HUAWEI

Unrestricted Certification under Part 90Z (3650-3700 Band)

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 Listen before Talk (LBT) contention based protocol, and then improves spectrum sharing by forcing frequent detecting times before occupying or release. It recognizes other operating co-channel systems using received power spectrumregardless of similar or different system.

(2)System can also use technology that collaborates with power control and scheduling technologies to mitigate inter-system interference.

2.2. Threshold detection to determine occupancy

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】When the Listen before Talk (LBT) configuration is set to On, the system detects whether there are other systems using the spectrum within the working bandwidth. The following is the LBT algorithm based on configurable thresholds:

1)LbtNiHighThreshold: default -85 dBm/MHz, interference threshold for turning off down link transmission. When detected interference level is above this threshold, DL transmission will be turned off.

2)LbtNiLowThreshold: default -90 dBm/MHz, interference threshold for turning on down link transmission. When detected interference level is below this threshold, DL transmission will be turned on.

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 sec for both initial transmission and in between communications.

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

【Answer】The configured channel bandwidth, which is the occupied bandwidth at full traffic, will be used for monitoring.

How much variability is provided to the system operator to adjust busy channel detection threshold?
【Answer】The adjustable range for busy channel detection threshold by the system operator is 60 dB.

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.

What additional checks does the system perform to determine if the spectrum is being used before initiating a transmission?
【Answer】Before initiate a transmission, the system monitors the interference level in 10 ms intervals. It will only transmit if the average interference level in 5 seconds is below the LbtNiHighThreshold.

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 interference monitoring. 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. It is extremely unlikely for that to occur in a WLL network deployment because the propagation losses between the masters are much lower due to higher antenna heights and higher antenna gains. In addition the masters typically transmit higher power than the clients, and the clients are typically equipped with directional antennas pointing at the serving masters and are power controlled by the serving masters.

2.3.Action taken when occupancy is determined
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 stops transmission when it determines occupancy by other systems. It vacates the channel and starts to monitor the channel to see whether it is released by other systems. It resumes transmissionif it determines that the channel becomes available. The carried traffic has no impact on the performance of spectrum sensing or avoidance.

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】No other means is used to determine the existence of other systems.

Describe any mechanism that would limit a transmission from a remote station if only the master detects occupancy (hidden node avoidance mechanism).
【Answer】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. It is extremely unlikely for that to occur in a WLL network deployment because the propagation losses between the masters are much lower due to higher antenna heights and higher antenna gains. In addition the masters typically transmit higher power than the clients, and the clients are typically equipped with directional antennas pointing at the serving masters and are power controlled by the serving masters.

2.4. Opportunities for other transmitters to operate
When describing occupancy profile, clarify any differences between start-up acquisition mode of spectrum, and operational modes.
【Answer】In the start-up acquisition mode the system will only monitor the spectrum 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 the full channel when traffic is high. In addition it continuously monitors the channel for interference from other systems.

In operational mode, how long does the system transmit before stopping giving others a reasonable time to transmit before continuing?
【Answer】In the operational mode, the system transmits according to configured LTE TDD subframe configurationswhile continuously monitors the interfere level. The LTE TDD subframe structure naturally provides opportunities for other systems to transmit when this system is not transmitting. If detected interference levels exceed the configured threshold, it will stop transmission completely and entered into the monitoring only state.

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.

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】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 the full channel when traffic is high.

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

【Answer】In the acquisition mode, the master does not provide any service to the clients. In the operational mode, the master can monitor the spectrum while providing services, which has no impact on the QoS of services. However if interference from other systems is detected, the master will vacate the channel and stop providing services to clients while continues to monitor the channel for possible resumption of services. This will have a negative impact on QoS of real time and delay sensitive services.

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】Systems based on the same technology can use network planning to share the spectrum in co-channels. Systems based on different technologies need to maintain synchronization to share the spectrum to minimize mutual interference.