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(54) Procedure for the identification of transmitter or region in common-wave broadcasting networks

(57) The invention concerns a procedure for use in common-wave radio broadcasting.
For common-wave broadcasting, it is necessary for the modulation content of the transmitter frequencies of the individual broadcasting stations to be identical.
In order to make transmitter or regional identification possible, however, one or more additional carrier frequencies, which differ from each other from region to region, are emitted, reception of these additional carrier frequencies making it possible to select at the receiver specialized regional news.
The number of additional carrier frequencies required can be reduced to four individual frequencies or groups of frequencies if the additional carrier signals are modulated with identification signals.

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Description

A high-quality radio transmission meeting the quality standards required by digital storage media (compact disk, DAT) is impossible using present analogue FM-transmission procedures, particularly in case of reception in moving motor vehicles or in mobile devices. Fluctuations in field strength and multipath reception lead to distorted signals, with their consequences can be reduced only partially by tricky alternating strategies using alternative receiver frequencies (e.g., in connection with the radio data system, RDS).

Digital radio transmission for the mobile reception using satellites is presently still prevented by the mandatory use of receiver antennas with a distinct alignment capacity, necessary due to the relatively low transmission power.

For this reason, for several years a standard is being developed for a novel, terrestrial, digital transmission process, known under the title "DAB" (Digital Audio Broadcasting) (here see: "Funkschau – Spezial": "Digitaler Ton – von Hörfunk bis Mobiltelefon", (Radio show – special, digital sound – from radio to mobile telephone), 1989, pages 9 – 18).

One of the specifics of the planned transmission network is the common-wave radio operation of transmitter stations participating within the scope of a nationwide radio program. This means that in a certain region all transmitter stations simultaneously emit transmission signals with the same modulation content on the very same transmission frequency and/or the same carrier frequencies. Here, the so-called COFDM-method (Coded Orthogonal Frequency Division Multiplex) is provided as the transmission procedure, by which within a region, e.g., the transmission area of a statewide radio station, utilizing a carrier frequency – bandwidth of e.g., 1.5 MHz, simultaneously approx. 5…6 stereo programs can be broadcasted (in addition to data related to or independent from said programs). Within the channel bandwidth available here a plurality of individual carriers (e.g., 448 carrier frequencies equidistantly spaced over the frequency axis) is impinged with a 4-DPSK-modulation (DPSK –

Differential Phase Shift Keying). By scrambling the digital program data within the sequence and the allocation to individual carrier frequencies it is prevented that any transmission errors, caused by fluctuations in field strength, extend over long, temporarily continuous signal sections, and thus they can be corrected more easily.

A detailed explanation of the principle transmission and coding procedures is discernible from the article "Digital Sound Broadcasting to Mobil Receivers" in the publication "IEE Transactions in Consumer Electronics", Vol. 35, no. 3, Aug. 89, pages 439 – 503.

In order to design a radio network covering several states it is necessary to provide a minimum of 4 different transmission channels of a certain bandwidth B such that the different programs of the individual transmission regions are prevented from interfering each other. With the help of these four different transmission channels it is possible to plan the individual transmission regions in the form of a 4-part cluster such that an inter-regional and/or international transmission network shows no abutting zones to different programs with simultaneously an identical transmission frequency.

Therefore a frequency band with a bandwidth totaling 4 x B is required to implement the common-wave broadcasting of the DAB – radio transmission. Of course, by using the other 3 cluster frequencies a network of locally limited transmitters can be installed within a certain transmission region, so that in addition to the 5…6 nationwide programs additionally 6 to 18 local programs can be broadcasted.

As mentioned at the outset, the common-wave broadcasting of e.g., a nationwide transmission network requires the 100-percent consistency of the modulation content of the frequency portions simultaneously emitted by the individual transmitter stations, in order to allow a flawless decoding of the program data. Due to the fact that the future DAB-network shall additionally handle the tasks of the present FM-radio network e.g., any nationwide broadcasting of traffic news contradicts the necessity to transmit to the vehicle operators targeted regional or local traffic information. Additionally, the vehicle operator transferring from one transmission region to an adjacent one shall be provided with rough information of location in order to allow him/her to automatically or manually adjust the receiver to the receiver channel or the neighboring region.

Accordingly the objective of the invention is to provide a procedure for the identification of transmitter or region, which abstains from interfering with the common-wave operation of the transmission network. The method shall additionally be capable to transmit additional transmission data, unrelated to the region.

This objective is attained in the common-wave transmission procedure defined in the preamble of claim 1 by the features mentioned in the characterizing part of claim 1. Additional advantageous embodiments of the invention are disclosed in the dependent claims 2 - 6.

In the following the invention is explained in greater detail based on the drawings:

They show:

Fig. 1a the arrangement of the carrier frequencies for a statewide common-wave network;

Fig. 1b the arrangement of the carrier frequencies according to Fig. 1a, however with additional transmitter and/or regional identification;

Fig. 2 the frequency distribution diagram in the form of a 4-part cluster.

According to Fig 1a, in the DAB – broadcasting method within a statewide transmission region (e.g., 448) carrier frequencies are transmitted simultaneously with equidistant frequency distances Δf in a frequency range with the bandwidth B. The individual carriers are each modulated with one part of the digital data, with the modulation content of the individual carries being identical for all transmitter stations of the transmission region. When operation occurs in the time multiplex system here the data of different programs are transmitted within the data packages in a temporal sequence such that for a program change within the programs offered by a certain transmitter station no change of the adjustment frequencies is necessary in the receiver but only a switch of the time - allocated decoding of the data packages. The data content of a program is not limited to radio signals but can also comprise partially or entirely information or control data (e.g., image transmission or control data (e.g., image transmission or traffic control information).

Outside the transmission region of a state broadcast station with the carrier frequency range B_1, of course a transmitter with a different program offer cannot use the same carrier frequencies, because in the overlapping area of both transmission regions then any unambiguous program decoding is no longer possible.

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Accordingly, a separate carrier frequency range B_2 must be allocated to this adjacent broadcast region. It is discernible from Fig. 2 that, assuming at least four different frequency ranges $B_1 \ldots B_4$, a frequency planning can be prepared in which regions with identical carrier frequency ranges are not abutting each other (cf. 4-color display of political maps).

However, within one transmission region additionally locally limited transmitters can be embedded with different program offers, if the other three cluster frequencies are allocated thereto and it is ensured that their transmission cannot penetrate into the adjacent transmission regions with the same carrier frequency range.

In order to ensure a flawless common-wave operation within a transmission region it is mandatory that all carrier frequencies used for transmitting programs or data are impinged with respectively identical modulation content, i.e. a regional or transmitter-specific identification is impossible within the program information. However, in order to allow e.g. a targeted selection from the nationwide prepared traffic information for traffic news or the detection of a regional standard alarm message it is necessary to allow via particular transmitter identification a rough local orientation to the receiver. Here, all transmitters of a certain region may be provided with the same identification when the message is not only of regional importance. In order to detect which particular transmitter station is the closest within the nationwide common-wave broadcast network of the receiver the field strength and/or the number or temporal sequence of the received echo of the receiver signal provided with particular identification can be evaluated.

According to Fig. 1b the identification can occur via n non-modulated carrier frequencies (dot-dash frequency lines n·3…n), which are transmitted in addition to the carrier frequencies l…m used for program transmission according to Fig. 1a. These additional n carriers may be inserted within or outside the frequency band required for program transmission at any position, however only within the predetermined frequency grid. In any case here the bandwidth to be transmitted expands from B to B'. The arrangement of the additional carrier frequencies in the frequency range to be transmitted allows a plurality of variations of the identification.

The additional carrier frequencies required for transmitter identification lead to a large number of transmitter stations within a transmission region and to a considerable expansion of the frequency bandwidth B' to be transmitted. This disadvantage can be avoided when one or more of these additional carriers are modulated with a particular identification signal. In order to prevent interfering with common-wave broadcasting, similar to Fig. 2 here at least four groups of additional carriers may be provided, with their regional use being planned such that no mutual interference develops. The identification signals are modulated on the additional carriers in the same manner as the COFDM procedure.

By the modulation of the additional carriers with identification signals here arbitrary numbers of secondary common-wave networks can be formed in reference to the additional carriers within wide-area common-wave broadcasting.

In order to transmit regionally independent data the additional carriers may also be modulated e.g., with switching or synchronizing signals. Due to the fact that sufficient time is provided for the evaluation of the additional signals and/or error safety is ensured within the transmission capacity of an individual additional carrier by sufficient redundancy, here the additional frequencies required can be limited in most cases to one additional carrier each, instead of an entire group.

By using the transmitter or regional identification it is additionally possible during mobile reception in the international traffic to detect in due time the transfer into an adjacent broadcasting region with a different program offer. Here, the orientation occurs by a comparison of the received identification with the identification list allocated to the broadcast landscape, stored in an internal device storage. This way the receiver can be adjusted manually or automatically to the group of carrier frequencies of the new broadcasting region as soon as the receiver quality of the previously received transmitter signal is no longer sufficient.

Claims

1. A method for the wireless transmission of digital information and/or control signals in common-wave broadcasting with a plurality of individual carriers, respectively modulated with a portion of the desired signal, characterized in that one or more additional, regionally different individual carrier frequencies are transmitted for identifying the respective transmitting station or for marking a certain broadcast region, with their presence being evaluated for transmitter identification, and which prevent any interference of information in the common-wave broadcasting.
2. A method according to claim 1, characterized in that the additional carrier frequencies in the common-wave broadcasting network allocated to the individual transmitter stations or regions are distributed over at least four groups (4-part cluster) such that the same frequencies can be used simultaneously in transmitting regions sufficiently distant from each other, and that this additional carrier frequencies are modulated with particular identification signals for the identification of the transmitter or region.
3. A method according to claim 2, characterized in that in common-wave broadcast networks, modulated according to the COFDM method, the identification signals are modulated on the additional carriers according to the same method.
4. A method according to claim 2, characterized in that for the identification of transmitters or regions only a single additional carrier is used per group, modulated with an identification signal.
5. A method according to one of claims 2 to 4, characterized in that the additional carrier frequencies allocated to the individual transmitter stations or regions are not only provided with identification signals but are also modulated with additional data, not necessarily related to the region.
6. A method according to one of claims 1 to 4, characterized in that secondary common-wave networks are formed within one common-wave broadcast network, designed in the form of clusters, using one or more identification carriers per cluster.

Here, 2 page(s) of drawings

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Drawings page 1

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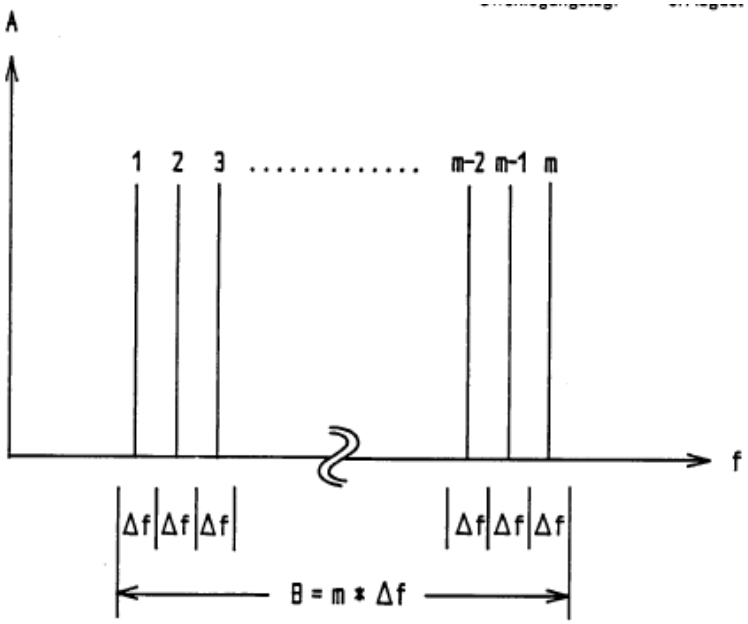

FIG. 1a

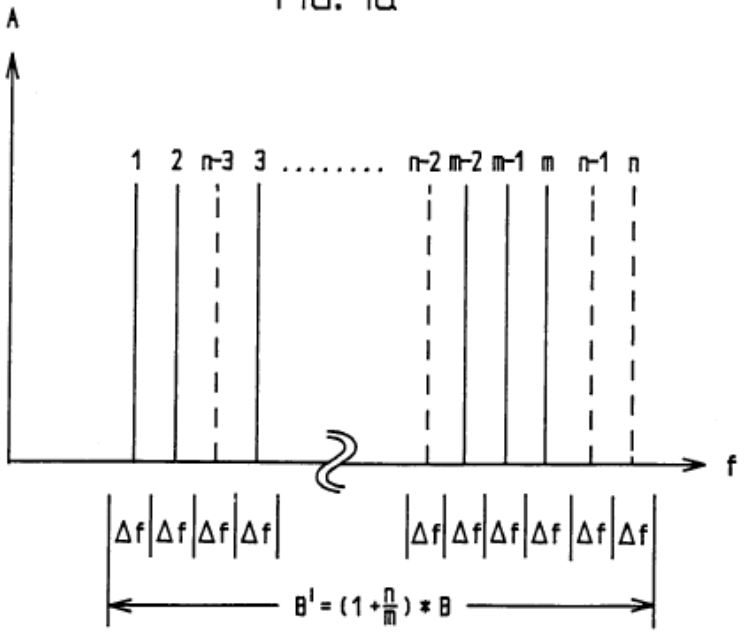

FIG. 1b

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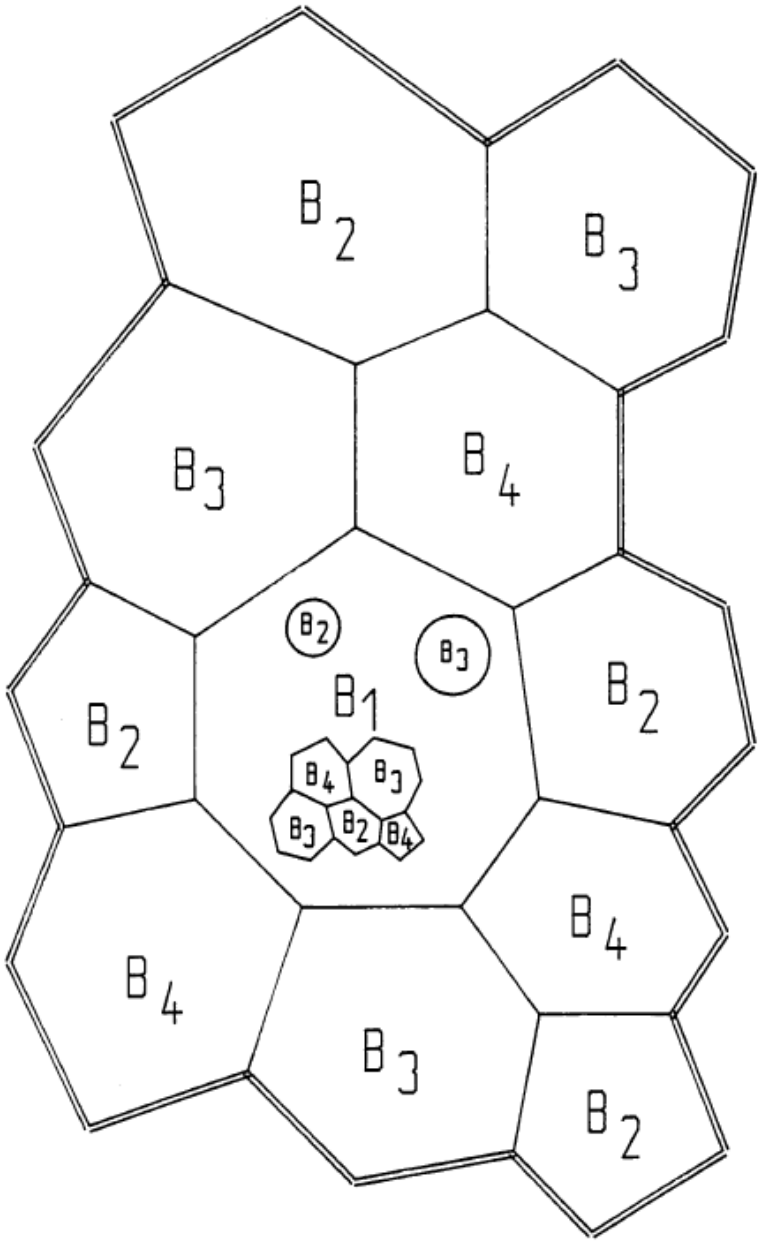

FIG. 2

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