

efficient information transmission which is easy to use for the wireless devices.

PRIOR ART DOCUMENT

NON-PATENT DOCUMENT

[0005] Non-Patent Document 1: Kentaro Ishizu, and four others, "Design of spectrum sharing type cognitive radio system with out-band pilot channel", The Institute of Electronics, Information and Communication Engineers, Technical Committee on Software Radio, March, 2010, vol. 109, No. 442, pages 37 to 44

Non-Patent Document 2: Kentaro Ishizu, and three others, "Out-band pilot channel for notification of regulatory information and terminals' sharing of environmental information", The Institute of Electronics, Information and Communication Engineers, Technical Committee on Software Radio, May, 2010, vol. 110, No. 41, pages 57 to 64

Non-Patent Document 3: Kentaro Ishizu, and two others, "Prototyping and evaluation of out-band pilot channel mechanism for spectrum sharing type cognitive radio system", The Institute of Electronics, Information and Communication Engineers, Technical Committee on Software Radio, January, 2011, vol. 110, No. 398, SR2010-81, pages 73 to 80

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] Embodiments of the present invention provide an information transmission device and an information transmission method capable of allowing a wireless device intended to newly start an operation in a white space to efficiently perform its preparatory operation.

MEANS FOR SOLVING THE PROBLEMS

[0007] According to a first aspect of this invention, there is provided an information transmission device including: ~~a first retainer configured to retain first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness; a second retainer configured to retain second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness; a generator configured to generate multiplexed information including the first information and the second information so that the first information and the second information are repeated at equal frequencies in a time axis direction, or the first information is repeated at a frequency higher than that of the second information in the time axis direction; and a transmitter configured to wirelessly transmit the multiplexed information~~ a first retainer configured to retain first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness; a second retainer configured to retain second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness; a first encoder configured to encode the first information retained by the first retainer so that the first information has a redundancy, to generate first encoded information having a first code amount; a second encoder configured to encode the second information retained by the second retainer so that the second information has a redundancy, to generate second encoded information having a second code amount equal to the first code amount; a

generator configured to generate multiplexed information including the first encoded information and the second encoded information so that the first encoded information and the second encoded information are repeated at equal frequencies in a time axis direction; and a transmitter configured to wirelessly transmit the multiplexed information.

[0007a] According to a second aspect of this invention, there is provided an information transmission device including: a first retainer configured to retain first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness; a second retainer configured to retain second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness; an encoder configured to encode the first information retained by the first retainer so that the first information has a redundancy, to generate first encoded information having a first code amount; a generator configured to generate multiplexed information including the first encoded information and the second information so that the first encoded information is repeated at a frequency higher than that of the second information in the time axis direction; and a transmitter configured to wirelessly transmit the multiplexed information.

[0008] Namely, the information transmitted from this information transmission device results from multiplexing the information of channels available in each of the partial areas which are geographical divisions in a coarse manner, and the information of channels available in each of the partial areas which are geographical divisions in a manner finer than the above case. Further, the former is set to be repeatedly transmitted at a frequency same as or higher than that of the latter. The former has relatively small amount of information, and the latter has relatively large amount of information.

[0009] A wireless device after receiving the information from this information transmission device can first obtain, based on its positional information, the information of available channels in comparison with the former information. This only requires simple processing which takes a short period of time. Even in a case where the former information does not indicate an available channel, since there is a possibility that the indication is made, with a margin, regarding the partial areas which are geographical divisions in a coarse manner, the side of the wireless device can further obtain the information of available channels in comparison with the latter information as needed. This requires processing which relatively takes a long time and which is relatively not simple, but, the processing is not always conducted. As a whole, the wireless device can efficiently perform its preparatory operation.

[0010] According to a second ~~third~~ aspect, there is provided an information transmission method including: ~~retaining first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness; retaining second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness; generating multiplexed information including the first information and the second information so that the first information and the second information are repeated at equal frequencies in a time axis direction, or the first information is repeated at a frequency higher than that of the second information in the time axis direction; and wirelessly transmitting the multiplexed information~~ retaining first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness; retaining second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a

second fineness finer than the first fineness; encoding the first information so that the first information has a redundancy, to generate first encoded information having a first code amount; encoding the second information so that the second information has a redundancy, to generate second encoded information having a second code amount equal to the first code amount; generating multiplexed information including the first encoded information and the second encoded information so that the first encoded information and the second encoded information are repeated at equal frequencies in a time axis direction; and wirelessly transmitting the multiplexed information.

[0010a] According to a fourth aspect, there is provided an information transmission method including: retaining first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness; retaining second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness; encoding the first information so that the first information has a redundancy, to generate first encoded information having a first code amount; generating multiplexed information including the first encoded information and the second information so that the first encoded information is repeated at a frequency higher than that of the second information in the time axis direction; and wirelessly transmitting the multiplexed information

[0011] This information transmission method is a method capable of being performed by corresponding to the configuration of the above-described information transmission device.

EFFECT OF THE INVENTION

[0012] According to the embodiments of the present invention, it is possible to provide an information transmission device and an information transmission method capable of allowing a wireless device intended to newly start an operation in a white space to efficiently perform its preparatory operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a functional block diagram illustrating a configuration of an information transmission device being one embodiment of the present invention.

FIG. 2 is an explanatory diagram illustrating a configuration example of information retained by an information retaining unit 11 illustrated in FIG. 1.

FIG. 3 is an explanatory diagram illustrating a configuration example of information retained by the information retaining unit 11 illustrated in FIG. 1, in addition to the configuration example of information illustrated in FIG. 2.

FIG. 4A is an explanatory diagram illustrating one example of form of multiplexing performed by a multiplexed information generating unit 12 illustrated in FIG. 1.

FIG. 4B is an explanatory diagram illustrating another example of form of multiplexing performed by the multiplexed information generating unit 12 illustrated in FIG. 1.

FIG. 4C is an explanatory diagram illustrating still another example of form of multiplexing performed by the multiplexed information generating unit 12 illustrated in FIG. 1.

FIG. 5 is an explanatory diagram illustrating a configuration example of information

WHAT IS CLAIMED IS : CLAIMS

1. An information transmission device, comprising:
 - a first retainer configured to retain first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness;
 - a second retainer configured to retain second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness;
 - a first encoder configured to encode the first information retained by the first retainer so that the first information has a redundancy, to generate first encoded information having a first code amount;
 - a second encoder configured to encode the second information retained by the second retainer so that the second information has a redundancy, to generate second encoded information having a second code amount equal to the first code amount;
 - a generator configured to generate multiplexed information including the first encoded information and the second encoded information so that the first encoded information and the second encoded information are repeated at equal frequencies in a time axis direction, ~~or the first information is repeated at a frequency higher than that of the second information in the time axis direction;~~ and
 - a transmitter configured to wirelessly transmit the multiplexed information.
2. An information transmission device, comprising:
 - a first retainer configured to retain first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness;
 - a second retainer configured to retain second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness;
 - an encoder configured to encode the first information retained by the first retainer so that the first information has a redundancy, to generate first encoded information having a first code amount;
 - a generator configured to generate multiplexed information including the first encoded information and the second information so that the first encoded information is repeated at a frequency higher than that of the second information in the time axis direction; and
 - a transmitter configured to wirelessly transmit the multiplexed information.

3. The information transmission device according to claim 2, further comprising:
a second encoder configured to encode the second information retained by the second retainer so that the second information has a redundancy, to generate second encoded information having a second code amount,
wherein the generator is configured to generate the multiplexed information so that the multiplexed information includes the first encoded information and the second encoded information, the first encoded information being repeated at a frequency higher than that of the second encoded information in the time axis direction.
24. The information transmission device according to claim 1 or 2,
wherein the first retainer treats each mesh obtained when dividing the area into meshes as each of the first-type partial areas to retain the first information; and
wherein the second retainer treats each mesh obtained when dividing the area into meshes finer than the meshes in the first retainer as each of the second-type partial areas to retain the second information.
35. The information transmission device according to claim 1 or 2,
wherein each of the first information and the second information is information further including, in addition to the list of channels available, usage regulations in each of channels of the list of channels available.
46. The information transmission device according to claim 1 or 2,
wherein the first retainer treats each of partial areas obtained when dividing the area based on administrative divisions as each of the first-type partial areas to retain the first information; and
wherein the second retainer treats each of partial areas obtained when dividing the area based on administrative divisions finer than the administrative divisions in the first retainer to retain the second information.
57. An information transmission method, comprising:
retaining first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness;
retaining second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness;
encoding the first information so that the first information has a redundancy, to generate first encoded information having a first code amount;

encoding the second information so that the second information has a redundancy, to generate second encoded information having a second code amount equal to the first code amount;

generating multiplexed information including the first encoded information and the second encoded information so that the first encoded information and the second encoded information are repeated at equal frequencies in a time axis direction; and

wirelessly transmitting the multiplexed information.

~~The information transmission device according to claim 1, further comprising:~~

~~—— a first encoder configured to encode the first information retained by the first retainer so that the first information has a redundancy, to generate first encoded information having a first code amount; and~~

~~—— a second encoder configured to encode the second information retained by the second retainer so that the second information have a redundancy, to generate second encoded information having a second code amount equal to the first code amount;~~

~~—— wherein the generator generates the multiplexed information by multiplexing the first encoded information and the second encoded information so that the first encoded information and the second encoded information are repeated at equal frequencies in the time axis direction.~~

68. An information transmission method, comprising:

retaining first information including at least a list of channels available in each of first-type partial areas obtained when dividing an area at a first fineness being a predetermined fineness;

retaining second information including at least a list of channels available in each of second-type partial areas obtained when dividing the area at a second fineness finer than the first fineness;

encoding the first information so that the first information has a redundancy, to generate first encoded information having a first code amount;

generating multiplexed information including the first encoded information and the second information so that the first information and the second information are repeated at equal frequencies in a time axis direction, or the first encoded information is repeated at a frequency higher than that of the second information in the time axis direction; and

wirelessly transmitting the multiplexed information.