



A RADIO MODULE INCLUDED IN A PRIMARY RADIO STATION, AND A RADIO STRUCTURE CONTAINING SUCH MODULES

TECHNICAL FIELD

5 The present invention relates to a radio module which is included in a primary radio station of a mobile radio system. The primary radio station may be a base station of a mobile telephone system for instance, although it may also form part of a mobile services switching centre having integrated transmitter-receiver units. The invention also relates to a primary radio station that is
10 constructed from a number of such modules, said modules being mutually independent and functioning as separate autonomous base stations in the main primary station.

BACKGROUND ART

15 A radio subsystem of a mobile radio system is generally comprised of one or more radio signal transceivers TRX, an antenna part which is common to several transceivers, and a control part. The transceivers include the radio technical units, such as modulator/demodulator, frequency synthesizer, amplifier units, while the control part includes those controlling and switching devices
20 required to operate the transceivers, and to divert calls to/from the mobile services switching centre (MSC) of the system.

Those digital TDMA systems developed in recent times in Europe and North America also include units for channel coding (channel decoding) in conjunction with transmission and reception, and
25 time-slot allocation (burst generators) and recovery of data from a given time-slot (symbol detector, possibly also equalizer) and speech coding and speech decoding units. In these digital systems, the aforesaid units are controlled by the control unit when transmitting and receiving signals on the basis of the channels that have been allocated, among other things, meaning that both
30 frequency and time slot allocation must be controlled in the transceiver units. For instance, the frequency synthesizer must



be tuned to the correct receiving frequency. Furthermore, it is necessary to be able to control the burst generator and the symbol detector in the receiver so as to enable the signal burst intended for a given channel to be recovered from the time-slot determined.

- 5 The base station may contain several such transceiver units and one such given unit need not be allocated a given radio channel or other radio parameter (time-slot, frequency, power output, etc.), but can be controlled generally by the control unit to transmit/receive on all of the radio channels allocated to the base
10 station.

- Each base station of a cellular system may be allocated a particular set of radio channels and a given radio coverage in a given cell or several sector cells. It is generally known to use a single antenna unit for a plurality of transceiver units within a base
15 station. The individual transmitter units may be connected to the common antenna via coaxial connections and a so-called filter combiner or hybrid combiner.

- In other cases, a high linear amplifier intended for a plurality of carrier frequencies is used prior to delivering signals to the
20 antenna via a coaxial connection.

- Although this enables the antenna construction of the base station to be simplified, it also results in unnecessary power consumption, since it is necessary to compensate for attenuation of the radio signal caused by the coaxial connection and the combiner
25 with greater power in the output amplifier of the transmitter part. In the other case, which uses a high linear amplifier without a combiner, significant power losses are experienced not only in the coaxial connection but also in the amplifier. Furthermore, the use of a filter combiner, which has lower losses than a
30 hybrid combiner, has, instead, the disadvantage of not permitting any desired frequency combination to be used in the transmitter, because the filters must be designed to be selective for a given transmitter frequency.



The inclusion of transceiver modules in a radio base station has earlier been proposed; see for instance U.S. Patent 4,694,484. Each such module is assigned unique parameters with regard to its function in the radio system, depending on the location of these transceivers and the antenna configuration used.

The radio system described in the aforesaid patent is an FDMA-system in which a channel corresponds to a specific radio frequency. The system also includes a fixed antenna unit comprised of sector antennas each illuminating a cell, and associated combiners (cavities 610-614, Figure 6). A number of such modules in a base station can be controlled by the base station controller so as to transmit/receive over certain radio channels and in accordance with those requirements demanded by the antenna unit in the base station. The module can be controlled so as to be operative for both transmission/reception of radio calls, for instance, which is the most usual, or solely to receive and page radio signals. This known structure is able to reduce greatly the number of complicated connections between the different base station units, although the disadvantage of needing to adapt the individual modules to the demands of the antenna unit still remains.

DISCLOSURE OF THE INVENTION

The development of cellular land mobile radio systems in recent years has been influenced in arriving at the present invention. Older cellular radio systems of this kind generally comprise larger cells, require high power outputs from the base stations, and have relatively few channels/base stations. The majority of the older systems are analog systems.

Present-day cellular radio systems and those systems developed in recent times are characterized by small and large cells (micro-cells, umbrella cells), lower power outputs, many channels and higher frequencies. The recent systems are also often digital systems with time-division multiplex access (TDMA).



An object of the present invention is to provide a radio module for a base station of a mobile radio system and a structure of such modules which are autonomous and mutually arranged so as to be able to fulfil their function independently of one another, thereby better adapting the structure to present-day radio systems and anticipated future radio systems.

By "present-day radio systems" is primarily meant the FDMA- and TDMA-systems mentioned in the introduction. But the radio module according to the invention can also be applied on a radio system of so called CDMA-type in which the radio signals are modulated and transmitted/received within a broad frequency band.

Another object of the present invention is to provide a module structure which will improve efficiency and eliminate the need of combines and associated cabling to the combines from the various transmitter units.

The properties of the proposed radio structure and the modules included therein enable the requirements placed on present-day systems to be satisfied to a greater extent. Primarily, the need of combines and associated coaxial cables is eliminated. In those cases when combines are not used but a power consuming high-linear final amplifier is used, the proposed modular structure enables the final amplifier to be made more simple and leaner in power. The inventive radio structure is particularly suitable in those cases in which the antennas can be given small dimensions in systems which use very high frequencies (in the order of 1500 MHz).

The inventive module is characterized by the features set forth in Claim 1 and the inventive base station structure is characterized by the features set forth in Claim 6.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail with reference to the accompanying drawings, in which



Figure 1 is a sectioned side view of an inventive radio module;
Figure 2 is a cross-sectional view of the antenna module shown in
Figure 1;

Figure 3 illustrates the antenna side of the radio module shown in
Figure 1;

Figure 4 illustrates the component side of the radio module shown
in Figure 1;

Figure 5 is a block diagram of the transmitter units included in
the module shown in Figure 1;

Figure 6 illustrates schematically a general base station
structure according to the present invention;

Figure 7 illustrates a similar base station structure to Figure 6,
but with receiver diversity;

Figure 8 is a block diagram which illustrates the receiver
diversity in the base station structure of Figure 7 in more
detail; and

Figure 9 is a diagrammatic illustration of signal suppression
between modules in the inventive structure.

BEST MODES OF CARRYING OUT THE INVENTION

Figure 1 is a longitudinal sectioned view of an inventive radio
module. The body of the actual module is comprised of a fixed
profile 1 made of aluminium for instance and having an H-shaped
cross-section (see Figure 2). Figure 1 also shows a longitudinal
cross-section of the profile. In each of the thus formed lon-
gitudinally extending openings of the profile 1, there is attached
or firmly clamped an antenna part 2 between the two side parts 12
and 13 of the profile 1 on one side thereof. The component part 3
of the transmitter-receiver units of the module is attached in a
suitable manner to the other side of the profile 1 and along the
web 11 of said profile. The component part 3 may be comprised of
a flat, rectangular insulating plate, for instance a laminate on
which blocks 33 and 34 containing the transceiver components are
mounted. This is shown more clearly in Figure 4. There may also be
provided a component block 32, which represents a duplex filter
and is mounted on the plate 31. Provided at the lower end-part of



the component part 3 is a cable connection 35 by means of which the transceiver units are connected to external units, such as the control unit. This connection is suitably effected with a coaxial cable.

5 The antenna part 2 is comprised of a fiberglass board 21 provided with metal configurations that form the antenna dipoles, as shown in Figure 3. The antenna board 21 is attached or firmly clamped between the two side parts 12 and 13 in some suitable manner. The space between the antenna board 21 and the web 11 may be filled
10 with a soft, insulating material. The board 21 is mounted so that the metal patterned surface faces inwards towards the web 11 of the module, as shown in Figures 1 and 2.

Figure 2 is a cross-sectional view of the radio module and shows the H-shaped profile 1 and also the antenna part 2 and the
15 component part 3 of the transceiver units in their assembled states.

Figure 3 illustrates the construction of the antenna part 2 in more detail. The antenna part has the form of a known stripline antenna which includes a conductive pattern as described above in the form of a plurality of conductive plates 22-26 (five plates in
20 the illustrated embodiment) which form the antenna dipoles and associated conductor layout 27. An electric connection 28 (see Figure 1) is provided at the upper part of the antenna board 21. The antenna plates 22-26 are connected to the duplex filter 32 by means of an electric connection (naked wire) 4, via the electrical
25 connection 28, and the duplex filter 32 is in turn connected to the transceiver units. The web 11 of the module may form the earth of the antenna unit and may also form the earth of the transceiver units 33 and 34.

30 When incoming radiation is received from a mobile station, for instance, electric voltages are induced in the plates 22-26 and the combined voltage (relative to the earth surface) is conducted from the plates through the electric contact 28, the electric connec-



tion 4 and the duplex unit 32 to the receiver block 34. Conversely, the transmitter signals are conducted from the transmitter block 33 to the plates 22-26, via the naked wire 4, the electrical contact 28 and the duplex unit 32.

5 Figure 4 illustrates the front side of the component part 3 containing the transmitter units 33 and the receiver units 34. These components are known components and are mounted on a circuit board 31 and connected in a known manner to produce the desired, known transceiver functions and consequently form no part of the
10 present invention. An inventive radio module is characterized in that the antenna function, i.e. the antenna part 2, has been integrated with the transceiver functions, i.e. the component part 3, to form a single unit. In the embodiment illustrated in Figures 1-2, these units have been constructed on an H-shaped profile, although it will be understood that the body 1 may have another
15 profile and that the antenna and component parts can be attached or firmly clamped in some other way. An essential feature is that a radio module will have its own antenna part which is connected to its own component part for the transceiver units (in the absence of a combiner), said parts not being common to any other
20 radio module in a base station, and that the modules can be placed close together in a structure, as described below.

Figure 5 is a block diagram of a typical embodiment of the transmitter units in the block 33 included in a radio module
25 according to the invention. All units in the module are in themselves known in the construction of a base station of a cellular mobile radio system.

Connected to the input of the transmitter block, said input being connected to the electric contact device 35 in Figure 1, is a unit
30 51 for timing recovery and distribution of those signals which arrive from the base station controller via the connection 36 in Figure 1 and which are intended to control the various units in the transmitter block according to Figure 5.



Thus, the unit 51 has a connection which leads control signals to a frequency synthesizer 53 which set or adjust the synthesizer to the radio frequency f_1 used for the radio module. A modulator block 52 includes a modulator which modulates the baseband signals to a desired form, for instance a 4piQAM-modulator in the illustrated case. Control signals which control the function of this modulator and other units are also obtained over the input B. The block 52 also includes an RF-modulator, i.e. a frequency modulator, which transforms the baseband modulated signals to the desired radio frequency band. The chosen radio frequency f_1 is delivered to the RF-modulator from the frequency synthesizer 53, controlled by the unit 51.

Further, control signals are sent from the unit 51 to a level regulator 54 with the intention of being able to regulate the level of the signals obtained from the RF-modulator in block 52 to the following final stage 55. The final stage 55 includes a power amplifier which delivers amplified radio signals having a given power output to the following antenna unit 2, via the connection 4 and the duplex filter 32 shown in Figure 1.

One special feature of the transmitter unit 33 in an inventive radio module resides in the control of the frequency synthesizer 53 and the level regulator 54. When the module is included together with a plurality of other modules in an FDMA-system, the frequency synthesizer can be controlled in a desired manner, although such that each radio module in the system has its own particular frequency, i.e. for an FDMA-system, and its own individual radio channel among a number of modules each having their own particularly selected radio channels. This will be described in more detail further on. Selective setting of the radio frequency in known systems which include a combiner is prevented by the combiner.

Control signals to the level regulator 54 from the base station controller for instance, control the setting or adjustment of the level of the output signals from the modulator unit 52, so that



these signals will be adapted to the antenna unit 2 subsequent to being amplified in the final stage 55. The final stage 55 includes a power amplifier (not shown), as in the case of known final stages. Since no losses are occurred by the presence of a combiner
5 or associated coaxial connection in the base station, there is no longer the same need for high amplification as in known designs.

When the radio system is a TDMA-system, certain additional units are included, among them the block 56 shown in broken lines in Figure 5, which contains a burst generator for distributing the
10 incoming baseband signals into given time-slots for each TDMA-frame.

Figure 6 illustrates an array of radio modules in a base station of a mobile radio system. The illustrated array includes a total of 18 modules, of which nine modules M1-M9 are arranged in the
15 upper row and nine modules M10-M18 in the bottom row. All modules are mounted in a suitable manner and form the primary station (the base station). A general condition, irrespective of the type of system involved (FDMA or TDMA) is that modules M1-M8 and M11-M18 transmit on their own individual frequency f1-f8 and f11-f18
20 respectively and that no module is able to transmit on the same frequency as another module. The unit 34 is removed from each of these modules and the duplex filter 32 is replaced with a strap. In the case of an FDMA-system, each module M1-M8 and M11-M18 transmits on a given carrier frequency that is different from the
25 carrier frequency of each other module. The modules M9 and M10 are receiving modules and each one will thus include only one receiver amplifier according to Figure 1. The receiving modules M9 and M10 are able to receive radio signals from secondary radio units over several carrier frequencies f9 and f10 respectively, although
30 these carrier frequencies are spaced from the carrier frequencies on which the modules M1-M8 and M11-M18 transmit by a given duplex distance (for instance, 45 MHz).

Frequency jumping or hop is used in the GSM-system, i.e. the value f1 of the carrier frequency of a given transmitter on a given



occasion will hop to another value f_2 on another given occasion. When applied to the inventive module structure, the use of frequency hopping would mean that when the carrier frequency f_1 is used by the module M1 and the carrier frequency f_2 is used by the module M2 on a given occasion and module M1 hops from f_1 to f_2 , it would then be necessary for the module M1 to hop at the same time to some other frequency that is not used by the structure. Frequency hopping can be effected from one time slot to another.

Those procedures that must be taken in order to ensure that the different modules M1-M18 will not disturb one another have not been shown in this Figure, but will be described in greater detail below with reference to Figure 9.

Figure 7 illustrates an array of radio modules M1-M9, M12-M20 similar to the Figure 6 array, with the exception that the Figure 7 array includes two further modules M10, M11. These additional modules are included with the intention of achieving reception diversity, i.e. reception of radio signals from a given mobile radio at two mutually separate places in the base station. Diversity design of antennas and transceiver units is known to the art. Such designs include two antennas which are spaced mutually apart in the radio receiver. The radio receiver may then either have two separate signal processing paths for the recovery of transmitted information (speech or data) or may have a common signal path which includes a switch to each antenna.

In the diversity design illustrated in Figure 7, it is assumed that the modules M1-M9 and M12-M20 have both transmitter and receiver units and that the two modules M10 and M11 form only antenna modules. By way of example, it is assumed that only three standard modules M1, M2 and M3 are disposed for diversity reception. The antenna module M10 is connected to one receiving path of the modules M1, M2 and M3 by a coaxial connection S10, while the antenna module M11 is connected to the other receiving path of the modules M1, M2 and M3 by a coaxial connection S11. It is therewith possible to achieve diversity with two separate antenna pairs.



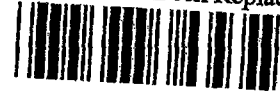
This opposes what has earlier been said with regard to the construction and function of the different modules, but two pairs of modules, for instance M1, M10 and M1, M11 can, in this case, each be considered as a single receiving module having the same radio parameters (frequency and time-slot), but where the antenna part is divided into two parts, each positioned at a different geographical location.

Figure 8 illustrates the diversity design of the three modules M1, M2 and M3 with associated antenna modules M10, M11 in more detail.

Each of the antenna modules M10, M11 is comprised of an antenna A1 and A2 and a receiver distributor MD1 and MD2 respectively. The antennas will preferably have the construction shown in Figures 1 and 3 and each of the receiver distributors MD1, MD2 is comprised of a resistive network, optionally including an amplifier. The antenna signal incoming from the antenna A1 in the module M10 for instance is divided into three generally equal signals, each corresponding to the antenna signal, and the three signals are passed to one receiving input of respective modules M1, M2, M3. Similarly, the antenna signal incoming from the antenna A2 in the module M11 is divided into three equal signals and the signals are passed to the other receiving input of the modules M1, M2, M3. Each such module will preferably have separate signal processing units and can be constructed as disclosed in the U.S. Patent 4,868,890 for instance.

An analysis of the received signal is carried out in each module M1-M3, as described in the aforesaid U.S. patent and the best signal contribution is recovered from the two parallel receiving circuits for further signal processing (channel decoding, etc.).

As will be understood, each module can function as a fully autonomous transmitter and receiver in which the own antenna is used both for transmitting and receiving signals. However, it is necessary in this case to provide a duplex filter between the antenna unit and the transmitter and receiver respectively in the



module. This solution, however, does not provide the aforescribed diversity effect.

Thus, the modules M1-M18 illustrated in Figures 6-8 can be combined selectively, provided that the requirement of different carrier frequencies on mutually different modules is observed. Leakage between antenna elements in one module to another module, via radiation and earth currents from the antenna in one module to an adjacent module and capable of causing intermodulation, can be suppressed in the manner described below.

This suppression can be achieved with the aid of three mutually independent procedures capable of reducing leakage between two mutually adjacent modules, and therewith intermodulation, either together or individually.

Figure 9 illustrates an example of such suppression. The conductive walls of the module profile earlier described with reference to Figure 1 are shown in the section S-S of the four modules M1-M4 shown in Figure 9. The two defining walls of two modules M1 and M2 can be short-circuited or choked by means of a sharp U-shaped conductive connection C1, and remaining modules can be short-circuited or choked in a similar manner. In this case, the connection C1 shall be such that the part of connection that extends between the modules in their longitudinal direction shall have a distance d to the opposing defining surface that is equal to a quarter of a wavelength, i.e. $d = \lambda/4$ of the field transmitted by the module. The short-circuit is transformed in this way to an infinitely great impedance for this wavelength and provides effective damping or attenuation of a horizontal polarized field.

The module transmits a periodic field whose frequency is equal to the frequency of the radio frequency used (this frequency being f_1 for the module M1). For instance, the distance d will equal 75 mm in the case of the GSM-system, which transmits and receives on



900 +/- 22.5 MHz. The distance between two mutually adjacent walls, i.e. the length of the connection part C1, is preferably much smaller than one-quarter wavelength.

5 Disturbances between two modules can also be eliminated by providing a resistive and radio-frequency absorbent material between the modules, as illustrated by the broken line contour A in Figure 9.

10 Another method is to provide a circulator on the output of the transmitter element of each module, or to provide one or more ferrite insulations in known manner.

15 The aforesaid methods of suppressing the influence of the radio field from one module to one or more mutually adjacent modules can be applied either individually or in combination. It is primarily the antenna unit that leaks radio fields to its neighbours. An antenna unit has a natural leakage of 35-40 dB. A short-circuiting (choke) according to the above results in an attenuation of about 20 dB in the case of a horizontal polarized field. In the case of a vertical polarized field, the leakage is = 0. Resistive material provides an attenuation of 25-30 dB and a circulator provides an
20 attenuation of 20-25 dB, whereby an attenuation of 60-100 dB can be achieved, which provides acceptable insulation between two modules.

25 The aforescribed radio base structure provides a flexibility which enables traffic capacity to be extended incrementally, while also enabling the allocation of available resources, such as time, frequency and power output, to be effected without obstruction and without limitations in each individual module and in large unit assemblies consisting of several modules. The structure is general and can be implemented for different analog and digital radio
30 systems, i.e. for both FDMA, TDMA and CDMA systems. It is also independent of mobile radio standards, i.e. can be implemented for the Nordic Mobile Telephone System (NMT), the Northamerican



Digital Cellular System (ADC), the Pacific Digital Cellular System (PDC) and the Global Mobile Telephone System (GSM).

5 The independent relation between the modules implies that these, apart from being capable to operate instantaneously on different frequencies, also are capable to operate according to different modulation schemes.

10 Consequently, all the modules can operate in TDMA, FDMA or CDMA together, each or mutually in another arbitrary combination. The invention is thus not limited to be able to operate according to one and the same modulation scheme.



CLAIMS

1. A radio module included in a primary radio station of a mobile radio system in which radio communication is effected over a plurality of radio frequencies between the primary station (BS) and a number of secondary stations (MS1, MS2, ...),

characterized in that the module includes

a) a transmitter unit (33) which includes transmitter devices (52-55) for transmitting radio signals in a known manner to a given secondary station at a given radio frequency which is individual to the module on a given occasion;

b) an antenna unit (2) which is connected directly to said transmitter unit (33) for transmitting the transmission signals generated in said transmitter devices (52-55) to said secondary radio station; and

c) control means (51) included in said transmitter unit (33) for delivering control signals to the transmitter means (52-55) in accordance with radio parameters which are delivered from the primary control unit (BSC) and which relate to a given radio frequency which is assigned exclusively to the module on a given occasion and to which associated transmitter means (53) shall be adjusted or set when communicating with said secondary radio unit.

2. A radio module according to Claim 1, characterized in that the control means (51) is constructed to control level adjusting means (54) in the transmitter unit (33) so that the power output of the signals delivered from the transmitter unit (33) to the first antenna unit (2) is adapted to the antenna unit (3).

3. A radio module in a primary radio station of a mobile radio system in which communication takes place between the primary radio station and a secondary radio station over a given radio frequency, wherein the module includes an antenna part (2) and at least one transmitter part (3), characterized in that the module is comprised of



a) a body (1) having a given cross-section profile such as to form a first and a second space;

5 b) a circuit board (21) which forms the module antenna part (2) accommodated in the first space, said circuit board including a conductor pattern comprising a plurality of individual, mutually connected antenna elements (22-26);

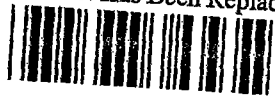
10 c) a component part (31) forming the transmitter part (3) and accommodated in the second space of said body (1) and on which a transmitter unit (33) of the radio module is mounted, wherein a first connection (35, 36) is provided for input signals to the transmitter unit (33) from the control unit of the primary station; and

15 d) a second connection (4) for radio frequency signals which connects the conductor pattern (27) of the antenna part (2) directly to the component part (31).

20 4. A radio module according to Claim 3, characterized in that the module body is an H-profile in which said first and said second spaces are formed, wherein each of said spaces is defined by the profile web (11) and its two side-walls (12, 13), and wherein the antenna part (2) is firmly clamped in the two side-walls on one side of the web (11) and the component part (31) is secured on the side-walls (12, 13) on the other side of the module web (11).

25 5. A radio module according to Claim 4, characterized in that the circuit board (21) is mounted so that the antenna elements (22-26) face inwardly towards the module web (11).

30 6. A radio base structure for a primary radio station of a mobile radio system in which radio communication takes place over a number of radio frequencies between the primary station and a number of secondary stations, characterized in that the structure is comprised of at least two modules (M1-M18, Figure 6), wherein each module includes an antenna unit (2) connected directly to a transmitter unit (33) which transmits radio signals



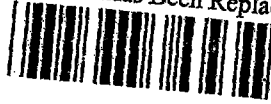
at a given frequency (f_1) determined for said module (M1) on a given occasion, said frequency being different to the frequency used by any other module (M2-M18, Figure 6), such that transmission from the module (M1) over said frequency (f_1) and on a given occasion is individual to precisely this module and cannot be used by any other module on the same occasion; and in that each module is so arranged in relation to each other module in the structure that galvanic leakage and/or the influence of the radio field from one module to each other module in the structure is negligible.

7. A radio base structure according to Claim 6 when each module has a given profile and includes conductive walls which border on the walls of the nearest module profile in the structure, characterized in that said leakage and influence from one module to each other module is suppressed by providing a conductive connection (C1) between said two neighbouring walls of each module in the structure.

8. A radio base structure according to claim 6, when each module has a given profile and includes conductive walls which border on the walls of the nearest module profile in the structure, characterized in that said leakage and/or influence from one module to another is suppressed by applying radiofrequently resistive material between two adjacent walls of said walls in each module of the structure.

9. A radio base structure according to claim 6, characterized in that the transmitter output of each module is provided with one or more ferrite insulators.

10. A radio base structure for a primary radio station with diversity in a mobile radio system in which radio communication takes place over a number of radio frequencies between the primary station and a number of secondary stations, characterized in that the structure is comprised of a plurality of transceiver modules (M1-M9, M12-M20) and a module pair (M10, M11, Figure 7) of which each module includes solely one antenna unit



(A1, A2), wherein a first connection (S10) is provided for conducting a received antenna signal from one antenna module (M10) to a first signal path in a transceiver module (M1), and a second connection (S11) is provided for conducting a received antenna signal from the other antenna module (M11) to a second signal path in said transceiver module (M1).

11. A radio base structure according to Claim 8, characterized in that one module (M10) of said module pair is spaced from the other module (M11) of said pair at a distance which is significantly greater than two mutually adjacent modules (M1, M2) in the structure.

12. A radio base structure for a primary radio station with receiving diversity in a mobile radio system in which radio communication takes place over a plurality of radio frequencies between the primary station and a plurality of secondary stations, characterized in that the structure is comprised of a plurality of transceiver modules (M1-M9, M12-M20) and a module pair (M10, M11, Figure 7) comprising a first and a second module of which each includes solely one antenna unit (A1 and A2 respectively) and a respective receiver distributor (MD1 and MD2 respectively) for received antenna signals, wherein the first module (M10) of the pair is spaced from a given third module (M1) and a given fourth module (M2) at a distance which is significantly greater than two mutually adjacent modules in the structure, and wherein a first connection (S10) from the receiver distributor (MD1) of the first module is intended to conduct received antenna signals from the first module to a first signal path in the receiver unit of the third and the fourth module (M1, M2), and a second connection (S11) from the receiver distributor (MD2) of the second module is intended to conduct antenna signals from the second module (M11) to a second signal path in the receiver unit of the third and fourth modules (M20).