May 17, 2011

To:
Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD

Subject: Answers to FCC technical questions for devices operating in the 3650-3700 MHz band as per 552295 D01 CBT Guidance for 3650 3700 Band v01r01.

The product that we are seeking approval for is already certified for restricted use.

2.1 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:

Does the system use spectrum sensing to determine if the other devices are transmitting and then find ways to share the bandwidth, or

Have some other strategy?

Alvarion Extreme base station (802.16e WiMAX device) has implemented a channel collision sensing mechanism similar to the DFS-FCC 06-96A1 mechanism called DCS. The system performs a "listen before transmit" function at system startup (channel availability check) and also during normal operation once every two frames (10 ms). The system will detect (both at startup and on normal operation) if another system is transmitting on the same frequency, regardless of the type of transmitting protocol, and will move to a different frequency (user predefined) restarting the "listen before talk" function.

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?

The system uses an envelope detector to determine if the channel is busy. The detection threshold is configurable between -91 dBm to -65 dBm.

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

Alvarion Ltd.
21A HaBarzel Street, Tel-Aviv 69710, Israel
Main Line / Fax: 982-3-645-6262/6222
www.alvarion.com

At the initial time (system startup/channel move/channel availability check time) it can be configured between 10 ms and 4000ms. In normal operation, the measurement is made every two frames (10 ms) between the uplink and the downlink during the TTG gap which is 260 micro-seconds.

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

The bandwidth being monitored is the entire occupied channel, 5 MHz, 7 MHz, 10 MHz or 20 MHz as selected by the operator.

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

The system operator can adjust the busy channel detection threshold between -91 and -65 dBm. Also, the system operator can adjust for how long the base station needs a clear channel before starting to transmit, between 10 ms to 4000 ms.

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

When using the QPSK modulation scheme, CPEs will associate at minimum -98 dBm. However, the receive threshold depends on the Carrier/Interference requirements, which are different for each modulation level at various channel bandwidths. The system threshold and monitoring threshold have the same dynamic range.

2.2.7 Do 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)?

The base station performs threshold detection. Since the protocol is scheduled when the master stops working, the slaves stop also. In addition, a client is not allocated in each and every frame. It only works up to 30% of the time, giving other clients the opportunity to work in between.

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?

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If the base station determines the channel is occupied, it will stop transmitting on the current frequency and will move to another frequency from the user predefined frequencies list. After moving to another frequency, it will perform an initial "listen before talk" similar to channel availability check in DFS, for a configurable amount of time (between 10 ms to 4000ms) and if the channel is clear, it will resume normal operation. When a single frequency is configured, the algorithm listens to the channel once every two frames. If another system is detected, the master stops transmitting and starts the channel availability check. It resumes transmission after the channel is free of interference for a configurable amount of time (between 10 to 4000 ms), but continues to monitor it once every two frames.

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.

Not applicable.

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).

The Alvarion Extreme base station uses the 802.16e WiMAX protocol. Being a scheduled protocol, if the base station stops transmitting, the client will not receive its scheduling information and will also stop transmitting. In addition, a client is not allocated in each and every frame. It only works up to 30% of the time, giving other clients the opportunity to work in between.

2.4.1 When describing the occupancy profile, clarify any differences between start-up acquisition mode of spectrum and operational modes.

At initial start-up (cold or warm start-up), the system will perform a channel availability check during which will determine if the spectrum is clear or not. In this period, the base station will be silent. If the channel is clear, the system will start normal operation but will monitor the channel every two frames (every 10 ms).

2.4.2 In operational mode, how long does the system transmit before stopping giving others a reasonable time to transmit before continuing?

The base station will stop transmitting after detecting other systems on its frequency after maximum 4 frames (20 ms).

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

Yes, the system monitors the channel every two frames before transmitting as previously explained.

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?

BreezeMAX Extreme is a scheduled system which is defining its frame, downlink and uplink zones and load according to the traffic needs. If no traffic is required, then the base station is transmitting for a very short time in each frame at the beginning of the downlink zone, while CPEs are very rarely transmitting in the beginning of the uplink zone. The more traffic is needed, the longer the transmission will be. Such traffic load, even at the maximum level, will not influence the channel busy detection capability, because of the dedicated detection slot.

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).

The system does not impose any limitations. However, when sharing the spectrum with others, the overall capacity will be reduced. Also real time services will be affected.

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?

BreezeMAX Extreme, as well as other systems similar to ours, is able to work on the same frequency using Reuse 1 since it has permutation capabilities that randomize the subcarriers. In addition, the system is GPS synchronized, which means that the transmission and reception from one BS will not overlap with another BS. All base stations transmit at the same time and all the base stations receive at the same time. The system implements a power control mechanism on the UL direction to prevent interference between the sectors. Additionally, the system implements CAC on start up and, if it detects a BS transmitting, it switches to another channel.

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