Guidance regarding contention based protocol for devices operating in the 3650-3700 MH Band under Part 90Z

Document Overview

This document identifies several questions / information to help determine the contention bas protocol capability of a device that may operate in the 3650 – 3700 MHz under part 90Z of c rules. These questions are intended to be used as a guide by the applicant to describe how th system meets the requirements for 3650-3700 contention based protocol. The list is not intend to be exhaustive and may be modified in the future. There may be follow-up questions based the responses provide by the applicant for authorization.

Applicants seeking certification for systems as complying with restricted contention based protocol (3650 to 3675 MHz) that permit operation on a co-channel with like systems (similar systems) may seek equipment authorization from a Telecommunications Certification Body (TCB) using the Permit but Ask procedure as described in Section 3 .

Applicants seeking certification for systems as complying with the unrestricted contention base protocol for operation in the 3650 to 3700MHz band that permit operation on a co-channel with similar or different systems (recognizing other systems) must apply to the FCC for equipment authorization.

1. **Restricted Certification under Part 90Z (3650-3675 Band)**

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

1.1. Restricted Protocol Description

1.1.1. Although the restricted protocol does not have the extended requirement to recognize al other systems it is still mandatory to incorporate a contention based protocol that provid satisfactory sharing of spectrum with similar systems.

1.1.2. Address the key requirements for operation using restricted contention based protocol opportunities for other transmitters to operate. Please note that this requires recognizing like systems (similar to yours) that permit operation on a co-channel.

1.1.3. Provide any additional manuals and operational descriptions to allow the reviewer to understand the product and its operation.

1.2. Describe the method to permit occupancy

1.3. Describe the action taken if two or more transmitters simultaneously access the same chann by the master and the client devices.

1.4. Describe opportunities for other similar systems to operate. Address how or if a different system operator using the same technology can operate in the same band.

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

In order to ensure that a device complies with the requirements of unrestricted contenti 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 protoc Please note that this requires recognizing other systems (both similar to yours a different from yours) that operate on a co-channel. Indicate the strategy for sharing t spectrum in terms of: Does the system use spectrum sensing to determine if the oth devices are transmitting and then find ways to share the bandwidth, or Have some oth strategy?

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 th device determine if another system is operating on the spectrum? Answer: One of the important parameters, the WiMax TDD system measures, is the environment noise level. The Base Station (BST - the master) is measuring the noise level in the initialization phase (before the start of any transmission). It also measures the noise level, every configured frame number, during operational time.
The system can operate in 10MHz BW or 5MHz BW. Based on 10MHz BW, the noise level with no interferences is detected. If no interference, the noise level will b -98dBm (10MHz BW assuming 0dBi receive antenna gain). If there is interference the noise level is increased, accordingly, and determines that another system is operating on the same frequency spectrum.

2.2.2. How long does the system observe to determine if the channel is busy – at the initial tim and in between communications? Answer: The observation time is taken in the initialization processes, right after power on (before starting to transmit), during 500msec, and after that during the normal operation in frames that are not occupied by users (clients) or by measuring the noise by reading the S/N from the users.

2.2.3. What is the bandwidth being monitored versus bandwidth occupied for all modes of operation? Answer: The BW being monitored is according to the operational BW. In case of 10MHz operation the BW being monitored is 10MHz.

2.2.4. How much variability is provided to the system operator to adjust busy channel detectio threshold? Answer: The detection threshold is detected and monitored in the BST an the user. The threshold in which actions are taken is configurable.

2.2.5. What is the operating system threshold (receive threshold) compared to the monitoring threshold (busy channel threshold)? Answer: Operating system threshold (Receive threshold) and busy channel threshold are configurable. Usually the figures are:
Receive threshold: At noise lower than -92dBm
Busy channel threshold: At noise higher than -92dBm

2.2.6. What additional checks does the system perform to determine if the spectrum is being used before initiating a transmission? Answer: Beside the noise measuring, during initialization, the BST is measuring the noise in normal operation as well by "lookin on clear frames (when no user is transmitting by analyzing its S/N).

Comment [Y.Z.1]: Does was replaced by Do.

2.2.7. Do the master and the client perform the threshold detection? If master only performs th detection how does it determine if the client may interfere with the other system (hidder node detection mechanism)? Answer: As been said before, the master is performs threshold detection. On initialization case, it will start transmission, only after it will

find a "clear" frequency. The users will not transmit until they will be synchronized the master transmission, in the "clear" frequency. So, they will not interfere. On normal case, the users' transmission is controlled by the master, so they will not transm without the master instruction, by receiving precise transmission map.
Additional detection is made by the user: It always check the S/N level. Once it find tha it's lower than configured threshold (HO-TH1), it start scanning (receive only) other configured frequencies, which should be used by other masters. Once S/N decrease belo lower configured threshold (HO-TH2), it roams to adjacent master, if exist, with cleane frequency.

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 o the spectrum sensing or avoidance performance? Answer: When the system determine occupancy, the master will change the frequency to a "clear" frequency. At this poin the frequency is vacated. Every few seconds (configurable), the system is checking the operating frequency and can return to the original frequency, if it's clear. The impact of traffic and performances is minor, since it's been done on very short times (few milliseconds).

2.3.2. If you use other means, please describe how the device determines the existence of othe systems and what steps it takes to either share the channel or avoid its use. Answer: The devices always report their S/N and the master controls its transmission and the devices transmission, accordingly. If the S/N is bad, the master will move to robust transmission and the throughput will be very low. It will also instruct the devices to use robust transmission, accordingly. If the S/N is too bad, the device may roam to adjacent master, which use different frequency.

2.3.3. Describe any mechanism that would limit a transmission from a remote station if only tl master detects occupancy (hidden node avoidance mechanism). Answer: The master th detects high noise informs its users and its neighbor masters that it is going to chang frequency. All the system is synchronized and all the users will scan pre-configured frequencies, and synchronized to the new frequency, which master move to. As beer said in item 2.2.7, remote station will not transmit, without the master instructions. Transmission instructions are sent as uplink map, every frame (5mS).

2.4. Opportunities for other transmitters to operate

2.4.1. When describing occupancy profile, clarify any differences between start-up acquisitior mode of spectrum and operational modes. Answer: In startup, initialization time, the BST is measuring the environmental noise, taking into account the RF parameters o its RF module (NF, etc…). The BST will not start to transmit if the channel noise is above -92dBm, as indicated in 2.2.5, and will scan after a new frequency to find cle one.
In operational mode the BST is measuring the noise by two ways:
- In free frames, when no user is transmitting. As been said before, the BST allocate the users transmitting frames and knows when frames are clear.
- By using the received signals and the S/N measuring from the users transmissions.

2.4.2. In operational mode, how long does the system transmit before stopping giving others a reasonable time to transmit before continuing? Answer: In operational time, the time needed for transmitting the information, before stopping the transmission, is about 5 frames (5x5=25msec).

2.4.3. Does the system (master and / or client) listen prior to every transmission? If no, explai

Answer: The master and client listen prior to every transmission.

2.4.4. Describe how the operational spectrum usage (on air time) is dependant 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 any case, after initialization process finished successfully, the BS will transmit 1 Preamble symbol and 2 or 4 additional symbols, which contain DL-MAP and UL MAP (if exist). All other symbols are for data and pilots information. there is no data only pilots are transmitted. Small part of operational spectrum is occupied by Pilots and their energy is small, about 2/14 than full energy. On the Preamble symbol, only 1/3 sub channels are occupied, means 1/3 of spectrum is use The Preamble symbol is boosted by 9 dB/per carrier, above the data, and by 6.5dB, above the pilots. Note: the output power is measured on the Preamble symbol.

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 applications or QoS.

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: The master's scheduler will schedule the sessions according to several criteria. Among others, the required level of QoS, per each session, priority, utilization of the resources in each frame, Channel condition of each client, in UL transmission, etc. This mechanism is used, to maximize air interface resource usage, to minimize power consumption and transmission power and maximize cell range coverag The system, which will occupy the spectrum, first, will cause the other system to loc for clean spectrum.

3. Procedures for Permit-but-Ask approvals

Applications for equipment based on restricted contention based protocol can be approved a TCB following the permit-but-ask procedure. An initial inquiry providing the informati described in Section 1 above must be submitted to the FCC for review. Once approved TCB may file for final approval once the rest of the application has been reviewed f compliance. The TCB is responsible for ensuring a complete review of the application f compliance with all the relevant requirements.

Special note must be made about the power limits specified in the rules for these devic These devices are subject to transmitted power[1] and power density limits. Also, mob devices may have to meet special restrictions based on the mode of operation. The grant mu also list the note code RS[2] to denote "restricted contention based protocol".

Change Notice:

4. **1/13/2010 552295** D01 CBT Guidance for 3650 3700 Band v01 has been changed to 55229 D01 CBT Guidance for 3650 3700 Band v01r01 to correct an error. Section 3 -Procedures f Permit-but-Ask approvals – the first sentence was correct from unrestricted to the restricted based protocol.

1 Grant comments "Output is EIRP".

2RS Note Code: This device incorporates a restricted contention based protocol. It is not capable of avoiding c frequency interference with devices using all other types of contention-based protocols. Operation is restricted to the 3650-3675 MHz band.