CONTROLLING TRANSMISSION POWER

TECHNICAL FIELD

The exemplary and non-limiting embodiments of the invention relate generally to wireless communication systems. Embodiments of the invention relate especially to apparatuses and methods in wireless communication networks.

BACKGROUND

Power control of terminal devices in modern communication networks is an important aspect. The terminal devices must be able to communicate with the network with good signal quality. On the other hand, interference to other users in the communication network and to environment should be low. Further, the battery life of mobile units is also an issue which should be kept in mind.

Typically, the maximum transmission power the terminal devices may use in communication is limited by legislation. The purpose is to ensure that interference is kept low. Also, the radiation the users of the terminal devices experience is one factor limiting the maximum available power.

SUMMARY

According to an aspect, there is provided the subject matter of the independent claims. Embodiments are defined in the dependent claims.

In an aspect, the present disclosure refers to an apparatus comprising:

means for determining total guard bandwidth as the shortest frequency distance between an edge of an uplink bandwidth allocated to uplink signal of a terminal device and an edge of a frequency range to be protected from interference;

means for determining one or more total guard bandwidth threshold values using a second order polynomial function where the uplink bandwidth is used as a parameter;

means for comparing the total guard bandwidth to the one or more total guard bandwidth threshold values;

means for selecting the additional maximum power reduction value for the terminal device based on the comparison.

In an aspect, the present disclosure refers to a method comprising:

determining total guard bandwidth as the shortest frequency distance between an edge of an uplink bandwidth allocated to uplink signal of the terminal device and an edge of a frequency range to be protected from interference;

determining one or more total guard bandwidth threshold values using a second order polynomial function where the uplink bandwidth is used as a parameter;

comparing the one or more total guard bandwidth to the one or more total guard bandwidth threshold value;

selecting the additional maximum power reduction value for the terminal device based on the comparison.

In an aspect, the present disclosure refers to a non-transitory computer readable medium comprising program instructions for causing an apparatus to perform at least the following:

determining total guard bandwidth as the shortest frequency distance between an edge of an uplink bandwidth allocated to uplink signal of the terminal device and an edge of a frequency range to be protected from interference;

determining one or more total guard bandwidth threshold values using a second order polynomial function where the uplink bandwidth is used as a parameter;

comparing the one or more total guard bandwidth to the one or more total guard bandwidth threshold value;

selecting the additional maximum power reduction value for the terminal device based on the comparison.

In an example, there is provided an apparatus comprising: means for determining uplink bandwidth allocated to a terminal device, means for determining total guard bandwidth as the shortest frequency distance between an edge of frequency range allocated to uplink signal of the terminal device and an edge of a frequency range to be protected from interference, means for selecting the additional maximum power reduction values for the terminal device based on the determination.

In an example, there is provided a method comprising: determining uplink bandwidth allocated to a terminal device; determining total guard bandwidth as the shortest frequency distance between an edge of frequency range allocated to uplink signal of the terminal device and an edge of a frequency range

to be protected from interference; and selecting the additional maximum power reduction values for the terminal device based on the determination.

In an example, there is provided an apparatus further comprising means for selecting the additional maximum power reduction values for the terminal device based on mapping of the uplink bandwidth allocated to a terminal

device to a total guard bandwidth threshold below which a higher level of output power reduction is allowed.

In an example, there is provided an apparatus further comprising means for selecting the additional maximum power reduction values for the terminal device when the uplink bandwidth allocated to the terminal device is inside a resource allocation regrowth region where spectral regrowth causes spurious emissions.

In an example, there is provided an apparatus comprising at least one processor; and at least one memory including computer program code; the at least one memory storing instructions that, when executed by the at least one processor, cause the apparatus at least to: determine uplink bandwidth allocated to a terminal device; determine total guard bandwidth as the shortest frequency distance between an edge of frequency range allocated to uplink signal of the terminal device and an edge of a frequency range to be protected from interference; and select the additional maximum power reduction values for the terminal device based on the determination.

In an example, there is provided a non-transitory computer readable medium comprising program instructions for causing an apparatus to perform at least the following: determining uplink bandwidth allocated to a terminal device; determining total guard bandwidth as the shortest frequency distance between an edge of frequency range allocated to uplink signal of the terminal device and an edge of a frequency range to be protected from interference; and selecting the additional maximum power reduction values for the terminal device based on the determination.

One or more examples of implementations are set forth in more detail in the accompanying drawings and the description below. Other features will be apparent from the description, drawings and the claims.

BRIEF DESCRIPTION OF DRAWINGS

In the following, embodiments will be described in greater detail with reference to the attached drawings, in which

Figure 1 illustrates an exemplified wireless communication system,

Figures 2A and 2B illustrate examples of uplink operating band and a protected frequency range,

Figure 3 illustrates an example of allocation regions,

Figures 4 and 5 illustrate output power back-off in regrowth region versus total guard bandwidth and allocation bandwidth,