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(54) PANEL ANTENNA HAVING SEALED RADIO ENCLOSURE

PANELANTELLE MIT VERSIEGELTEM FUNKGEHÄUSE
ANTENNE PLATE À ENCEINTE RADIO SCELLÉE

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Description

Field Of The Invention

[0001] The field of the invention relates generally to panel antennas used in communications applications. More particularly, the field of the invention relates to arrangements of passive and active antenna components in an multiple radiating element panel antenna.

Background Of The Invention

[0002] A typical known Cellular Telephone Base Station System comprises several elements, including one or more panel antennas, each panel antenna comprising an array of radiating elements mounted at an elevation above the ground, and base station electronics mounted remotely from the antenna arrays. The known antenna arrays typically include a plurality of radiating elements and a feed network. The radiating elements and feed network may be mounted on a panel antenna plate. See, e.g., U.S. Patent No. 6,034,649, titled Dual Polarized Base Station Antenna. In some antennas, a ground plane for the radiating elements may be used as a part of the antenna structure. In some known panel antennas, the feed network may include power dividers, phase shifters, or other circuit devices for adjusting beam width and/or beam direction. Typically, however, such known panel antennas have feed networks which comprise passive components, and do not have active devices which perform power amplification. Prior art document US 2006/250311 A1 describes an enclosure with antennas protected by radome.

[0003] Typically, the known panel antennas are driven by a Low Noise Amplifier (LNA). A LNA may be mounted on support structure for the panel antenna or located as part of a base station, comprising an environmental enclosure on the ground below the panel antenna. The LNA may be coupled to the feed network of the panel antenna by coaxial cable. Locating the LNA in the environmental enclosure at the base station facilitates protecting active electronics from the elements. However, such an arrangement also requires extensive cabling from the base station environmental enclosure to the location of the panel antenna, which may be located at a significant elevation above the base station.

[0004] Another type of panel antenna is one where individual radio elements are associated with the radiating elements. For example, international patent application WO 2008/1009421, titled "Antenna Array System," discloses an all-digital antenna array. In the '421 application, a digital signal is provided to a Communications Hub. The Communications Hub distributes the digital signal to a plurality of micro radios. An antenna radiating element is associated with each micro radio. However, the '421 patent application does not consider or solve certain issues with packaging and antenna design.

[0005] For example, in prior art remote radio head an-

tennas, the components in the panel antenna are passive and heat dissipation is not an issue. In the '421 application, however, each micro radio has a power digital to analog converter for converting the digital signal into an RF signal. This power converter generates a significant amount of heat that must be dissipated. The '421 application does not teach or suggest a way to solve the heat dissipation problem. Additionally, locating active electronic components, including power amplifiers in the panel antenna raises substantial issues regarding protecting such electronics from adverse environmental conditions, such as rain and other forms of precipitation. Protection from environmental conditions is not solved in the '421 application. Also, the 421 application does not address issues concerning electromagnetic interference, manufacturing assembly and serviceability.

Summary of The Invention

[0006] According to one example of the present invention, a panel antenna may include an enclosure, an inner seal, a plurality of micro radios and RF modules, and a radome. The enclosure may include a rectangular rear panel, and, extending in a longitudinal direction of the enclosure, first walls extending from at least the longitudinal edges of the rear panel, second walls extending from the first walls and being angled inwardly, third walls extending from the second walls, and flange extending from the third wall portion outwardly from the cavity of the enclosure, the flange being substantially parallel with the rear panel, the flange having a mounting locations and a sealing area located between the mounting locations and the third wall portion. The first and third walls may be generally perpendicular to the rear panel. The inner seal may be dimensioned to overlap an area defined by the flange of the enclosure such that the inner seal forms an environmental seal when positioned on the sealing area of the flange. The inner seal may also have a plurality of RF radiating modules fastened thereto. The inner seal may also provide electromagnetic shielding. The plurality of micro radios are located inside the cavity of the enclosure, and each micro radio is coupled to an RF radiating module. The radome encloses the RF radiating modules.

[0007] Additionally, the panel antenna may further include a heat sink mounted on an exterior side of the rear panel. The micro radios may be mounted such that the heat sinks dissipate heat generated by the micro radios. The ends of the enclosure may be substantially flat end walls, or the shape of the longitudinal walls may be carried through to one or both of the ends of the enclosure.

[0008] A panel antenna according to another example of the present invention includes an enclosure, a radome assembly, and a plurality of micro radios protected by the enclosure and the radome assembly. The enclosure may have a rear panel, a first wall portion extending from the rear panel, a second wall portion and a third wall portion, and a flange extending outwardly from the third

wall portion. The second wall portion is angled inwardly toward a cavity of the enclosure, the flange having a mounting locations and a sealing area located between the mounting locations and the third wall portion. The radome assembly may have a radome, a plurality of RF radiating modules fastened thereto, and a seal element located around a periphery of a cavity of the radome. The seal element on the radome assembly may be adapted to form a seal with the sealing area of the flange. The plurality of micro radios are located inside the enclosure, and each micro radio is coupled to one of the plurality of RF radiating modules. A plurality of micro radios may be located on a micro radio module.

Brief Description of The Drawings

[0009]

Fig. 1 is an illustration of the components of one example of a panel antenna according to the present invention.

Fig. 2 is a cross-sectional diagram of one example of a housing according to the present invention.

Fig. 3 is an isometric view of a part of one example of a housing according to the present invention.

Fig. 4 illustrates another example of a panel antenna according to the present invention with the radome assembly detached.

Fig. 5 is an illustration of the components of one example of a radome assembly according to the present invention.

[0010] The present invention provides a digital Base Station Antenna that provides for protecting a plurality of micro-radios from environmental conditions while providing a mechanically rigid, readily serviceable panel antenna.

Detailed Description of The Present Invention

[0011] Referring to Figure 1, in one example, a Panel Antenna 10 comprises an enclosure 12, internal cover 14, radome 16 and rear heat sinks 18. As described in more detail below, the enclosure 12 may be formed from sheet metal. The Panel Antenna 10 may include a plurality of micro radios 20 mounted within the enclosure 12. The micro radios 20 may be thermally coupled to the rear heat sinks 18. In one aspect of the invention, described in more detail below, the internal cover 14 may include a plurality of RF modules 24.

[0012] Referring to Figures 2 and 3, the enclosure 12 comprises a rear panel 30, a lower side wall 32, an angled side wall 34, an upper side wall 36, and a flange 38. In one example, lower side wall 32 and upper side wall 36

are perpendicular to rear panel 30 and flange 38 is parallel to the rear panel 30. Angled side wall 34 is angled toward the interior of the enclosure. The rear panel 30, side walls 32, 34, 36 and flange 38 may be formed from sheet metal. Corners, formed at the junctions of the walls may be welded. Welded corners have the benefit of preventing moisture from entering the enclosure via the corners.

[0013] The combination of the rear panel 30, lower side wall 32, inclined side wall 34, upper side wall 36, and flange 38 may be configured such that these elements, when viewed in cross section, appear in a Z-shape. In one example of the invention, this Z-shape arrangement is employed on two longitudinal sides of the enclosure, and end walls 37 are flat. In alternative examples, the Z-shape may be employed on three sides of the enclosure (e.g., two longitudinal sides and an end) or on all four sides of the enclosure. The Z-shape provides improved structural rigidity over conventional box-style structures.

[0014] In addition to enhancing rigidity, a Z-shaped sidewall enclosure provides enhanced internal space for a given outer flange dimension. For example, for a given flange dimension, the Z-shaped enclosure has more interior volume than a conventional box enclosure having an outward-turned flange of the same dimensions. An inward-turned flange may be used, however, such a flange may have additional challenges regarding sealing against adverse environmental conditions, especially moisture. Additionally, an outward-turned flange is desirable because a radome may be configured to slide over and engage the outward-turned flanges, which allows installation and removal of a radome without installing or removing fasteners. This may be advantageous when servicing a Panel Antenna 10 located on a communications tower.

[0015] Flange 38 may be flat and parallel to the rear panel 30. In one example, a flat flange 38 provides an area for facilitating a seal between flange 38 and inner cover 14. In this example, flange 38 includes sealing area 40. Flange 38 may also include a fastening system for the inner cover 14.

[0016] In one example, the sealing area is located between the fastening system and a peripheral opening defined by upper side walls 36. In this example, locating the fasteners on the flange 38 outside the sealing area eliminates the need for the fasteners themselves to be sealed or to be of a sealable design. Thus, many options are available for the fasteners. Additionally fasteners may be added after the sheet metal has been finished (e.g., painted, coated).

[0017] The Panel Antenna 10 includes a communications hub 50, a power supply 52, and a calibration radio 54. In the illustrated example, interconnections between the communications hub, power supply, and calibration radio are protected from adverse environmental conditions by the enclosure 12, inner cover 14, and sealing area 40.

[0018] In the example illustrated in Fig. 1, eight RF

modules 24 and sixteen micro radios 20 (each with a duplexer) are shown. Each RF module 24 is coupled to a corresponding pair of micro radios 20. In this example, a first micro radio 20 of a pair of micro radios drives a first radiating element of the corresponding RF module 24, and a second micro radio 20 of the pair of micro radios drives a second radiating element of the corresponding RF module 24. This arrangement may be used, for example, where the RF modules 24 comprise dual polarized radiating elements.

[0019] Each micro radio 20 is also connected to the communications hub 50. The communications hub 50 is connected to Base Station Equipment (BSE) (not illustrated). A digital signal may be provided by the Base Station Equipment to the communications hub 50. For example, a fiber optic link or other digital transmission medium may provide the connection between the BSE and the communications hub 50. Typically, the communications hub receives digital signals from the BSE, comprising information for RF transmission by the Panel Antenna 10, and transmits digital signals to the BSE, comprising information received by RF signal by the Panel Antenna 10.

[0020] The connection between the communications hub 50 and each micro radio 20 may also be digital. In one example, the communications may comply with the SerDes standard. The communications hub 50 sends signals to the micro radios 20 for RF transmission, and receives signals from the micro radios 20 that correspond to RF signals received by the RF modules 24 and the micro radios 20. The communications hub 50 may also perform amplitude and phase adjustment to control attributes of RF transmission or reception. When amplitude and phase adjustment is performed electronically, a conventional feed network having electromechanical power dividers and phase shifters need not be included.

[0021] In one example, a micro radio 20 may comprise a Digital Up Converter, a power Digital to Analog Converter (including a digital to RF converter). The micro radio may comprise a duplex radio, in which case it may also include a Time Division Duplex Switch, a Low Noise Analog to Digital Converter (including an RF to digital converter) and a Digital Down Converter. A Time Division Duplex Filter couples the Time Division Duplex Switch to a RF module.

[0022] Internal cover 14 may be manufactured from a sheet of aluminum. Other materials may be used for internal cover 14. In the illustrated example, aluminum is selected because the material serves to provide both an environmental seal and an electromagnetic shield. In this example, internal cover 14 protects the micro radios 20 and other electronics in the Panel Antenna 10 from moisture and other environmental hazards, and shields the micro radios 20 and other electronics from the electromagnetic transmissions of the RF modules 24. The RF modules 24, as passive devices, need not be as effectively sealed from the elements as the active electronics. RF signals are carried between the RF modules 24 and

micro radios 20 on cables (not shown). The cables may pass through sealed apertures in the inner seal 14.

[0023] The internal cover 14 may also serve as a structural support for the RF modules 24. The RF modules may include a plurality of radio frequency radiating elements. In one illustrated example, the internal seal 14 supports eight RF modules 24. In one example, the RF modules 24 comprise patch antennas, and in particular, dual polarized patch antennas. Alternatively, the RF modules may comprise dipole or cross-dipole antenna elements. In some embodiments, radiating elements may be disposed over a pan-shaped reflector. In other embodiments, radiating elements may be disposed over a ground plane.

[0024] An example of a suitable patch antenna may be found in International Application WO 2006/135956 A1, which is incorporated by reference. In this example, a patch radiator is positioned above a ground plane and excited such that a dual polarized RF signal is produced. This may be accomplished by exciting opposite sides of the radiator in antiphase.

[0025] The internal seal 14 may be drilled to match the enclosure 12, so that mounting hardware may join the internal seal 14 to the enclosure 12. A seal 62 may be located over the studs in the aluminum frame. Alternatively, the seal may be located inside a periphery defined by the studs. Alternatively, two seals may be provided, a first seal over the studs, and a second seal inside a periphery defined by the studs.

[0026] The radome 16 may include flanges (not illustrated) to engage and slide over edges defined by the flange of the enclosure 12, or the edges of the internal seal 14, or both. Alternatively the radome 16 includes mounting apertures (not illustrated) through which fastening devices may pass.

[0027] Referring to Figures 4 and 5, another example of a Panel Antenna 110 is provided. In this example of the invention, Panel Antenna 110 comprises an enclosure 112, radome assembly 116 and rear heat sinks 118. In this example, enclosure 112 is substantially the same as enclosure 12, the description of which is not repeated herein. Panel Antenna 110 may include a plurality of micro radios 120 mounted within the enclosure 112. The micro radios 120 may be grouped into radio modules 122. The radio modules 122 may be thermally coupled to the rear heat sinks 118. In one aspect of this example, described in more detail below, the radome assembly 116 includes a plurality of RF modules 124.

[0028] In Fig. 5, a radome assembly 116 is illustrated. The radome assembly 116 includes a radome 160, a seal 162, and a plurality of RF modules 124. Each RF module 124 may include a plurality of RF elements. The RF elements may comprise individual modules, pairs or other groups of modules, or a plurality of RF elements in a single module. In one illustrated example, the Radome assembly of Fig. 5 includes eight RF modules. Each RF module 124 comprises one group of radiating elements.

[0029] In the example illustrated in Fig. 5, four radio

modules 122 are shown. Each micro radio module 122 in this example includes two micro radios 120. The radio modules 122 are not limited to two micro radios, and may contain additional micro radios. Each micro radio 120 is connected to a corresponding RF module. Each micro radio 120 is also connected to the communications hub 150. The communications hub is connected to Base Station Equipment. A digital signal may be provided by the Base Station Equipment to the communications hub. A fiber optic link or other digital transmission medium may provide the connection. The connection between the communications hub and each micro radio may also be digital.

[0030] The radome assembly 116 may include an aluminum frame 164 with studs 166. In one example, the reflecting elements of the RF modules 124 are integrated with the aluminum frame 164. The seal 162 may be located over the studs in the aluminum frame. Alternatively, the seal may be located inside a periphery defined by the studs. Alternatively, two seals may be provided, a first seal over the studs, and a second seal inside a periphery defined by the studs.

[0031] The radome 160 includes mounting locations 168. In one example, the mounting locations 168 may comprise apertures through which fastening devices may pass. In one example, the RF modules 124 are located within the radome 160 with brackets 170 and screws 172, which pass through mounting locations 168. Alternatively, clips or bonding agents may be used to secure the RF modules 124 to radome 160. Providing mounting locations 168 in the radome 160 helps ensure accurate positioning of the RF elements in the radome 160.

[0032] In the illustrated example, the RF modules 124 may be installed in the radome 160 to comprise the radome assembly 116. In this arrangement, electronic components, such as the micro radios 120, may be accessed without disturbing the location of the RF modules 124 in the radome 160. However, the RF modules 124 may be removed from the radome assembly 116 if service is required.

[0033] As in the earlier-described example, the RF modules 124 may comprise patch antennas, and in particular, dual polarized patch antennas. Alternatively, the RF modules may comprise dipole or cross-dipole antenna elements. In some embodiments, radiating elements may be disposed over a pan-shaped reflector. In other embodiments, radiating elements may be disposed over a ground plane.

Claims

1. A cellular base station antenna (10), an enclosure (12, 112), the enclosure (12, 112) including a rear panel (30), a first side wall (32), and a second side wall (34), a top wall (36) and a bottom wall, the rear panel (30) and the walls defining a cavity, the walls further defining an aperture through which the cavity

of the enclosure (12) may be accessed, at least one active radio component (20) mounted inside the cavity, on the rear panel (30), a heat sink (118) mounted on an external surface of the rear panel (30), **characterised by:**

an internal cover (14) mounted to the aperture, the internal cover (14) being dimensioned to overlap an area defined by the aperture of the enclosure (12),

a passive radio enclosure (116) including a radome (160), the passive radio enclosure (116) being defined by the radome (160) and an exterior surface of the internal cover (116) and the radome (160) slidingly engages flanges on the enclosure (12),

at least one passive radio element (124) mounted inside the passive radio enclosure (116) such that the at least one active radio component is being accessible without disturbing the location of the at least one passive radio element located within the radome secured thereto, e.g. by brackets and screws or clips or bonding agents, to be easily removed for service purposes, wherein the enclosure (12) and internal cover (14) provide environmental sealing and electromagnetically shielding for the active radio component (20), and wherein the radome (160) of the passive radio enclosure (116) does not provide environmental sealing or electromagnetic shielding for the passive radio element (124).

2. The cellular base station antenna (10) of claim 1, wherein the active radio component (20) further comprises a micro radio (120) and the passive radio element (124) comprises a RF module (124).

3. The cellular base station antenna (10) of claim 1, wherein the active radio component (20) further comprises at least two micro radios and the passive radio element (124) comprises a dual polarized RF module, wherein a first micro radio is coupled to a first radiating element of the dual polarized RF module, and a second micro radio is coupled to a second radiating element of the dual polarized RF module.

4. The cellular base station antenna (10) of claim 1, wherein the active radio component (20) further comprises a plurality of micro radios and the passive radio element (124) comprises a plurality of RF modules.

5. The cellular base station antenna (10) of claim 1, wherein the internal cover (14) is fabricated from a sheet of aluminum.

6. The cellular base station antenna (10) of claim 1, wherein the active radio component (20) further com-

prises:

a micro radio,
a communications hub (150) coupled to the micro radio, and
a calibration radio.

7. The cellular base station antenna (10) of claim 1, wherein the passive radio component further comprises a plurality of RF modules mounted to the outer surface of the internal cover (14).
8. The cellular base station antenna (10) of claim 1, wherein a flange joins the first and second side walls (32, 34) and the top and bottom wall, and a lip extends from the flange, further defining the aperture through which the cavity of the enclosure may be accessed, the lip being engaged by the internal cover (116) to provide the environmental seat.
9. The cellular base station antenna (10) of claim 1, wherein the first walls and the third walls extend at right angles to the rear panel.
10. The cellular base station antenna (10) of claim 1, wherein the radome (160) slidingly engages flanges on the enclosure (12),
11. The cellular base station antenna (10) of claim 1, further including an inner seal that provides environmental and electromagnetic shielding.
12. The cellular base station antenna (10) of claim 1, wherein each radiating element is associated with two micro radios,
13. The cellular base station antenna (10) of claim 1, further comprising a communications hub coupled to each micro radio.
14. The cellular base station antenna (10) of claim 13, further including a calibration radio.

Patentansprüche

1. Eine Mobilfunk Basisstationsantenne (10), ein Gehäuse (12, 112), wobei das Gehäuse (12, 112) eine Rückenplatte (30), eine erste Seitenwand (32) und eine zweite Seitenwand (34), eine obere Wand (36) und eine Bodenwand einschließt, wobei die Rückenplatte (30) und die Wände einen Hohlraum bestimmen und die Wände weiter eine Öffnung bestimmen, durch welche auf den Hohlraum des Gehäuses (12) zugegriffen werden kann, wobei mindestens eine aktive Funkkomponente (20) in dem Hohlraum montiert ist, und an die Rückenplatte (30), eine Wärmesenke (118) an einer äußere

ren Oberfläche der Rückenplatte (30) montiert ist, **gekennzeichnet durch**

eine interne Abdeckung (14), die an der Öffnung montiert ist, wobei die interne Abdeckung (14) dimensioniert ist, um einen Bereich zu überlappen, der **durch** die Öffnung des Gehäuses (12) bestimmt wird,

ein passives Funkgehäuse (116), das ein Radom (160) einschließt, wobei das passive Funkgehäuse (116) von dem Radom (160) und einer äußeren Oberfläche der internen Abdeckung (116) bestimmt wird und das Radom (160) verschiebbar in Flansche am Gehäuse (12) eingreift,

mindestens ein passives Funkelement (124), das in dem passiven Funkgehäuse (116) montiert ist, so dass auf die mindestens eine aktive Funkkomponente zugegriffen werden kann, ohne die Position des mindestens einen passiven Funkelements zu stören, das sich innerhalb des Radoms befindet, das daran gesichert ist, z. B. **durch** Klammern und Schrauben oder Klemmen oder Haftmittel, um sie für Servicezwecke leicht zu entfernen, wobei das Gehäuse (12) und die interne Abdeckung (14) eine Umgebungsabdichtung und elektromagnetische Abschirmung für die aktive Funkkomponente (20) bereitstellen, und wobei das Radom (160) des passiven Funkgehäuses (116) keine Umgebungsabdichtung oder elektromagnetische Abschirmung für das passive Funkelement (124) bereitstellt.

2. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei die aktive Funkkomponente (20) weiter ein Mikrofunktmodul (120) umfasst und das passive Funkelement (124) ein HF-Modul (124) umfasst.
3. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei die aktive Funkkomponente (20) weiter mindestens zwei Mikrofunktmodule umfasst und das passive Funkelement (124) ein doppel polarisiertes HF-Modul umfasst, wobei ein erstes Mikrofunktmodul mit einem ersten Einzelstrahler des doppel polarisierten HF-Moduls gekoppelt ist, und ein zweites Mikrofunktmodul mit einem zweiten Einzelstrahler des doppel polarisierten HF-Moduls gekoppelt ist.
4. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei die aktive Funkkomponente (20) weiter eine Vielzahl von Mikrofunktmodulen umfasst und das passive Funkelement (124) eine Vielzahl von HF-Modulen umfasst.
5. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei die interne Abdeckung (14) aus einem Aluminiumblech hergestellt ist.
6. Die Mobilfunk Basisstationsantenne (10) gemäß An-

spruch 1, wobei die aktive Funkkomponente (20) weiter Folgendes umfasst:

ein Mikrofunktmodul,
einen Kommunikationsknoten (150), gekoppelt mit dem Mikrofunktmodul, und
ein Kalibrierfunktmodul.

7. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei die passive Funkkomponente weiter eine Vielzahl von HF-Modulen umfasst, die an der äußeren Oberfläche der internen Abdeckung (14) montiert sind. 10
8. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei ein Flansch die ersten und zweiten Seitenwände (32, 34) und die obere und die Bodenwand verbindet und eine Lippe sich vom Flansch erstreckt, die weiter die Öffnung bestimmt, durch welche auf den Hohlraum des Gehäuses zugegriffen werden kann, wobei die interne Abdeckung (116) in die Lippe eingreift, um die Umgebungsabdichtung bereitzustellen. 20
9. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei die ersten Wände und die dritten Wände sich in rechten Winkeln zur Rückenplatte erstrecken. 25
10. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei das Radom (160) verschiebbar in Flansche am Gehäuse (12) eingreift. 30
11. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, die weiter eine innere Abdichtung einschließt, welche für Umgebungs- und elektromagnetische Abschirmung sorgt. 35
12. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, wobei jeder Einzelstrahler mit zwei Mikrofunktmodulen verbunden ist. 40
13. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 1, die weiter einen Kommunikationsknoten umfasst, der mit jedem Mikrofunktmodul gekoppelt ist. 45
14. Die Mobilfunk Basisstationsantenne (10) gemäß Anspruch 13, die weiter ein Kalibrierfunktmodul einschließt. 50

Revendications

1. Antenne de station de base cellulaire (10), une enceinte (12, 112), l'enceinte (12, 112) comprenant un panneau arrière (30), une première paroi latérale (32), et une deuxième paroi latérale (34), une paroi

supérieure (36) et une paroi inférieure, le panneau arrière (30) et les parois définissant une cavité, les parois définissant en outre une ouverture à travers laquelle on peut accéder à la cavité de l'enceinte (12),

au moins un composant de radio actif (20) monté à l'intérieur de la cavité, sur le panneau arrière (30), un dissipateur de chaleur (118) monté sur une surface externe du panneau arrière (30), **caractérisé par:**

une couverture interne (14) montée à l'ouverture, la couverture interne (14) étant dimensionnée pour se superposer à une aire définie par l'ouverture de l'enceinte (12),
une enceinte de radio passive (116) comprenant un radôme (160), l'enceinte de radio passive (116) étant définie par le radôme (160) et une surface extérieure de la couverture interne (116) et le radôme qui vient en prise de façon coulissante avec des brides sur l'enceinte (12),
au moins un élément de radio passive (124) monté à l'intérieur de l'enceinte de radio passive (116) de sorte que le au moins un composant de radio actif peut être accessible sans déranger l'emplacement du au moins un élément de radio passif situé entre le radôme fixé à celui-ci, par exemple par des supports et des vis ou pinces ou agents de liaison, pour être facilement enlevé à des fins de maintenance, dans laquelle l'enceinte (12) et la couverture interne (14) fournissent une protection hermétique et un blindage électromagnétique pour le composant de radio actif (20), et dans laquelle le radôme (160) de l'enceinte de radio passive (116) ne fournit pas de protection hermétique ou de blindage électromagnétique pour l'élément de radio passif (124).

2. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle le composant de radio actif (20) comprend en outre une micro radio (120) et l'élément de radio passif (124) comprend un module RF (124).
3. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle le composant de radio actif (20) comprend en outre au moins deux micro radios et l'élément de radio passif (124) comprend un module RF bipolarisé, dans lequel une première micro radio est couplée à un premier élément rayonnant du module RF bipolarisé, et une deuxième micro radio est couplée à un deuxième élément rayonnant du module RF bipolarisé.
4. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle le composant de radio actif (20) comprend en outre une pluralité de micro

radios et l'élément de radio passif (124) comprend une pluralité de modules RF.

5. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle la couverture interne (14) est fabriquée à partir d'une feuille d'aluminium. 5
6. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle le composant de radio actif (20) comprend en outre : 10
 - une micro radio,
 - un centre de communication (150) couplé à la micro radio, et
 - une radio d'étalonnage. 15
7. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle le composant de radio passif comprend en outre une pluralité de modules RF montés sur la surface externe de la couverture interne (14). 20
8. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle une bride connecte les première et deuxième parois latérales (32,34) et la paroi supérieure et inférieure, et un rebord s'étend depuis la bride, définissant ultérieurement l'ouverture à travers laquelle on peut accéder à la cavité de l'enceinte, le rebord venant en prise avec la couverture interne (116) pour fournir la protection hermétique. 25
30
9. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle les premières parois et les troisièmes parois s'étendent à angle droit par rapport au panneau arrière. 35
10. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle le radôme (160) vient en prise de façon coulissante avec les brides sur l'enceinte (12). 40
11. Antenne de station de base cellulaire (10) de la revendication 1, comprenant en outre un joint interne qui fournit une protection électromagnétique et hermétique. 45
12. Antenne de station de base cellulaire (10) de la revendication 1, dans laquelle chaque élément rayonnant est associé à deux micro radios. 50
13. Antenne de station de base cellulaire (10) de la revendication 1, comprenant en outre un centre de communication couplé à chaque micro radio. 55
14. Antenne de station de base cellulaire (10) de la revendication 13, comprenant en outre une radio d'étalonnage.

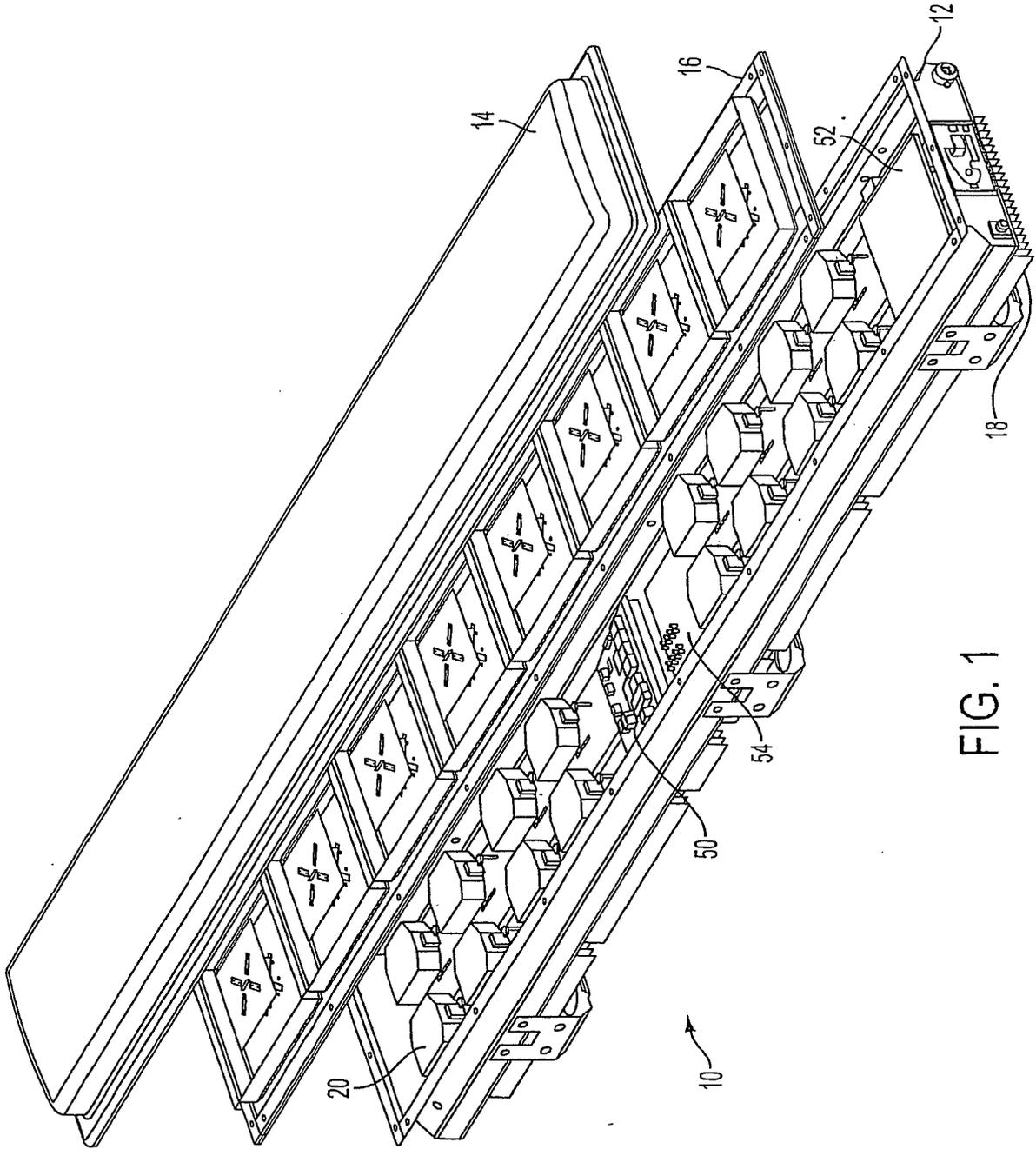


FIG. 1

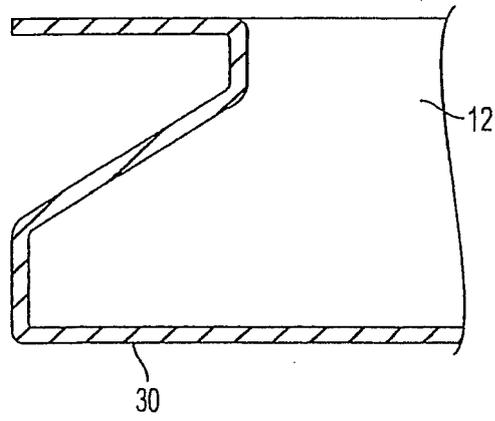


FIG. 2

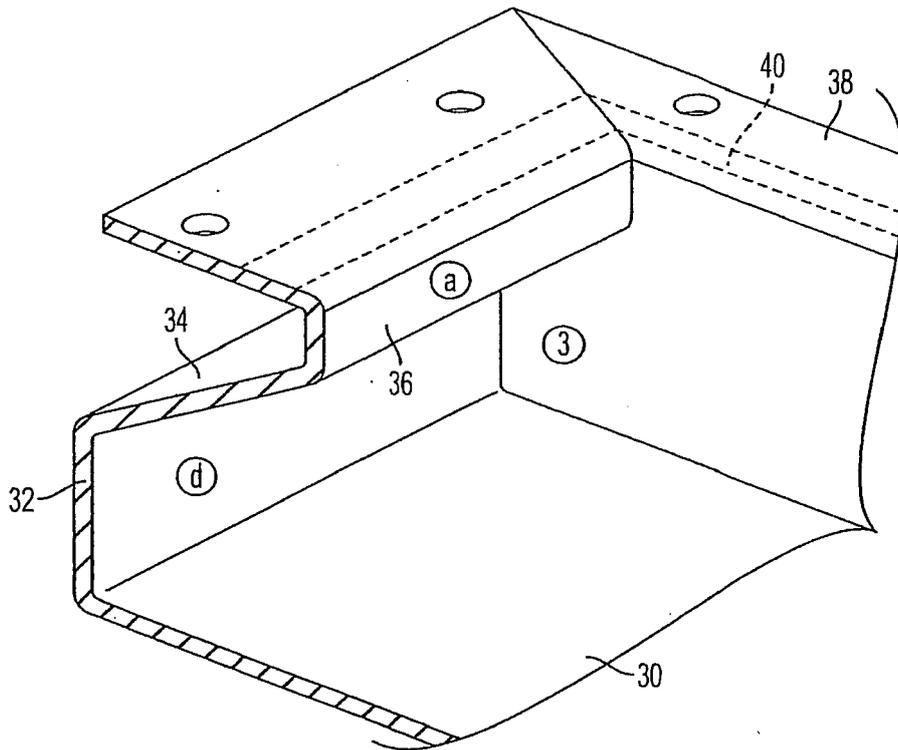


FIG. 3

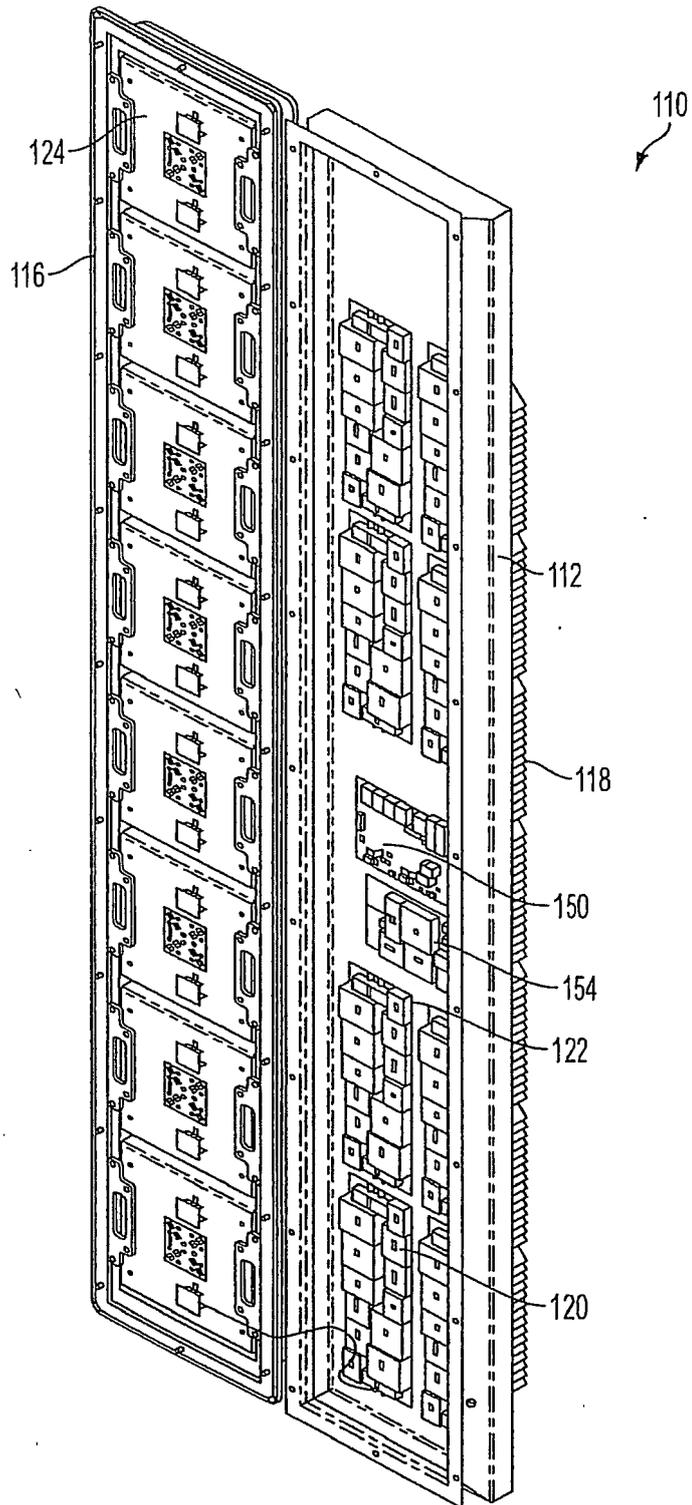


FIG. 4

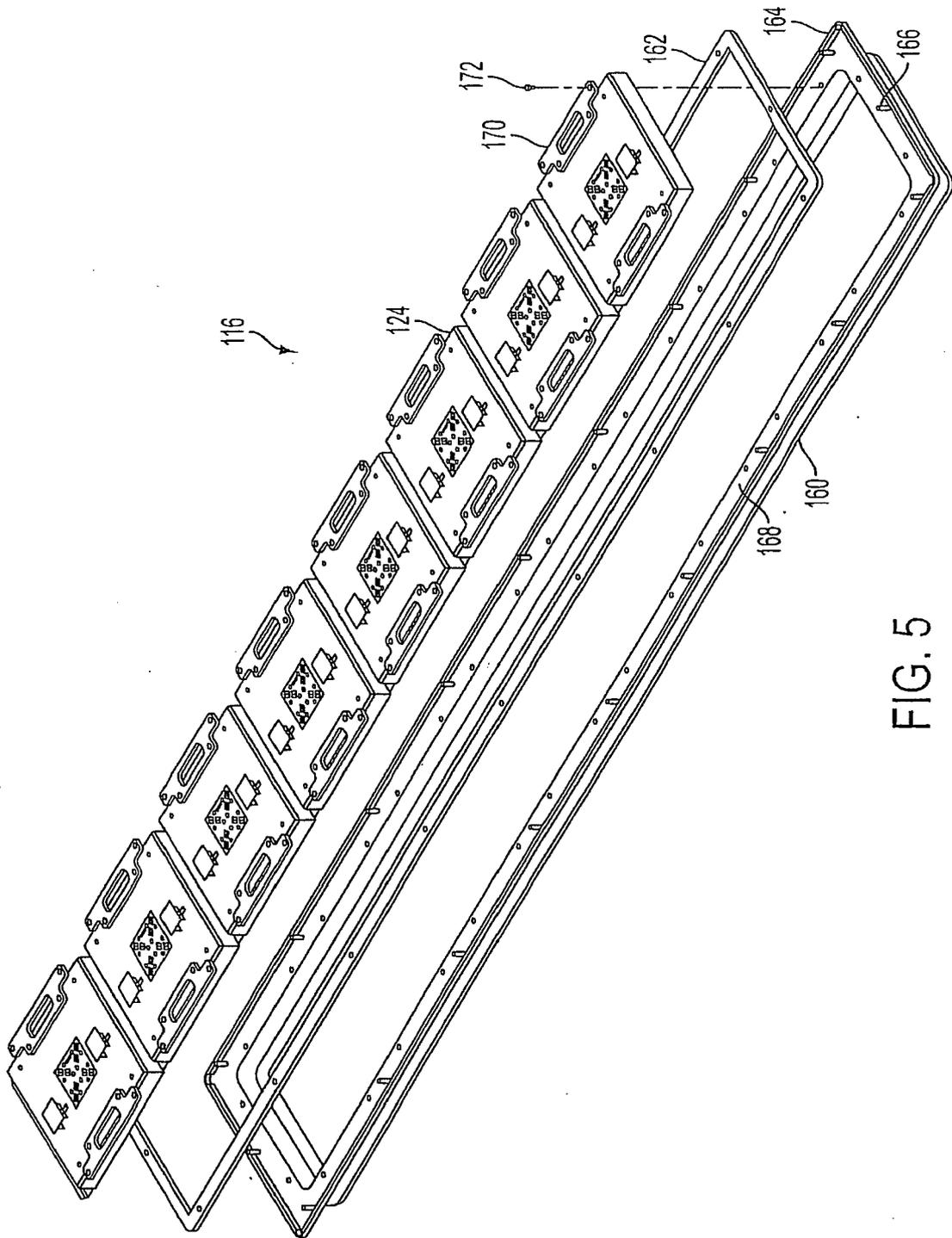


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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