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Unrestricted Protocol Description

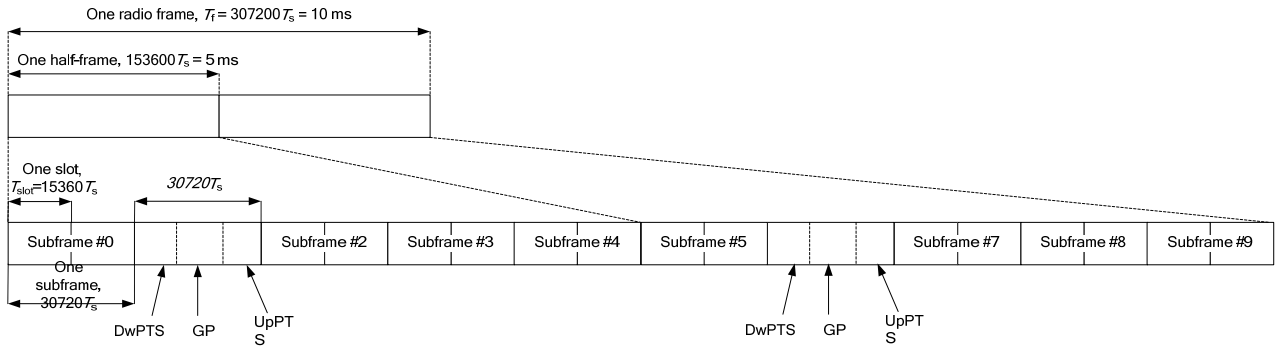
In order to ensure that a device complies with the requirements of unrestricted contention based protocol, the following information should be provided in the application.

2.1. Unrestricted Protocol Description

Address the key requirements for operation using unrestricted contention based protocol. Please note that this requires recognizing other systems (both similar to yours and different from yours) that operate on a co-channel. Indicate the strategy for sharing the spectrum in terms of: (1) Does the system use spectrum sensing to determine if the other devices are transmitting and then find ways to share the bandwidth, or (2) Does the system have some other strategy?

Answer:

（1）System detects co-channel other systems by which used LBT (Listen before Talk) contention based protocol, it also recognizes other operating co-channel systems using received power spectrum regardless of similar or different system. Timing of frames, how much time is allowed for listening, and back-off time. These times are defined in fractions of seconds. The GAP time in follow figure is used to back-off and be ready for talking.



The period of the GAP is configured by base station from 66.7us to 667us, see bellows chart: ‘GP’ is the GAP, and one symbols is 66.7us.

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Special subframe configuration	Extended cyclic prefix length in OFDM symbols			Normal cyclic prefix length in OFDM symbols		
	DwPTS	GP	UpPTS	DwPTS	GP	UpPTS
0	3	8	1	3	10	1
1	8	3		9	4	
2	9	2		10	3	
3	10	1		11	2	
4	3	7	2	12	1	
5	8	2		3	9	2
6	9	1		9	3	
7	-	-	-	10	2	
8	-	-	-	11	1	

（2）System can also use Power Control and scheduling technologies to mitigate inter-system interference.

2.2. Threshold detection to determine occupancy

2.2.1 Describe how your system determines if another system is using the spectrum. At what detection level – relative to 0 dBi receive antenna gain (busy channel threshold), does the device determine if another system is operating on the spectrum?

Answer:

System in TDD mode can detect the interference power and noise power when receiving downlink data, whether there are other systems using the spectrum within the working bandwidth.

The system has a robust, adaptive and scalable spectrum sensing, energy detection and interference elimination mechanism. For short-time and sudden partial spectrum interference in the channel, spectrum usage in these parts can be avoided by selective frequency scheduling. For long-time and strong interference in all channel, center frequency point can be reconfigured.

As for “busy channel” detection threshold, the default value is -85dBm/MHz.

As for “clear channel” detection threshold, the default value is -90dBm/MHz.

The interference plus the base noise power equals the threshold value, which represents that the resource is available. The system supports multiple antenna reception. Each antenna can be measured separately and the mean value will be taken.

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2.2.2 How long does the system observe to determine if the channel is busy – at the initial time and in between communications?

Answer:

The system makes the determination based on observation in 5-10 seconds at the initial time and in between communications.

2.2.3 What is the bandwidth being monitored versus bandwidth occupied for all modes of operation?

Answer:

The system supports all bandwidth detection of the channel, as well as other channel bandwidth detection within the RF band.

2.2.4 How much variability is provided to the system operator to adjust busy channel detection threshold?

Answer:

The adjustable range for busy channel detection threshold is 65 dB.

2.2.5 What is the operating system threshold (receive threshold) compared to the monitoring threshold (busy channel threshold)?

Answer:

The operating system threshold is -3 dB or higher than the monitoring threshold.

2.2.6 What additional checks does the system perform to determine if the spectrum is being used before initiating a transmission?

Answer:

In every detection cycle, the system can detect the signal power, interference power and base noise power of each resource unit; and judge whether the resource unit is “busy channel”. Meanwhile, it is a periodically detecting mechanism, which monitors the interference every SIB intervals.

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2.2.7 Does the master and the client perform the threshold detection? If master only performs the detection how does it determine if the client may interfere with the other system (hidden node detection mechanism)?

Answer:

Only the master performs the threshold detection. Although in theory it is possible that a client on the edge of coverage of a master can interfere with another master belonging to a different system while the masters cannot hear from each other, which is known as the Hidden Node issue. But in a WISPA network, typically the client side has a high gain directional antenna pointing at the serving masters and are power control and scheduled by the serving masters.

2.3. Action taken when occupancy is determined

2.3.1 What action does your system take when it determines occupancy? Does it vacate the channel or does it have some back-off and retry strategy? What is the impact of traffic on the spectrum sensing or avoidance performance?

Answer:

The system will keep detecting whether other devices will occupy the channel. If there is, it will stop transmit. The system will only work on channels without interference. It can recognize whether the received signal is interference signal or signal sent out by master. A dedicated algorithm in the system can distinguish different signals.

2.3.2 If you use other means, please describe how the device determines the existence of other systems and what steps it takes to either share the channel or avoid its use.

Answer:

There is no other means. The system will judge whether there is any device working on this channel via interference detection, stop or resume transmitting.

2.3.3 Describe any mechanism that would limit a transmission from a remote station if only the master detects occupancy (hidden node avoidance mechanism).

Answer:

When the serving side of the system detect the interference, it will stop transmission, and the client side device will lose connection and keep listening and searching

transmitted signal. However, the remote device itself will not transmit any signal. When the system detects that the channel is available, it will send out a broadcast message to inform the remote device to reconnect and intercommunicate. Scheduling and power control algorithm with interference taken into consideration can limit the terminal transmitted power and scheduling resource.

2.4. Opportunities for other transmitters to operate

2.4.1 When describing occupancy profile, clarify any differences between start-up acquisition mode of spectrum, and operational modes.
Answer:
In the start-up, the system will only monitor the channel without any transmission, in the operational mode the system will transmit only in the broadcast portion of the channel when there is no traffic. It will transmit in part of the channel when traffic is low, and transmit in full channel when traffic is high. In addition it continuously monitors the channel for interference from other systems.

2.4.2 In operational mode, how long does the system transmit before stopping giving others a reasonable time to transmit before continuing?
Answer:
The system transmits according to configured LTE TDD subframe configurations while continuously monitors the interfere level. The time of a TDD signaling a sub-frame is 5 ms with 3ms downlink transmitting time and 2ms uplink receiving time. Other systems can access and occupy the channel during transceiving. The system will constantly detect whether other devices will occupy the channel and hand over the channel to the detected devices in 50ms.

2.4.3 Does the system (master and / or client) listen prior to every transmission? If no, explain.
Answer:
In the acquisition mode the system will monitor the spectrum before any transmission.
In the operational mode the system will continuously monitor the channel for interference from other systems while transmitting. It will stop transmitting if interference from other systems is detected.

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2.4.4 Describe how the operational spectrum usage (on air time) is dependent on system load conditions (no load, typical and overload). For example, if a station does not have any information to transmit, describe any regular or recurring transmission that may take place.

Answer:

Inthe operational mode the system will transmit only in the broadcast portion of the channel when there is no traffic. It will transmit in part of the channel when traffic is low, and transmit in full channel when traffic is high.

2.4.5 Describe if there are any limitations imposed by the contention protocol on what applications are used (i.e. limitations on Quality of Service).

Answer:

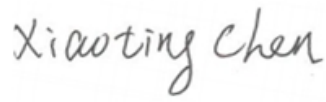
There is no limitation imposed by the contention protocol on what applications are used.

2.4.6 Describe how applications or configuration of services can affect spectrum usage. To describe your occupancy sharing capability you can assume that two systems on a co-channel are the same (your systems being described). How would they share the spectrum?

Answer:

System based on the same technology can use network planning to share the spectrum, and mutual interference between the stations can be avoided by using the same time slot ratio and frame synchronization. Spectrum can be shared as well.

Sincerely,



Sign :

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