Appeal decision

Appeal No. 2015-1247

France
Appellant ALCATEL-LUCENT LTD.

Tokyo, Japan
Patent Attorney OKABE, Yuzuru

Tokyo, Japan
Patent Attorney YOSHIZAWA, Hiroshi

The case of appeal against an examiner's decision of refusal of Japanese Patent Application No. 2012-516464, entitled "Method and device for processing component carriers to be aggregated for transmission" (International Publication No. WO2010-148530 dated December 29, 2010, and national publication of the translated version National Publication of International Patent Application No. 2012-531127 dated December 6, 2012) has resulted in the following appeal decision:

Conclusion

The appeal of the case was groundless.

Reason

1 History of the procedures

The present application was originally filed on June 22, 2009 as an International Patent Application, and a decision of refusal was issued on September 17, 2014. In response to this, a demand for appeal against the decision of refusal was made on January 22, 2015, and, in conjunction with this, a written amendment was submitted. However, a notice of reasons for refusal was issued on August 20 of the same year in the body. Then, with respect to this, a written opinion was submitted on November 24 of the same year.

2 The Invention

It is recognized that the invention according to claim 1 of the present application (hereinafter, referred to as "the Invention") is as follows as described in claim 1 of the scope of claims of the written amendment submitted on January 22, 2015.

"A method for processing multiple Component Carriers (CCs) to be aggregated for transmission, comprising steps of:

acquiring a time domain signal of each of the multiple CCs;

applying multiple fixed phase rotations respectively to the acquired time domain signal by utilizing multiple phase rotation values in a set of phase rotations, so as to obtain multiple phase rotation versions of each CC;

selecting one of the multiple phase rotation versions of each CC to respectively constitute each of multiple candidate transmission groups, and acquiring an amplitude sum of the phase rotation versions for each of the multiple candidate transmission groups;

determining a candidate transmission group having a minimum amplitude sum; and

transmitting multiple phase rotation versions in the determined candidate transmission group having the minimum amplitude sum, wherein

the method is applied to a Long Term Evolution-Advanced (LTE-A) system."

3 Cited invention

In Japanese Unexamined Patent Application Publication No. 2009-55395 (hereinafter, referred to as "the Cited Document 1") cited in the reason for refusal by the body, there are described the following matters as well as drawings, relating to [Background Art] of "Peak power reduction device in communication apparatus" (Title of Invention).

"[Background Art]

[0002]

Currently, as a communication system using multi-carriers, there are known an MC-CDMA (multi-carrier code division multiple access) method and an OFDM (Orthogonal Frequency Division Multiplex) method. In the MC-CDMA method, co-channel interference is reduced because dispersion is carried out in time domain, and, an OFDM system is used as a digital broadcast system and a wireless LAN system, and is considered to be a strong candidate of a next-generation mobile communication system. This OFDM system performs multi-carrier transmission, and, therefore, the frequency utilization efficiency is high, and also it is strong against frequency selective fading. In addition, by giving a guard interval (GI: GuardInterval), influence of multipath can be mitigated. In the meantime, in a communication system using multi-carriers, modulation signals of a plurality of sub-carriers are synthesized, and, therefore, its transmission peak power becomes a high value in comparison with that of a modulation signal of a single carrier. In particular, peak power of an OFDM signal made by synthesizing sub-carriers that are orthogonal to each other shows a large peak power value in comparison with that of a conventional single carrier modulation signal, and, by this, a peak power to average power ratio (PAPR) of a transmission signal is large, thereby inevitably deteriorating transmission quality. Moreover, when peak power is large, a power amplifier having large maximum transmission power needs to be used in an OFDM system, resulting in decrease of power efficiency, increase in power consumption, and an increase in cost, because enlargement of a back-off that is a difference between an average value of transmission signal power and the maximum transmission power of a power amplifier is required for the power amplifier.

[0003]

Therefore, in order to solve this problem, various peak power reduction methods have been examined conventionally. For example, there are: a clipping method to deform a signal in advance so as to make a peak power value become a setting value; an encoding method using error-correcting codes so as to make a code word having high

peak power not be detected; a selected mapping method (Selected Mapping) to make a modulation signal of each sub-carrier phase-rotate and make, from a plurality of phase rotation pattern candidates, optimum phase rotation be performed; a partial transmit sequence method (PTS: Partial Transmit Sequence) to divide sub-carriers for each block and make the divided sub-carriers phase rotate after applying inverse fast Fourier transform (IFFT) so as to mitigate the number of times of calculation processing of the selected mapping method; and a linear scaling method to perform compression and amplification of the amplitude of a transmission signal linearly, and so on.
When the content of processing of the partial transmit sequence (PTS) is described, in PTS, first, sub-carriers modulated by first modulated transmission symbols are divided into B blocks. Next, the divided sub-carriers undergo IFFT for each block, and are synthesized into sub-carriers of each block. Phase rotation is performed on the synthesized time axis waveform for each block, the phase-rotated time axis waveforms are added to generate an OFDM symbol, and the OFDM symbol waveform is stored in a memory.
[0004]

Here, given that the number of candidates of phase rotation is L, L^B (= U) can be obtained as the number of patterns of phase rotation. Then, after carrying out phase rotation to time axis waveforms after IFFT in all of the U patterns, an OFDM symbol waveform in each pattern made by adding time axis waveforms is stored in a memory. Among OFDM symbol waveforms of respective patterns stored in the memory, a sample having the highest peak power value Pi,uMAX (i: a symbol number, u: a pattern number (u = 1, 2 ... U)) is selected, Pi,uMAX of each of the U patterns are compared, PiMAX of the minimum peak power value (= MIN[Pi,uMAX]) is selected among those, and the OFDM symbol of the selected pattern is transmitted. This OFDM symbol is arranged such that the phase rotation pattern in question is notified to the receiver side to restore the waveform signal before phase rotation in the receiver side. In the receiver side, based on control information of the phase rotation pattern transmitted from the transmitting end, restoration to the waveform signal of the original phase is carried out by applying phase rotation opposite that of the transmitting end."

In view of the statements and the drawings of the above-mentioned Cited Document 1 and the common general technical knowledge in this field, it is recognized that there is described, in the above-mentioned Cited Document 1, the following invention (hereinafter, referred to as "the Cited Invention").

"A partial transmit sequence method, comprising steps of: dividing sub-carriers modulated by a first modulated transmission symbol into B blocks; performing IFFT to the divided sub-carriers for each block to synthesis sub-carriers of each block; performing phase rotation to the synthesized time axis waveform for each block; generating an OFDM symbol by adding time axis waveforms having undergone phase rotation (here, given that the number of candidates of phase rotation is L, L^B (= U) can be obtained as the number of phase rotation patterns); after carrying out phase rotation to the time axis waveforms after IFFT in all of the U patterns, selecting, among OFDM symbol waveforms of respective patterns, a sample having the highest peak power value Pi,uMAX (i: a symbol number, u: a pattern number (u = 1, 2 ... U)); comparing Pi,uMAX of each of the U patterns to select PiMAX of the minimum peak power value

(= MIN[Pi,uMAX]) among those; and transmitting the OFDM symbol of the selected pattern."

4 Comparison / judgment

In comparison of the Invention with the Cited Invention, the following is found.

a Although it can be said that B "blocks" made by dividing "sub-carriers modulated by a first modulated transmission symbol" of the Cited Invention are "a group of sub-carriers", it is common general technical knowledge that "component carrier (CC)" of the Invention is also an aggregation of sub-carriers, and, therefore, the two are in common in a point of being "a group of sub-carriers".
b It is a common general technical knowledge that, by "performing IFFT for each block" in the Cited Invention, "a time domain signal" can be obtained.
c Relating to "performing phase rotation to the synthesized time axis waveform for each block" of the Cited Invention, it is such that "(given that the number of candidates of phase rotation is L, L^B (= U) can be obtained as the number of phase rotation patterns)" specifically, and, therefore, it can be said that it is to "apply multiple fixed phase rotations respectively to the acquired time domain signal by utilizing multiple phase rotation values in a set of (L) phase rotations".
d It can be said that "generating an OFDM symbol by adding the time axis waveforms having undergone phase rotation (here, given that the number of candidates of phase rotation is L, L^B (= U) can be obtained as the number of phase rotation patterns)" of the Cited Invention corresponds to "respectively constituting each of multiple candidate transmission groups".
e It can be said that "after carrying out phase rotation to time axis waveforms after IFFT in all of the U patterns, selecting, among OFDM symbol waveforms of respective patterns, a sample having the highest peak power value Pi,uMAX (i: a symbol number, u: a pattern number (u = 1, 2 ... U)); comparing Pi,uMAX of each of the U patterns to select PiMAX of the minimum peak power value (= MIN[Pi,uMAX]) among those; and transmitting the OFDM symbol of the selected pattern" of the Cited Invention corresponds to
"acquiring an amplitude sum of the phase rotation versions for each of multiple candidate transmission groups", "determining a candidate transmission group having a minimum amplitude sum;", and "transmitting multiple phase rotation versions in the determined candidate transmission group having the minimum amplitude sum".
f In consideration of the examinations of the above-mentioned a to e, it can be said that "B blocks" of "sub-carriers" of the Cited Invention are ones whose time axis waveforms are added for transmission, and, therefore, these are ones to be "aggregated" "for transmission".

In addition, when focusing attention on each processing step performed to "B blocks" in "a partial transmit sequence method for transmitting an OFDM symbol" of the Cited Invention, it can be also said that it is "a method for processing a plurality of groups of sub-carriers".

Summarizing the above, in the end, the Invention and the Cited Invention are identical and different in the following points.

(Corresponding features)
"A method for processing a plurality of groups of sub-carriers to be aggregated for transmission, comprising the steps of:

obtaining a time domain signal of each of the plurality of groups of sub-carriers;

applying multiple fixed phase rotations respectively to the acquired time domain signal by utilizing multiple phase rotation values in a set of phase rotations, so as to obtain multiple phase rotation versions of each group of sub-carriers;

selecting one of the multiple phase rotation versions of each group of sub-carriers to respectively constitute each of multiple candidate transmission groups, and acquiring an amplitude sum of the phase rotation versions for each of the multiple candidate transmission groups;

determining a candidate transmission group having a minimum amplitude sum; and

transmitting multiple phase rotation versions in the determined candidate transmission group having the minimum amplitude sum."

(The different feature)

A point that, in the Invention, "a group of sub-carriers" is "a component carrier (CC)", and the "method" is "applied to Long Term Evolution-Advanced (LTE-A) system",
whereas, in the Cited Invention, "a group of sub-carriers" is "a block (of sub-carriers)", and it is not specified whether it is applied to an LTE-A system or not.

Hereinafter, the aforementioned different feature will be examined.

As is described in Cited Document 1 that "in a communication system using multi-carriers, modulation signals of a plurality of sub-carriers are synthesized, and, therefore, its transmission peak power becomes a high value in comparison with that of a modulation signal of a single carrier. In particular, peak power of an OFDM signal made by synthesizing sub-carriers that are orthogonal to each other shows a large peak power value in comparison with that of a conventional single carrier modulation signal, and, by this, a peak power to average power ratio (PAPR) of a transmission signal is large, thereby inevitably deteriorating transmission quality." ([0002]), the Cited Invention is one for the purpose of reducing a peak power to average power ratio (PAPR) of a transmission signal in a communication system using multi-carriers such as an OFDM system. However, as communication standards for such OFDM system, LTE-A (Long Term Evolution-Advanced) that aggregates a plurality of component carriers is a well-known communication standard, and, in addition, it is a well-known fact for a person skilled in the art that, in LTE-A, deterioration of PAPR is a problem at the time of carrier aggregation, as has been stated in LG Electronics, Issues on the physical cell ID allocation to the aggregated component carriers [online], 3GPP TSG-RAN WG1#55 R1-084195, and its Internet version of
<URL: http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_55/Docs/R1-084195.zip> on November 5, 2008 that was cited in the reason for refusal by the body (in particular, refer to the statements of "Carrier aggregation is one of the main features of LTE-Advanced (LTE-A) to support wider bandwidth than that of Rel-8 LTE." in the chapter of "1. Introduction", and "High CM values in case of carrier aggregation occur due to the repeated RS pattern across the component carriers. Similar CM/PAPR issue can be

also observed with synchronization channels." in chapter "2.1 Downlink reference signal CM issue").

Then, it would have been easily conceived by a person skilled in the art to apply a method according to the Cited Invention whose purpose is to reduce a peak power to average power ratio (PAPR) of a transmission signal in a communication system using multi-carriers such as an OFDM system to an LTE-A system having a similar issue.

In addition, on this occasion, although how to divide a number of sub-carriers of an LTE-A system into B blocks should be selected accordingly by a person skilled in the art depending on the number of times of calculation processing desired to be mitigated, it is common general technical knowledge that a component carrier of LTE-A is a frequency block for LTE having a band of maximum 20 MHz; that is, an aggregation of a number of sub-carriers (of 15 KHz intervals), and, there is no difficulty in conceiving of using a "component carrier" that is such a frequency block for LTE as a "block (of sub-carriers)" of the Cited Invention.

Accordingly, it would be easily conceived by a person skilled in the art that the method of the Cited Invention is "applied to a Long Term Evolution-Advanced (LTE-A) system", and to make a "block (of sub-carriers)" be a "component carrier (CC)" of LTE-A.

Then, the function and effect of the Invention also is within the range predicted by a person skilled in the art from the Cited Invention.

5 Appellant's allegation

In the written opinion dated November 24, 2015, the appellant alleges that

<<However, "component carrier" of an LTE-A system is completely different in comparison with "block" (a set of sub-carriers) of the Cited Document 1 in points of a structure and a function. For example, a component carrier has a bandwidth of 1.4, 3, 5, 10, 15, or 20 MHz, and has a function as a carrier in itself (alone).

Aggregation of component carriers is a technology for LTE-A, and it is possible for discrete component carriers to be aggregated in different frequency bands from each other. In other words, aggregated component carriers can have discrete frequency bands of different frequency bands, and this is one of the characteristics of carrier aggregation.

On the other hand, a sub-carrier is, so to speak, a part of one (component) carrier, and has a bandwidth of 15 kHz, which is very small compared with that of a component carrier. A sub-carrier does not function independently in a single body or even in a form of a "block" made up of a plurality of sub-carriers, but functions as a total sub-carrier. Total sub-carriers made by synthesizing "blocks" have continuous frequency bands within the same frequency band.

As above, a "block" of the Cited Document 1 is different from a "component carrier" in an LTE-A system in the points of a function and a structure. For that reason, it is considered that there is no motive for a person skilled in the art to select a "component carrier" instead of a "block" of the Cited Document 1.>>.

This point will be examined below.

It is recognized that, in the Cited Invention, the purpose of block-making by dividing sub-carriers into B blocks is to make the number of OFDM symbol waveforms made by applying phase rotation and addition to time axis waveforms after IFFT be reduced to L^B (= U) by reducing the number of time axis waveforms after IFFT from the total number of sub-carriers to B that is the number of blocks, and thereby mitigating a calculation processing amount when using a selected mapping method (refer to [0003] and [0004] of the Cited Document 1). However, an effect of mitigation of such calculation processing amount depends simply on the number of blocks "B", and it is obvious that it can be obtained independently of whether or not each of the B blocks "functions as a carrier in itself (alone)", or whether or not the B blocks are "in a same frequency band", and the like. Therefore, it is an effect also capable of being predicted as a matter of course when a component carrier of LTE-A is made to be a "block" of the Cited Invention.

Then, even if, as alleged by the appellant of the appeal, <<a "block" of the Cited Document 1 is one different from a "component carrier" in an LTE-A system in the points of a function and a structure>>, these points are not disincentives at all upon using a "component carrier" that is a group of sub-carriers of LTE-A as a "block (of sub-carriers)" of the Cited Invention for the purpose of simply making the number of time axis waveforms after IFFT be reduced, and, therefore, it could be done by a person skilled in the art accordingly to use a "component carrier" that is a frequency block for LTE as a "block" of the Cited Invention.

Therefore, the allegation of the appellant of the appeal described above cannot be accepted.

6 Closing

Accordingly, the Invention is one that could have easily been derived by a person skilled in the art based on the invention according to the Cited Document 1, and, therefore, the appellant should not be granted a patent in accordance with the provisions of Article 29(2) of the Patent Act.

Therefore, the appeal decision shall be made as described in the conclusion.

February 1, 2016

Chief administrative judge: OTSUKA, Ryohei
Administrative judge: SHINKAWA, Keiji
Administrative judge: TAKAHASHI, Masayuki