systems are disclosed for removably mounting a signal testing unit to a suitable vehicle surface, and optionally providing for an electrical connector to a power source, GPS antenna, and cellular antennas such that moving a signal testing unit from one vehicle to another can be accomplished more easily. The mounting system includes a mounting bracket that is attachable to a vehicle surface and defines a plurality of keyholes. A plurality of screw-like protrusions extend from a face of a signal testing unit and, when each protrusion is engaged into each of the keyholes, movement of the signal testing unit relative to the mounting bracket is prevented.
RAPID EXCHANGE SYSTEM FOR TESTING WIRELESS NETWORKS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from provisional U.S. Patent Application No. 60/505,822, entitled, “Bracket to Hold Mobile Testing Unit in Vehicle,” which was filed Sep. 24, 2003, and which is incorporated herein by reference in its entirety.

BACKGROUND OF INVENTION

[0002] Signal network operators frequently use signal testing units to measure and improve signal coverage, such as cellular coverage, in a geographical area. The signal testing units are positioned in the coverage area and collect geographical position data and various radio communication related parameters, such as signal strength. This information is analyzed to troubleshoot and improve the coverage of cellular networks. Currently, signal network operators drive the signal testing units around a geographical area to collect data. Typically, the signal testing unit is placed in a vehicle in an unsecured manner or is semi-permanently mounted to the vehicle. When the signal testing unit is unsecured, it can be easily transferred from one vehicle to another, but the signal testing unit can be easily damaged, stolen, or interfere with operation of the vehicle. If the signal testing unit is semi-permanently mounted to the vehicle, then the unit cannot be easily transferred, and time and special tools may be required to remove and install the unit.

[0003] Multiple vehicles may be used to collect data in various locations. One option is to install the signal testing unit in each vehicle, but such an approach can be costly.

[0004] Further, when a signal testing unit is transferred to another vehicle, antenna and power connections may be required. The signal testing unit may require connection to a GPS antenna that is external to the testing unit for determining the unit’s location as well as cellular antenna(s) for collecting and reporting the data. Additionally, connection to the vehicle’s power system may be required. Completing these connections may further complicate transferring a signal testing unit from one vehicle to another if the installation is not compatible with the design of the signal testing unit.

[0005] Therefore, there is a need for an apparatus that provides easy removal of a signal testing unit from one vehicle and installation in another, so as to facilitate the use of signal testing units in different vehicles at different times, for monitoring a signal network, such as a cellular network.

BRIEF SUMMARY OF THE INVENTION

[0006] The embodiments of mounting devices disclosed below provide for a bracket on which to mount a signal testing unit, and optionally provide for a connector to a power source, GPS antenna, and cellular antennas such that moving a signal testing unit from one vehicle to another can be accomplished more easily. The bracket may provide secure (e.g., preventing unauthorized removal) or non-secure mounting of the signal testing unit. The bracket can be installed in or on a fleet of vehicles to facilitate the movement of the signal testing unit from one vehicle to another by providing the operator with a common bracket and optional electrical connection in one centralized area for secure installation and operation of the unit.

[0007] One embodiment of a vehicle mounting assembly includes a bracket that has a front face and a back face. The back face is fastened adjacent a suitable vehicle surface with fasteners, and the front face defines a plurality of keyholes for mounting a signal testing unit. The testing unit includes a plurality of screw-shaped protrusions that are positioned to engage the keyholes of the bracket. To mount the testing unit to the bracket, the head of each protrusion engages the wider, upper portion of a keyhole and the testing unit is moved downwardly until the body of each protrusion is intermediate the narrower, lower portion of a keyhole. The head of the protrusion is positioned behind the lower portion of the keyhole, and because the head is wider than the narrower, lower portion of the keyhole, the removal of the protrusion from the keyhole is prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a schematic of a vehicle with a signal testing unit mounted to a surface of the vehicle.

[0009] FIG. 1A is an illustration of an embodiment of a signal testing unit with one electrical connector.

[0010] FIGS. 2-3 illustrate mounting systems according to different embodiments of the invention.

DESCRIPTION OF INVENTION

[0011] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0012] Generally the embodiments of mounting devices disclosed below provide for a bracket on which to mount a signal testing unit, and optionally provide for a connector to a power source, GPS antenna, and cellular antennas such that moving a signal testing unit from one vehicle to another can be accomplished more easily. The bracket may provide secure (e.g., preventing unauthorized removal) or non-secure mounting of the signal testing unit. The bracket can be installed in or on a fleet of vehicles to facilitate the movement of the signal testing unit from one vehicle to another by providing the operator with a common bracket and optional electrical connection in one centralized area for secure installation and operation of the unit.

[0013] FIG. 1 depicts an embodiment of the system described above in which the signal testing unit 20 is mounted to a wall 13 inside the vehicle 10. In other embodiments, the testing unit 20 can be mounted against any suitable surface, such as a bulkhead, shelf, roof, floor, or exterior surface of the vehicle, using a bracket. The vehicle 10, which typically is a fleet vehicle, provides connections to a GPS antenna 11a, cellular antennas 11b, 11c and a power source 14. In the embodiment shown in FIG. 1, the signal testing unit 20 has separate connectors 21 that connect
with the power source 14, a GPS antenna 11a, and cellular antennas 11b, 11c. In another embodiment, as shown in FIG. 1A, the signal testing unit 20 includes one connector 22 that provides a connection with the power source 14, the GPS antenna 11a, and the cellular antennas 11b, 11c. In alternative embodiments, one or more of the antennas may be internal to the signal testing unit 20 and no connection to an external antenna 11a-c is required. Furthermore, the signal testing unit 20 may contain an internal energy source and not require connection to an external power source 14.

[0014] FIG. 2 depicts an embodiment of a mounting bracket 200. The mounting bracket 200 is in the form of a plate that defines a plurality of apertures 201 for receiving a fastener, such as a bolt or screw. A bolt or screw is engaged through each aperture 201 and into the vehicle surface 13 to hold the bracket 200 in a substantially stable position relative to the vehicle surface 13. Alternative embodiments of the mounting bracket 200 may utilize fasteners such as pins, straps, clamps, adhesives, welds, or other suitable fasteners known in the art that can be used to secure the bracket 200 to the vehicle surface 13.

[0015] The mounting bracket 200 further defines a plurality of keyholes 202. Each keyhole 202 comprises a top portion 204 and a bottom portion 205 where the breadth of the top portion 204 is larger than the bottom portion 205. In the embodiment shown in FIG. 2, the keyholes 202 are arranged along the outer perimeter of the front face of the mounting bracket 200. Alternative arrangements may include, for example, keyholes 202 positioned down a column in the center of the plate or in a row across the top of the plate.

[0016] In FIG. 2, a plurality of protrusions 24 on the signal testing unit 20 are screws or bolts that extend normal to the rear face 23 of the testing unit 20 and are positioned to match up with the keyholes 202 located on the mounting bracket 200. As shown in FIG. 2A, the screws 24 have an upper portion, or head, 26 and a lower portion, or body, 27, and the head 26 is of greater breadth than the body 27.

[0017] In an alternative embodiment, the signal testing unit 20 includes a lock-receiving portion 25 for receiving a locking mechanism. The bracket 200 further includes a lock-receiving portion 203 that aligns with the lock-receiving portion 25 of the testing unit 20. In the embodiment of the mounting assembly shown in FIG. 2, the lock-receiving portions 25, 203 are tabs that have an aperture in the center of each tab. When the testing unit 20 is mounted onto the bracket 200, the tab 25 of the testing unit 20 and the tab 203 of the bracket 200 are aligned so that the apertures are coincident and allow insertion of a padlock. Alternative locking mechanisms may be used, such as a tab padlock, eye/hasp, locking cylinder, or other suitable locking mechanism known in the art.

[0018] To assemble the mounting assembly according to one embodiment, the mounting bracket 200 is attached to a vehicle wall 13 by engaging screws or bolts through the apertures 201 and into the surface of the vehicle wall 13. The signal testing unit 20 is mounted to the mounting bracket 200 by placing the head 26 of each screw 24 through the top portion 204 of each keyhole 202 and then moving the testing unit 20 downwardly until the body 27 of the screw 24 is within the bottom portion 205 of the keyhole 202 and the head of the screw 24 is behind the bottom portion 205. After the testing unit 20 is mounted onto the bracket 200, the tab 203 of the mounting bracket 200 and the tab 25 of the testing unit 20 are aligned, and a padlock or locking cylinder is engaged through the tabs to prevent unauthorized removal of the testing unit 20 from the bracket 200.

[0019] It may be desirable to mount different sized testing units to the mounting bracket. The location of the protrusions on the rear face of a testing unit may differ depending on the testing unit’s size. For example, if protrusions on testing units are positioned in a similar pattern, the protrusions on the smaller units will be closer together than the protrusions on the larger units. To accommodate testing units of different sizes, an alternative embodiment of the mounting bracket 200 described above includes a plurality of spaced apart keyholes (see dashed lines of FIG. 2) located in a plurality of columns across the face of the bracket 200.

[0020] As an alternative embodiment to the plate embodiments described above, a U-shaped channel member 300 is formed into a U-shaped cross-sectional mounting bracket. In the embodiment illustrated in FIG. 3, the front surface 305 of the U-shaped member 300 defines a plurality of keyholes 202, an access hole 306 for accessing a fastener receiving portion 301, and a lock-receiving portion 303 for receiving a locking mechanism, such as those locking mechanisms discussed above in connection with FIG. 2.

[0021] The rear surface of the U-shaped channel member 300 is mounted adjacent to a suitable vehicle surface 13, such as a wall, by fasteners utilizing the fastener receiving portion 301. As discussed above regarding FIG. 2, fasteners may include a screw, bolt, pin, strap, clamp, adhesive, weld, or other fastener known in the art.

[0022] The testing unit 20 described above in relation to FIG. 2 can be mounted to the embodiment of the mounting bracket 300 described in relation to FIG. 3. The heads 26 of each screw 24 are engaged through the top portion 204 of a corresponding keyhole 202, and the testing unit 20 is moved downwardly until the body 27 of each screw 24 is adjacent to the bottom portion 205 of each keyhole 202. Alternatively, it should be appreciated by those skilled in the art that hooks and an eye for receiving hooks can be used to mount the signal testing unit 20 in lieu of protrusions and keyholes, respectively. Other embodiments can use hook and loop fasteners, such as the hook and loop fasteners sold under the trademark VELCRO.

[0023] The lock-receiving portion 303 of the mounting bracket 300 shown in FIG. 3, like the lock-receiving portion 203 shown in FIG. 2, is a tab that defines an aperture in the center of the tab. When the testing unit 20 is positioned onto the mounting bracket 300, the tabs 303, 25 are aligned and can receive a locking mechanism, such as padlock or locking cylinder, to prevent unauthorized removal of the testing unit 20 from the bracket 300.

[0024] FIGS. 2-3 illustrate mounting brackets that do not incorporate an electrical connector. When mounting brackets do not incorporate electrical connectors, the operator may have to connect the signal testing unit’s connector(s) to any external antenna(s) and/or power source(s) after the signal testing unit is installed or mounted to the bracket. Thus, an embodiment of each of the testing units described above in relation to FIGS. 2-3 typically would have one or
more electrical connectors that mate with electrical connectors positioned adjacent the mounting bracket 200, 300 for connection with an external antenna(s) and/or power source(s), if required. In one embodiment, an electrical connector is positioned adjacent the mounting bracket 200, 300 and is connected with the power source 14, GPS antenna 11a, and cellular antennas 11b, 11c that are connected to the vehicle 10, as discussed in connection with FIG. 1. In other embodiments, two or more connectors may be used to provide connections to such devices individually, or in different combinations. Additionally, the external GPS antenna and external cellular antennas may be positioned inside or outside of the vehicle.

That which is claimed:

1. In combination, a signal testing unit and vehicle mounting assembly, comprising:
   a signal testing unit having a front face and a rear face, said rear face including one or more protrusions;
   each of said protrusions including an outer portion and an inner portion, wherein said outer portion is of greater breadth than said inner portion;
   a bracket for securely disposing said testing unit on a vehicle surface, said bracket having a back planar face and a front planar face;
   said back planar face including a fastening portion for mounting said bracket to said vehicle surface; and
   said front planar face including one or more keyholes sized to receive and retain one of said one or more protrusions of said testing unit.