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(54) **Delivery of multicast and uni-cast services in an OFDMA system**

Bereitstellung von Multicast- und Unicast-Diensten in einem OFDMA-System

Distribution de services multidiffusion et unidiffusion dans un système par répartition en fréquence orthogonale (OFDMA)

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- **HUAWEI: "Further Consideration on Multiplexing of Unicast and MBMS", 3GPP DRAFT; R1-060235, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Helsinki, Finland; 20060119, 19 January 2006 (2006-01-19), XP050111366,**
- **LG ELECTRONICS: "MBMS transmission in E-UTRA", 3GPP DRAFT; R1-051300_MBMS TRANSMISSION, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Seoul, Korea; 20051031, 31 October 2005 (2005-10-31), XP050100906,**

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- **SAMSUNG: "Multiplexing of Broadcast and Unicast Traffic", 3GPP DRAFT; R1-060074, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Helsinki, Finland; 20060123, 19 January 2006 (2006-01-19), XP050417453, [retrieved on 2006-01-19]**
- **QUALCOMM EUROPE: "Scheduling for Enhanced MBMS", 3GPP DRAFT; R1-060174, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG1, no. Helsinki, Finland; 20060119, 19 January 2006 (2006-01-19), XP050111309, [retrieved on 2006-01-19]**
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Description

Technical Field

5 **[0001]** The present invention relates to methods and systems for supporting multicast and uni-cast services in a radio telecommunications networks. In a preferred embodiment the present invention provides methods and systems for providing a multimedia broadcast multicast service (MBMS) and a uni-cast service on a radio telecommunications network employing orthogonal frequency division multiple access (OFDMA).

10 Background Art

[0002] To meet an anticipated increase in user demand for high data rate and improved service quality in the future the 3GPP has identified that it will be desirable to develop new networks for deployment in the medium to long term providing data rates of up to 100 MBPS in the downlink direction and 50 MBPS in the uplink direction. In order to achieve this increased data rate with acceptable quality such networks will implement OFDMA and have a maximum downlink transmission bandwidth of 20 MHz.

[0003] Notwithstanding the desired 20MHz peak bandwidth criterion set out above, it is likely that for one reason or another cells with lower bandwidth such as 5 MHz, 10 MHz, 15 MHz, or even 1.25 MHz or 2.5 MHz will also exist. It is also desirable that UEs (User Equipments) having different reception capabilities, i.e. reception bandwidths will be able to communicate with such networks. As will be appreciated, higher capability handsets are likely to be more complex and therefore more expensive, and thus some users will be willing to trade off performance to obtain a cheaper handset.

[0004] HUAWEI: "Further Consideration on Multiplexing of Unicast and MBMS", 3GPP Draft; R1-060235, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre; 650, route des Lucioles; F-06921 Sophia-Antipolis Cedex; France, Vol. RAN WG1, No. Helsinki, Finland; 2006-01-19, XP050111366 is directed to multiplexing methods between MBMS and unicast transmission.

[0005] LG ELECTRONICS: "MBMS transmission in E-UTRA", 3GPP Draft; R1-051300_MBMS transmission, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre; 650, route des Lucioles ; F-06921 Sophia-Antipolis Cedex; France, Vol. RAN WG1, No. Seoul, Korea; 2005-10-31, XP050100906 is directed to the multiplexing of MBMS and unicast data.

[0006] SAMSUNG: "Multiplexing of Broadcast and Unicast Services", 3GPP Draft; R1-060074, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre; 650, route des Lucioles; F-06921 Sophia-Antipolis Cedex; France, Vol. RAN WG1, No. Helsinki, Finland; 2006-01-23, XP050417453 is directed to realization of a single-frequency network (SFN) operation for broadcast traffic transmitted using OFDM/A from multiple cells with timing errors within the cyclic prefix length.

[0007] QUALCOMM EUROPE: "Scheduling for Enhanced MBMS", 3GPP Draft; R1-060174, 3rd Generation Partnership Project (3GPP), Mobile Competence Centre; 650, route des Lucioles; F-06921 Sophia-Antipolis Cedex; France, Vol. RAN WG1, No. Helsinki, Finland; 2006-01-19, XP050111309 is directed to scheduling mechanisms for E-MBMS.

[0008] WO 2005/125254 is directed to techniques for implementing a multi-access hybrid OFDM-CDMA system that may be used to provide wireless voice and/or data communications.

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Disclosure of Invention

[0009] One of the services identified by the 3GPP for inclusion in this next generation of networks is multimedia broadcast multicast service (MBMS). Although MBMS is currently supported in 3G networks, its implementation in the next generation of networks will be significantly different due to the fact that OFDMA will be employed in such networks, rather than WCDMA, as is currently used. Accordingly there is a need to provide systems and methods that enable the deployment of MBMS in these networks in the future.

[0010] Moreover, because of the extended bandwidth of these future systems it is desirable that any deployment scheme for MBMS also allows the transmission of uni-cast services at the same time as an MBMS service. Accordingly there is a need for systems and methods that enable physical resource sharing between MBMS and uni-cast services.

[0011] In a first aspect the present invention provides a method implemented in a base station used in a radio telecommunications network according to the features of claim 1.

[0012] In a further aspect the present invention provides a base station according to the features of claim 4 configured to implement a method embodying the above mentioned aspect of the present invention.

[0013] In a further aspect the present invention provides a radio telecommunications network according to the features of claim 5 configured to implement a method embodying the above mentioned aspect of the present invention.

Brief Description of Drawings

[0014] Preferred embodiments of the present invention will now be described by way of non-limiting example only with reference to the accompanying drawings, in which:

Figure 1 depicts a schematic diagram of a base station transmitter and two UEs operating in a network operating according to a first embodiment of the present invention;

Figure 2 depicts a schematic diagram of a base station transmitter and two UEs operating in a network operating according to a second embodiment of the present invention; and

Figure 3 shows various options for mapping bandwidth allocations for UEs having 5 MHz, 10 MHz, 15 MHz and 20 MHz reception capabilities in a 20 MHz bandwidth cell according to an embodiment of the present invention.

Best Mode for Carrying Out the Invention

[0015] It will be convenient to describe the preferred embodiments using terminology adopted by the 3GPP, however the present invention should not be considered as being limited to application in networks operating according to a 3GPP standard.

[0016] Preferred embodiments of the present invention will now be described in the context of a OFDMA telecommunications network having UEs with 5 MHz, 10 MHz, 15 MHz and 20 MHz reception bandwidth. It is assumed that the maximum reception bandwidth supported by the lowest capability UE in the network is 5 MHz. This is a reasonable assumption as current WCDMA UEs have a 5 MHz reception bandwidth, and it is expected that in the future UEs will at least support this standard. It is also assumed that UEs have a capability of receiving only one 5MHz wide MBMS data stream. This assumption is based on current Eel'6 3GPP specifications for MBMS in WCDMA networks. In the preferred embodiments the parameters for downlink transmission processing and transmission are as indicated in Table 1.

Table 1 - Parameters for downlink transmission scheme in a preferred embodiment

Transmission BW	1.25 MHz	2.5 MHz	5MHz	10 MHz	15 MHz	20 MHz
Sub-frame duration	0.5 ms					
Sub-carrier spacing	15kHz					
Sampling frequency	1.92 MHz (3.84/2 MHz)	3.84 MHz	7.68 MHz (2 x 3.84 MHz)	15.36 MHz (4 x 3.84 MHz)	23.04 MHz (6 x 3.84 MHz)	30.72 MHz (8 x 3.84 MHz)
FFT size	128	256	512	1024	1536	2048
Number of occupied sub-carriers	76	151	301	601	901	1201

[0017] It should be understood that the present invention is not limited to the particular exemplary bandwidths and UE capabilities described above but may be applicable generally to networks having scalable transmission bandwidths and UEs of differing reception bandwidth.

[0018] In summary, embodiments of the present invention operate by effectively defining a Single Frequency Network (SFN) within the network's transmission bandwidth, which is dedicated to the transmission of all MBMS services. The remaining transmission bandwidth of each cell can then be used to transmit uni- cast data. Preferably the SFN will be transmitted on a bandwidth equal to the standard UE MBMS reception bandwidth capability, which in the preferred embodiments, is assumed to be 5MHz. Additionally, in the illustrative embodiments each MBMS service will be sent in a separate transmission time interval (TTI). This enables an efficient sleep mode to be implemented in the UEs, as a UE only needs to receive the MBMS data in the TTI corresponding to the MBMS service (s) of interest. Because the MBMS signal on all cells is confined to the same transmission band, the time delay between received multipath signals will be relatively long. Therefore, when the network is transmitting MBMS data a long cyclic prefix (CP) will be used to cope with long delay and to relax inter cell synchronization requirements.

[0019] Two exemplary implementations of the present invention will now be described in relation to Figures 1 and 2

of the accompanying drawings.

[0020] Figure 1 shows a schematic view of a base transceiver station (BTS) 100 in communication with two UEs 102 and 104. The BTS 100 has a transmission bandwidth of 20 MHz whereas UE 102 has 5 MHz reception bandwidth and UE 104 has 20 MHz reception bandwidth. In the present example the BTS 100 is transmitting a MBMS service as well as unicast. Both UEs 102 and 104 are scheduled to receive the MBMS service whereas only UE 104 is intended to receive the uni-cast data.

[0021] In order to transmit both services simultaneously the BTS needs to multiplex the MBMS and uni-cast services. In the present embodiment, the network has allocated predefined portion of the frequency spectrum for all BTS to be used for transmission of MBMS services, thereby effectively defining a Single Frequency Network within the transmission spectrum of the network on which MBMS services will be transmitted.

[0022] In this example the BTS performs the multiplexing in the frequency domain, by assigning a first block of sub-carriers 106 for the transmission of the MBMS service and a second block of sub-carriers 108 for the transmission of the uni-cast service. All other BTS in the network will also assign the same block of sub-carriers to the transmission of MBMS services, and if they have a bandwidth larger than that band they can assign the remaining bandwidth to the transmission of uni-cast services.

[0023] After frequency multiplexing the data, the entire set of sub-carriers (which is 120-1 in this example, since the BTS 100 has 20MHz transmission bandwidth) is converted to a time domain signal, by inverse fast Fourier transform (IFFT) 110 block. The IFFT is applied to the entire frequency band of the transmitter to generate a time domain signal. In the illustrative embodiment the IFFT applied is a 2048 point IFFT, however other IFFT sizes can be used depending upon the available bandwidth of the transmitter (see table 1 above). Only one IFFT is conducted across the entire set of sub carriers, rather than conducting separate IFFTs on each camping band. This simplifies base transceiver station design as only one IFFT block whose size is only dependent on transmitter bandwidth is needed for each transmitter antenna.

[0024] As is typical to OFDMA systems, next a cyclic prefix is added to the time domain signal in a manner that will be known to those skilled in the art at 112. Because a single frequency network within the wider network has been defined, many BTS will be transmitting the same MBMS data at the same time, therefore it is possible for UEs to see many multipath signals with widely varying delays. Accordingly in transmit time intervals (TTIs) when an MBMS service is to be transmitted a long cyclic prefix is added to the time domain signal by block 112. Conversely, in TTIs where no MBMS service is to be transmitted a short cyclic prefix can be used, to minimise overhead.

[0025] This signal then undergoes further processing at 114 prior to transmission by a base station transmitter 116. The transmitted signal is then received by each of the UEs 102 and 104.

[0026] In order to receive the transmitted MBMS service, each of the UEs 102 and 104 tunes its carrier frequency to appropriate central frequency, i.e. the portion of the transmission spectrum on which the MBMS data is transmitted for UE 102 and the centre of the entire BTS transmission spectrum for UE 104.

[0027] Because of the reception bandwidth restrictions of UE 102, only a 5MHz portion of the entire 20MHz transmitted bandwidth is received by UE 102 using RF block 118-1. Conversely, because UE 104 has a 20 MHz reception bandwidth all of the transmitted bandwidth is received (using RF block 118-2), including the portion of the transmitted signal that carries the MBMS service.

[0028] Next the received signals undergo further RF processing and analogue to digital conversion (not shown). In the preferred embodiments the sampling frequency of digital samples at the output of A/D conversion block (not shown) is 7.68MHz for UE 102 and 30.72MHz for UE 104. The cyclic prefix is then removed in blocks 120-1 and 120-2, in UEs 102 and 104.

[0029] As noted above the length of the CP will vary depending on whether an MBMS service is being transmitted in a particular TTI. Accordingly the UE will need to be aware of the CP length changes when they occur. For UEs that are receiving MBMS services, e.g. UEs 102 and 104, this is relatively straightforward as these UEs will regularly monitor the Multicast control channel (MCCH) regularly. However, there may well be other UE in the network that are not subscribed to any MBMS services, or that are not capable of receiving MBMS. These UE will not monitor the MCCH, and therefore need another mechanism to know about CP length changes. In a first embodiment the UE can be left to perform blind detection of the CP length. This will be performed using standard methods known to those skilled in the art. Alternatively, the MCCH, or other control channel, can be designed so that all UEs receive signaling to tell them which TTIs contains a MBMS traffic channel (MTCH).

[0030] Returning to Figure 1, both UEs then perform an FFT in blocks 122-1 and 122-2 in UEs 102 and 104 respectively, to convert the time domain signal into a frequency domain signal. Because of the radio tuning step performed initially, the size of the FFT performed is dictated by the reception bandwidth of the UE, and not by the position of the desired sub-carriers within cell transmission band. As can be seen from Table 1, UE 102 will use always 512 point FFT, because it has a 5MHz reception bandwidth and is seeking to extract only the 301 sub-carriers containing the MBMS service. Similarly, UE 104 will always use always 2048 point FFT, because it has a 20MHz reception bandwidth.

[0031] Figure 2 shows a schematic view of a base transceiver station (BTS) 200 in communication with two UEs 202

and 204. As in Figure 1, the BTS 200 has a transmission bandwidth of 20 MHz and UEs 202 and 204 have 5 MHz and 20 MHz reception bandwidths respectively. In the present example the BTS 200 is transmitting a MBMS service as well as uni-cast. Both UEs 202 and 204 are scheduled to receive the MBMS service whereas only UE 204 is intended to receive the uni-cast data. This embodiment differs from that of Figure 1 in the multiplexing method used by the BTS. In this embodiment, rather than frequency multiplexing the MBMS data, converting the multiplexed signal to a time domain signal in one operation, this embodiment performs two separate IFFTs and combines the frequency multiplexed signals in the time domain. Turning to the figure, as in Figure 1, the MBMS data is confined to a first band of sub-carriers 206 and the uni-cast data is confined to a second group of sub-carriers 208. These bands 206 and 208 do not overlap and therefore there is no interference between the signals in each group of sub-carriers. In order to minimise the complexity of large reception bandwidth UEs, the MBMS sub-carrier block 206 is located at one edge of the transmission spectrum of the BTS. Each of the sets of sub-carriers 206 and 208 are separately converted into a time domain signal by IFFT blocks 210 and 212. In order to ensure orthogonality of the signals is maintained both IFFT blocks are of the same length and span the entire width of the transmission spectrum of the BTS 200.

[0032] Next the time domain signal carrying the uni-cast data has a cyclic prefix (CP) added by block 212. Since BTS 200 will be the only BTS transmitting this data a short CP is used for the uni-cast data signal. The time domain signal carrying the MBMS data also has a cyclic prefix (CP) added (by block 210). However, since other BTS will also transmit the same data, a long CP will be added by block 210.

[0033] The two time domain signals will then be added at 214 and will then undergo RF processing at 206 prior to transmission by a base station transmitter 218. The transmitted signal is then received by each of the UEs 202 and 204.

[0034] UE 202 operates in the same manner as UE 102 of Figure 1 and therefore will not be described in detail.

[0035] UE 204, however is different from the previous embodiment in that it has two RF processing parts to process the MBMS data and uni-cast data separately, consequently it also has two FFT blocks of different lengths. In UE 204 the received RF signal is split into two components, one being a 5MHz band carrying the MBMS data, which is processed by RF block 220, the other being a 15MHz band carrying the uni-cast data, which is processed by RF block 222.

[0036] Because the CP of the uni-cast signal and multi-cast signal are different, the two CP removal blocks are different to each other. The CP removal block 224 for the MBMS signal is configured to remove the long CP attached to the MBMS time domain signal, whereas the CP removal block 226 for the uni-cast signal is configured to remove the short CP attached to the uni-cast time domain signal.

[0037] In this embodiment, the UE will not need to be aware of the CP length changes since the CP removal block 224 is configured to only operate on MBMS data.

[0038] Next the two signals are converted to the time domain. The MBMS stream is converted using a 512 point FFT block 228, corresponding to the 5MHz wide MBMS transmission band defined in the network, and the uni-cast stream is converted using a 1536 point FFT block 230, corresponding to the remaining 15MHz wide reception bandwidth of UE 204. UE 204 will also have a FFT block with size 2048 for use when processing the full 20MHz bandwidth as one signal, which will add significantly to the complexity of the UE. As will be appreciated, MBMS (or other multicast services) will not be active in all TTIs. Therefore, UEs will not always need to receive, or be ready to receive, multi-cast data. Therefore there is a need for a certain level of signaling data relating to the transmission of MBMS data to be made by the network. In current networks complying with 3GPP Rel'6 the MBMS control channel (MCCH) is defined on a cell by cell basis. However in embodiments of the present invention where the MTCH is delivered via a single frequency network (SFN), this may not be the case and the MCCH could also be delivered via SFN.

[0039] In preferred embodiments of the present invention, the MBMS control and data channels shall be transmitted in the same frequency band in all cells in a MBMS Cell Group. This cell group will generally have the same transmission bandwidth as the defined MBMS reception capability of UEs in the network (which is assumed to be 5MHz in the present case). The information about which band is used for MBMS and configuration of MCCH (so that UE can receive MCCH) will be sent on broadcast channel from each cell in the cell group.

[0040] UEs interested in MBMS shall be required to read the MCCH at least once every modification period. In some circumstances this will mean that a UE will need to tune its RF from a camped band to the MBMS band to receive the MCCH. For example, Figure 3 illustrates an exemplary band allocation scheme for a 20 MHz bandwidth cell for UEs having 5 MHz, 10 MHz, 15 MHz and 20 MHz reception bandwidths. The cell bandwidth is indicated by a frequency axis 300, which is graduated in sub-carriers (rather than in Hz) illustrating a 1201 sub-carrier frequency range from f_{-600} to f_{+600} . Using the system parameters set out in Table 1 this can be seen to equate to a 20MHz transmission bandwidth. Block 302, which is centred on f_0 , is the common band in which the synch channel, BCH, PCH and SCH of the cell is transmitted. Bands 304 to 330 represent an exemplary set of possible "camping bands" for UEs operating in this 20MHz cell.

[0041] In Figure 3, if all MBMS control and data is transmitted in the central 5MHz band 300 i.e. the common band and a UE is camped on a non-center band, e.g. bands 314, 316, 318, 322 or 324 to 330, then the UE has to switch its RF in order to read the MCCH or to receive MTCH. In this case, if the system schedules MBMS and uni-cast data in consecutive TTI for that UE, it may not be possible for it to receive both TTIs as it will take some time for the UE to switch

its RF band.

[0042] This potential problem can be dealt with in one of several ways.

[0043] In the first embodiment the BTS's scheduler can be configured so as not to schedule uni-cast data, for UE's that need to switch RF frequencies to receive MBMS, for a predetermined number of TTIs before and/or after a burst of MBMS TTI(s). However because the scheduling takes place at the Node B MAC which does not know which UE is receiving which MBMS service at which TTI this solution requires the UEs to inform the Scheduler which MBMS service it is going to receive. This solution may not be ideal as uplink signaling can become quite expensive if multiple services are involved. Moreover the Scheduler must be configured to know the MCCH details.

[0044] In a preferred embodiment the UEs shall autonomously move, or request to move to camp on the MBMS band (e.g. the common band in the above example) and monitor shared channel in that band. In this case, the UE must signal the Scheduler to inform it that it has moved (or that it wants to move) to camp on the MBMS band. Whilst some uplink signaling is needed, it is far less than in the first embodiment.

[0045] In a further embodiment the system can simply moves UEs not camping on MBMS band into the MBMS band when MBMS data is to be transmitted. Again this solution is not ideal as some UEs are not receiving any MBMS services, and will be forced to share congested spectrum in that band.

[0046] In a fourth alternative a solution to this issue can be left to the UE. As in 3GPP Rel'6, the UE can be left to decide which services deserve priority. However, this solution will lead to wasted resources if scheduled uni-cast data is given lower priority than MBMS by a UE and the uni-cast data is not received due to RF switching between MBMS and Uni-cast bands.

[0047] The present invention should not be construed as being limited to the MBMS, reception, common and camping bands described herein, as the definition of such bands described above is somewhat arbitrary. More (or less) bands could be defined. For example in the 20MHz bandwidth cell, 15 MHz bands could be defined with any central frequency between f_{-150} and f_{+150} . Similarly 10MHz bands could be defined with centre frequencies anywhere between f_{-300} and f_{+300} . Also the common band could be defined at any point along the bandwidth of the cell. The present invention has been described in connection with the transmission of MBMS services, however it should be noted that the present invention is not limited to this application but can be applied to the transmission of other types of multi-cast data.

[0048] It will be noted that the description presented herein is limited to the case where cell bandwidth is 10MHz or more, since for lower cell bandwidths such as 5MHz (or below) all UE will be able to receive the whole transmission bandwidth, in which case both MBMS and Uni-cast data can be multiplexed in one TTI.

Claims

1. A method implemented in a base station (100; 200) used in a radio telecommunications network, the method comprising:

generating a time domain signal including uni-cast data (108; 208) and multimedia broadcast multicast service MBMS data (106; 206) in a transmission time interval TTI; and

transmitting the time domain signal to a user equipment (102, 104; 202, 204),

wherein a short cyclic prefix CP is used for the uni-cast data (108; 208) and a long CP is used for the MBMS data (106; 206),

wherein

the time domain signal is generated by performing two separate Inverse Fast Fourier Transform, IFFT, operations respectively on the uni-cast data (108; 208) and the MBMS data (106; 206) and combining the frequency multiplexed signals in the time domain, wherein both the IFFT operations are of the same length and span the entire width of the transmission spectrum of the base station;

characterised in that

the MBMS data (106; 206) is delivered via a single frequency network SFN;

an MBMS control channel and an MBMS data channel are transmitted in a single frequency band in a plurality of cells in an MBMS cell group; and uni-cast data (108; 208) is not scheduled for user equipments (102, 104; 202, 204) that need to switch RF frequencies to receive MBMS, for a predetermined number of the TTIs before and /or after a burst of MBMS TTIs.

2. The method according to claim 1,

wherein the uni-cast data (108; 208) is transmitted only from the base station (100; 200).

3. The method according to claim 1,

wherein the radio telecommunications network includes another base station (100; 200), and

wherein the MBMS data (106; 206) is transmitted from the base station (100; 200) and said another base station (100; 200).

4. A base station (100; 200) used in a radio telecommunications network, the base station (100; 200) comprising:

a generating means for generating a time domain signal including uni-cast data (108; 208) and multimedia broadcast multicast service MBMS data (106; 206) in a transmission time interval TTI;
 a transmitting means for transmitting the time domain signal to a user equipment (102, 104; 202, 204),
 wherein a short cyclic prefix CP is used for the uni-cast data (108; 208) and a long CP is used for the MBMS data (106; 206); and
 means for generating the time domain signal by performing two separate Inverse Fast Fourier Transform, IFFT, operations respectively on the uni-cast data (108; 208) and the MBMS data (106; 206) and combining the frequency multiplexed signals in the time domain, wherein both the IFFT operations are of the same length and span the entire width of the transmission spectrum of the base station;

characterised in that the base station further comprises:

means for delivering the MBMS data via a single frequency network SFN; and
 means for transmitting an MBMS control channel and an MBMS data channel in a single frequency band in a plurality of cells in an MBMS cell group; and
 scheduling means for not scheduling the uni-cast data (108, 208) for user equipments (102, 104; 202, 204) that need to switch RF frequencies to receive MBMS, for a predetermined number of TTIs before and/or after a burst of MBMS TTIs.

5. A radio telecommunications network comprising:

a base station (100; 200) adapted to transmit a time domain signal; and
 a user equipment (102, 104; 202, 204) adapted to receive the time domain signal,
 wherein the time domain signal includes uni-cast data (108; 208) and multimedia broadcast multicast service MBMS data (106; 206) in a transmission time interval TTI, and
 wherein a short cyclic prefix CP is used for the uni-cast data (108; 208) and a long CP is used for the MBMS data (106; 206),
 wherein
 the base station is adapted to generate the time domain signal by performing two separate Inverse Fast Fourier Transform, IFFT, operations respectively on the uni-cast data (108; 208) and the MBMS data (106; 206) and combining the frequency multiplexed signals in the time domain, wherein both the IFFT operations are of the same length and span the entire width of the transmission spectrum of the base station;
characterised in that
 the base station is adapted to deliver the MBMS data (106; 206) via a single frequency network (SFN); and
 the base station is adapted to transmit an MBMS control channel and an MBMS data channel in a single frequency band in a plurality of cells in an MBMS cell group ; and
 the base station's scheduler is adapted to not schedule the uni-cast data (108, 208) for user equipments (102, 104; 202, 204) that need to switch RF frequencies to receive MBMS, for a predetermined number of TTIs before and/or after a burst of MBMS TTIs.

Patentansprüche

1. Verfahren, das in einer in einem Funktelekommunikationsnetz verwendeten Basisstation (100; 200) implementiert ist, umfassend:

Erzeugen eines Zeitbereichssignals umfassend Unicast-Daten (108; 208) und Multimedia-Rundesende-Multicast-Service-MBMS-Daten (106; 206) in einem Übertragungszeitintervall TTI; und
 Übertragen des Zeitbereichssignals an ein Benutzergerät (102, 104; 202, 204),
 wobei ein kurzes zyklisches Präfix CP für die Unicast-Daten (108; 208) verwendet wird und ein langes CP für die MBMS-Daten (106; 206) verwendet wird,
 wobei
 das Zeitbereichssignal erzeugt wird, indem zwei getrennte inverse schnelle Fourier-Transformations-IFFT-Operationen an den Unicast-Daten (108; 208) bzw. den MBMS-Daten (106; 206) durchgeführt werden und die

frequenzgemultiplexten Signale in dem Zeitbereich kombiniert werden, wobei die beiden IFFT-Operationen von der gleichen Länge sind und die gesamte Breite des Übertragungsspektrums der Basisstation überspannen; **dadurch gekennzeichnet, dass**

die MBMS-Daten (106; 206) über ein Einzelfrequenznetz SFN geliefert werden;

ein MBMS-Steuerkanal und ein MBMS-Datenkanal in einem Einzelfrequenzband in einer Mehrzahl Zellen in einer MBMS-Zellengruppe übertragen werden; und

Unicast-Daten (108; 208) für eine vorbestimmte Anzahl der TTIs vor und/oder nach einem Burst von MBMS-TTIs nicht für Benutzergeräte (102, 104; 202, 204) geplant sind, die RF-Frequenzen schalten müssen, um MBMS zu empfangen.

2. Verfahren nach Anspruch 1, wobei die Unicast-Daten (108; 208) nur von der Basisstation (100; 200) übertragen werden.

3. Verfahren nach Anspruch 1, wobei das Funktelekommunikationsnetz eine weitere Basisstation (100; 200) umfasst und wobei die MBMS-Daten (106; 206) von der Basisstation (100; 200) und der weiteren Basisstation (100; 200) übertragen werden.

4. Basisstation (100; 200), die in einem Funktelekommunikationsnetz verwendet wird, wobei die Basisstation (100; 200) umfasst:

Erzeugungsmittel zum Erzeugen eines Zeitbereichssignals umfassend Unicast-Daten (108; 208) und Multimedia-Rundesende-Multicast-Service-MBMS-Daten (106; 206) in einem Übertragungszeitintervall TTI; und Übertragungsmittel zum Übertragen des Zeitbereichssignals an ein Benutzergerät (102, 104; 202, 204), wobei ein kurzes zyklisches Präfix CP für die Unicast-Daten (108; 208) verwendet wird und ein langes CP für die MBMS-Daten (106; 206) verwendet wird,

Mittel zum Erzeugen des Zeitbereichssignals, indem zwei getrennte inverse schnelle Fourier-Transformations-IFFT-Operationen an den Unicast-Daten (108; 208) bzw. den MBMS-Daten (106; 206) durchgeführt werden und die frequenzgemultiplexten Signale in dem Zeitbereich kombiniert werden, wobei die beiden IFFT-Operationen von der gleichen Länge sind und die gesamte Breite des Übertragungsspektrums der Basisstation überspannen;

dadurch gekennzeichnet, dass die Basisstation weiterhin umfasst:

Mittel zum Liefern der MBMS-Daten (106; 206) über ein Einzelfrequenznetz SFN; und

Mittel zum Übertragen eines MBMS-Steuerkanals und eines MBMS-Datenkanals in einem Einzelfrequenzband in einer Mehrzahl Zellen in einer MBMS-Zellengruppe; und Planungsmittel, um Unicast-Daten (108; 208) für eine vorbestimmte Anzahl der TTIs vor und/oder nach einem Burst von MBMS-TTIs nicht für Benutzergeräte (102, 104; 202, 204) zu planen, die RF-Frequenzen schalten müssen, um MBMS zu empfangen.

5. Funktelekommunikationsnetz umfassend:

eine Basisstation (100; 200), die eingerichtet ist, um ein Zeitbereichssignal zu übertragen; und

ein Benutzergerät (102, 104; 202, 204), das eingerichtet ist, um das Zeitbereichssignal zu empfangen;

wobei das Zeitbereichssignal Unicast-Daten (108; 208) und Multimedia-Rundesende-Multicast-Service-MBMS-Daten (106; 206) in einem Übertragungszeitintervall TTI umfasst, und

wobei ein kurzes zyklisches Präfix CP für die Unicast-Daten (108; 208) verwendet wird und ein langes CP für die MBMS-Daten (106; 206) verwendet wird,

wobei

die Basisstation eingerichtet ist, um das Zeitbereichssignal zu erzeugen, indem zwei getrennte inverse schnelle Fourier-Transformations-IFFT-Operationen an den Unicast-Daten (108; 208) bzw. den MBMS-Daten (106; 206) durchgeführt werden und die frequenzgemultiplexten Signale in dem Zeitbereich kombiniert werden, wobei die beiden IFFT-Operationen von der gleichen Länge sind und die gesamte Breite des Übertragungsspektrums der Basisstation überspannen;

dadurch gekennzeichnet, dass

die Basisstation eingerichtet ist, um die MBMS-Daten (106; 206) über ein Einzelfrequenznetz SFN zu liefern; und die Basisstation eingerichtet ist, um einen MBMS-Steuerkanal und einen MBMS-Datenkanal in einem Einzelfrequenzband in einer Mehrzahl Zellen in einer MBMS-Zellengruppe zu übertragen; und

der Steuerer der Basisstation eingerichtet ist, um die Unicast-Daten (108; 208) für eine vorbestimmte Anzahl der TTIs vor und/oder nach einem Burst von MBMS-TTIs nicht für Benutzergeräte (102, 104; 202, 204) zu planen, die RF-Frequenzen schalten müssen, um MBMS zu empfangen.

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Revendications

1. Procédé implémenté dans une station de base (100 ; 200) utilisée dans un réseau de radiotélécommunications, le procédé comprenant :

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la génération d'un signal de domaine temporel incluant des données de diffusion individuelle (108 ; 208) et des données de service de diffusion/multidiffusion multimédia MBMS (106 ; 206) dans un intervalle de temps de transmission TTI ; et

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la transmission du signal de domaine temporel à un équipement utilisateur (102, 104 ; 202, 204), dans lequel un préfixe cyclique CP court est utilisé pour les données de diffusion individuelle (108 ; 208) et un CP long est utilisé pour les données MBMS (106 ; 206), dans lequel

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le signal de domaine temporel est généré en réalisant deux opérations de transformée de Fourier rapide inverse, IFFT, respectivement séparées sur les données de diffusion individuelle (108 ; 208) et les données MBMS (106 ; 206) et en combinant les signaux multiplexés en fréquence dans le domaine temporel, dans lequel les deux opérations d'IFFT ont la même longueur et couvrent la largeur entière du spectre de transmission de la station de base ;

caractérisé en ce que

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les données MBMS (106 ; 206) sont délivrées via un réseau monofréquence SFN ; un canal de commande MBMS et un canal de données MBMS sont transmis dans une bande de monofréquence dans une pluralité de cellules dans un groupe de cellules MBMS ; et les données de diffusion individuelle (108 ; 208) ne sont pas planifiées pour les équipements utilisateurs (102, 104 ; 202, 204) qui ont besoin de commuter des fréquences RF pour recevoir le MBMS, pour un nombre prédéterminé de TTI avant et/ou après une rafale de TTI de MBMS.

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2. Procédé selon la revendication 1, dans lequel les données de diffusion individuelle (108 ; 208) sont transmises uniquement à partir de la station de base (100 ; 200).

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3. Procédé selon la revendication 1, dans lequel le réseau de radiotélécommunications comprend une autre station de base (100 ; 200), et dans lequel les données MBMS (106 ; 206) sont transmises à partir de la station de base (100 ; 200) et de ladite autre station de base (100 ; 200).

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4. Station de base (100 ; 200) utilisée dans un réseau de radiotélécommunications, la station de base (100 ; 200) comprenant :

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un moyen de génération destiné à générer un signal de domaine temporel incluant des données de diffusion individuelle (108 ; 208) et des données de service de diffusion/multidiffusion multimédia MBMS (106 ; 206) dans un intervalle de temps de transmission TTI ;

un moyen de transmission destiné à transmettre le signal de domaine temporel à un équipement utilisateur (102, 104 ; 202, 204),

dans laquelle un préfixe cyclique CP court est utilisé pour les données de diffusion individuelle (108 ; 208) et un CP long est utilisé pour les données MBMS (106 ; 206) ; et

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un moyen de génération du signal de domaine temporel en réalisant deux opérations de transformée de Fourier rapide inverse, IFFT, respectivement séparées sur les données de diffusion individuelle (108 ; 208) et les données MBMS (106 ; 206) et en combinant les signaux multiplexés en fréquence dans le domaine temporel, dans lequel les deux opérations d'IFFT ont la même longueur et couvrent la largeur entière du spectre de transmission de la station de base ;

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caractérisée en ce que la station de base comprend en outre :

un moyen de délivrance des données MBMS via un réseau monofréquence SFN ; et

un moyen de transmission d'un canal de commande MBMS et d'un canal de données MBMS dans une

bande de monofréquence dans une pluralité de cellules dans un groupe de cellules MBMS ; et
 un moyen de planification destiné à ne pas planifier les données de diffusion individuelle (108 ; 208) pour
 des équipements utilisateurs (102, 104 ; 202, 204) qui ont besoin de commuter des fréquences RF pour
 recevoir le MBMS, pour un nombre prédéterminé de TTI avant et/ou après une rafale de TTI de MBMS.

5. Réseau de radiotélécommunications comprenant :

une station de base (100 ; 200) adaptée pour transmettre un signal de domaine temporel ; et
 un équipement utilisateur (102, 104 ; 202, 204) adapté pour recevoir un signal de domaine temporel,
 dans lequel le signal de domaine temporel inclut des données de diffusion individuelle (108 ; 208) et des données
 de service de diffusion/multidiffusion multimédia MBMS (106 ; 206) dans un intervalle de temps de transmission
 TTI, et

dans lequel un préfixe cyclique CP court est utilisé pour les données de diffusion individuelle (108 ; 208) et un
 CP long est utilisé pour les données MBMS (106 ; 206),

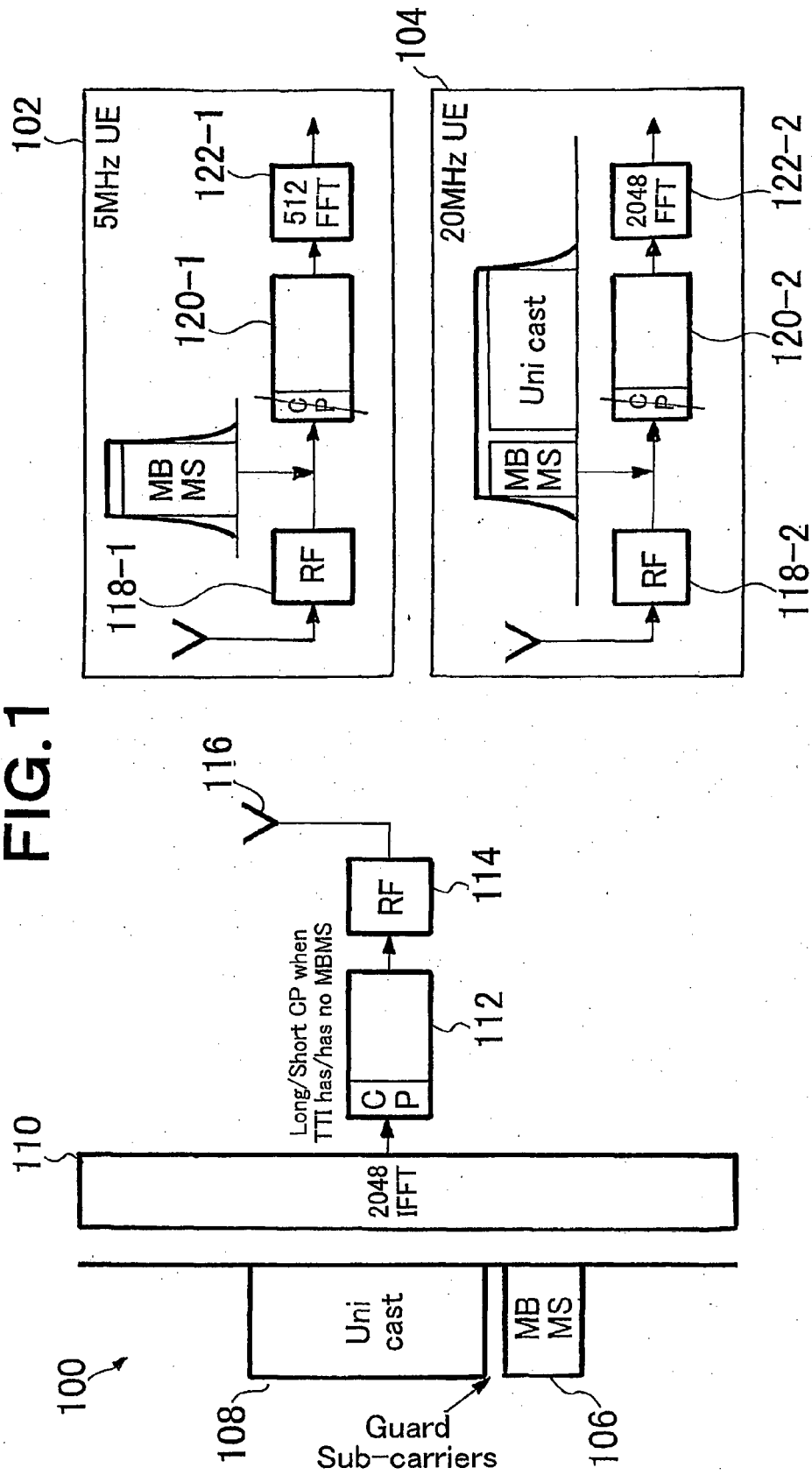
dans lequel

la station de base est adaptée pour générer le signal de domaine temporel en réalisant deux opérations de
 transformée de Fourier rapide inverse, IFFT, respectivement séparées sur les données de diffusion individuelle
 (108 ; 208) et les données MBMS (106 ; 206) et en combinant les signaux multiplexés en fréquence dans le
 domaine temporel, dans lequel les deux opérations d'IFFT ont la même longueur et couvrent la largeur entière
 du spectre de transmission de la station de base ;

caractérisé en ce que

la station de base est adaptée pour délivrer les données MBMS (106 ; 206) via un réseau monofréquence SFN ; et
 la station de base est adaptée pour transmettre un canal de commande MBMS et un canal de données MBMS
 dans une bande de monofréquence dans une pluralité de cellules dans un groupe de cellules MBMS ; et
 un planificateur de station de base est adapté pour ne pas planifier les données de diffusion individuelle (108 ;
 208) pour des équipements utilisateurs (102, 104 ; 202, 204) qui ont besoin de commuter des fréquences RF
 pour recevoir le MBMS, pour un nombre prédéterminé de TTI avant et/ou après une rafale de TTI de MBMS.

FIG. 1



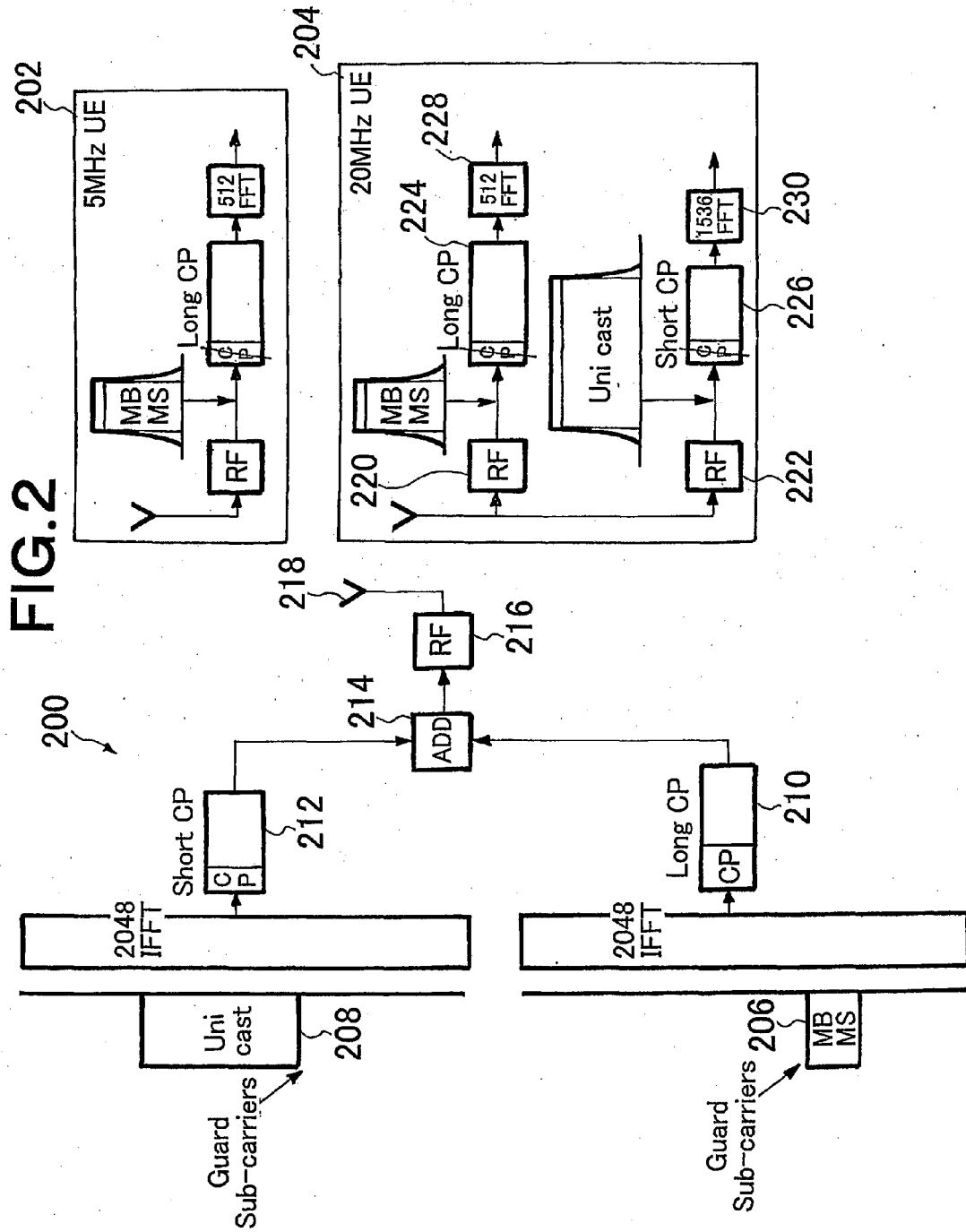
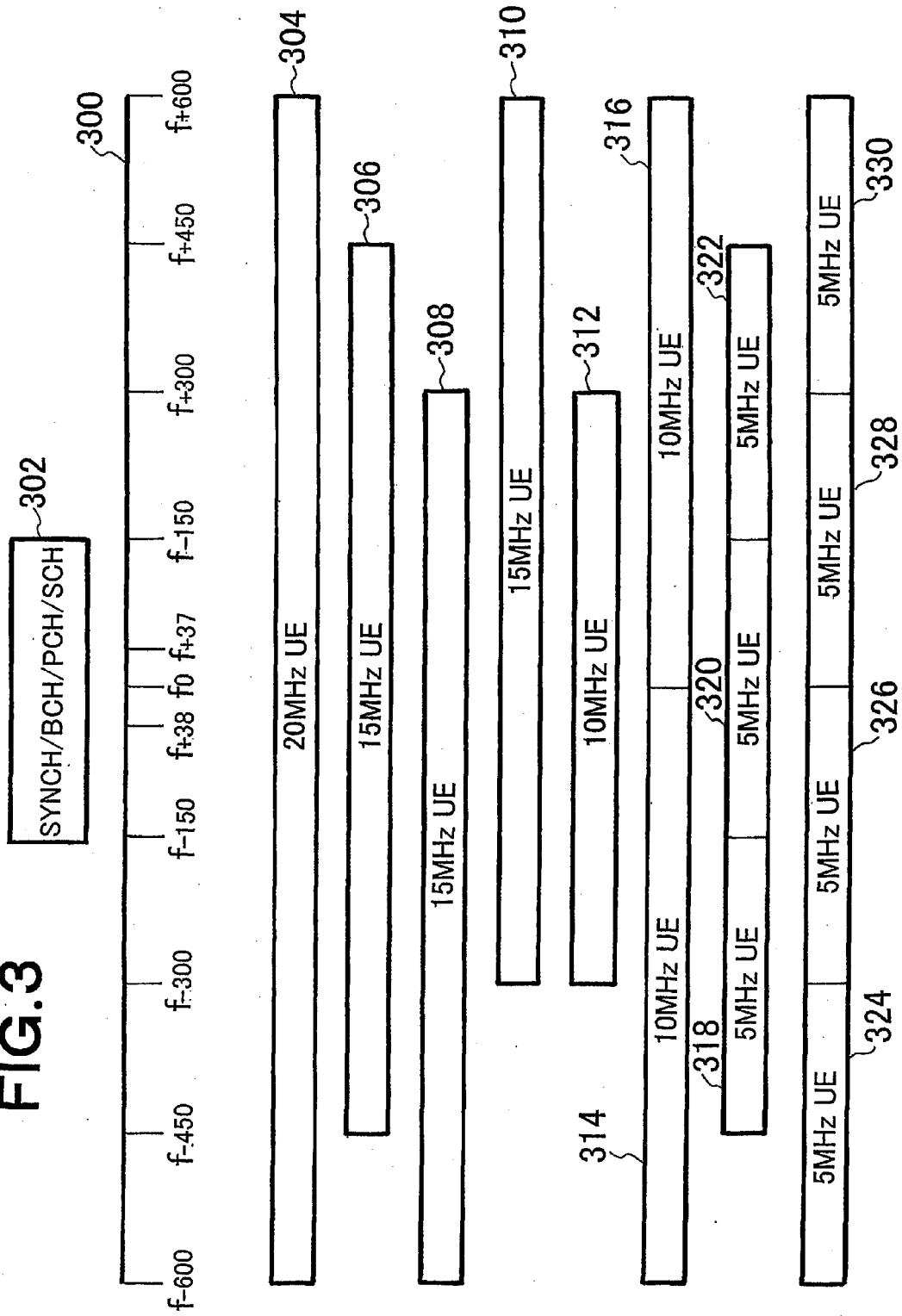


FIG. 3



REFERENCES CITED IN THE DESCRIPTION

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