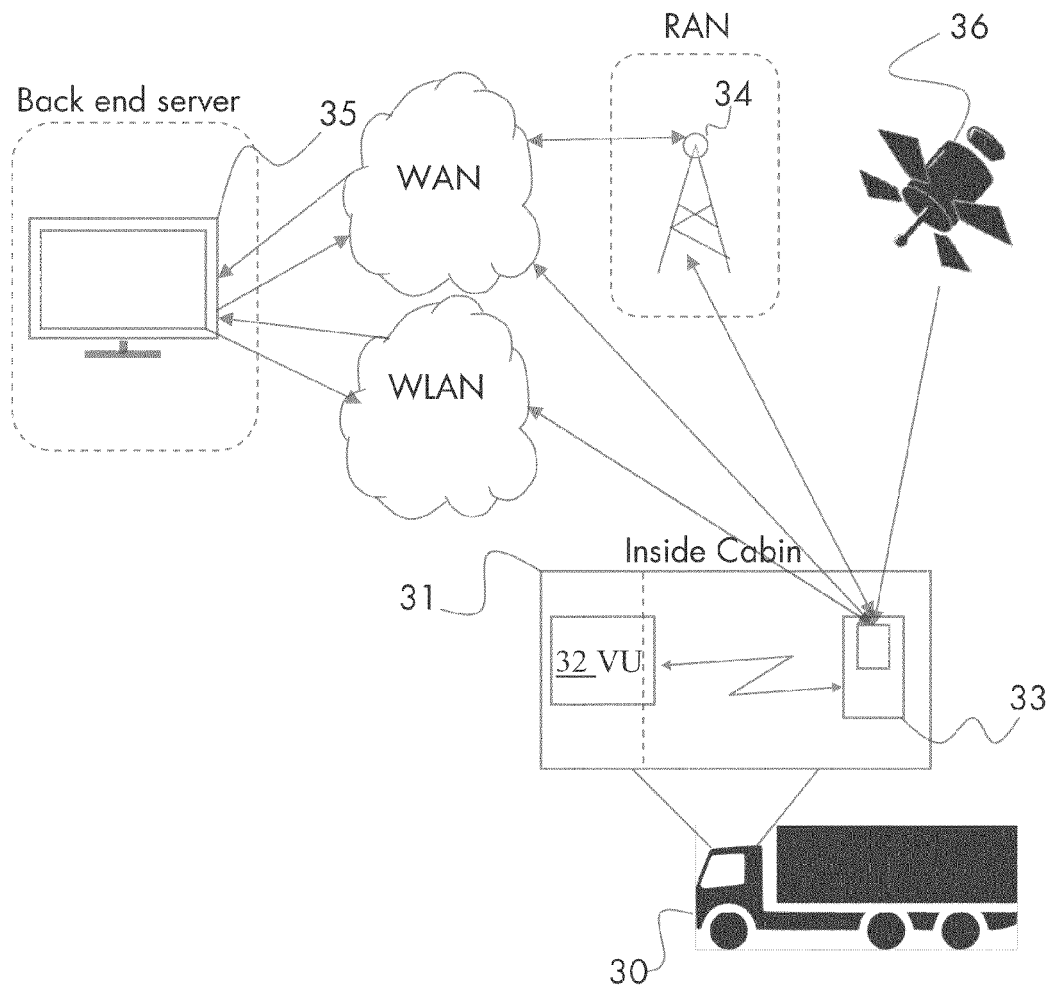


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15 May 2012	Examiner Pañeda Fernández, J
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EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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