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FCC ID: QC8-AN80IE

Answers to FCC Technical questions for devices operating in the 3650-3700MHz Band under Part 90Z 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. 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:

- 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?

[RDL] The Redline AN-80i master implements a collision avoidance mechanism which is similar to CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) used by the IEEE 802.11 standard. This additional functionality is on top of the scheduled air interface similar to that of the standards based 802.16-2004 (now 2009). This "listen before transmit" function is implemented before the start of every downlink transmission frame. If the signal power level detected is above the configurable threshold setting, the master will defer its transmission by a prescribed delay which is the configured frame duration (1…20ms) in fixed-frame mode or 1ms in variable-frame mode. After the prescribed delay, the AN-80i master will check again the signal power level and if it is found again above the threshold, the master will defer again its transmission by the prescribed delay. The process repeats until the master finds the channel free. The master checks that the channel is clear prior to every transmission.

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?

[RDL] The master transceiver design includes additional circuitry for detecting when the channel is busy. The busy channel detection level is configurable between -104 dBm (typical noise floor level) to -65 dBm relative to a unity gain antenna.

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

[RDL] The measurement is made every wireless frame (1 to 20ms) between the uplink and the downlink during the RTG gap which is at least 32 micro-seconds.

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

[RDL] The bandwidth being monitored is the entire occupied channel, 3.5 MHz,7 MHz, 14MHz, 28MHz, 5, 10, 20 or 40MHz as selected by the operator.

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

[RDL] The busy channel detection level is configurable between -104 dBm (typical noise floor level) to -65 dBm relative to a unity gain antenna. This allows the operator some level of flexibility for deployment while ensuring "sharing" of the band. This enforces the good RF neighbor policy for shared spectrum.

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

[RDL] Each modulation level, corresponding to the channel bandwidth, have their own Carrier/Interference requirement which in turns determines the receive threshold. The minimum level for the subscriber station to register is using BPSK at -97 dBm. The busy channel detection threshold has the same dynamic range.

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

[RDL] There are no additional checks.

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)?

[RDL] The air-interface protocol is based on scheduling; therefore every client is provided MAP information in order to transmit in the uplink. When the master does not transmit, there is no MAP information sent to the client so it will not transmit. When the master defers its transmission, the slaves will defer their own transmission by the same amount of time. Due to the nature of deployments (macro as opposed to micro or pico), the master has the vantage point of listening to the entire coverage area thus mitigating any chance of a hidden node.

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?

[RDL] When the detection threshold is exceeded, the master will defer its transmission. It will continue to monitor the channel and will resume the transmission once the RF channel becomes available. There is no impact of the traffic on the spectrum sensing. The mechanism works with 100% uplink and downlink bandwidth utilization as good as with 0% utilization.

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.

[RDL] 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).

[RDL] When the master does not transmit, there is no MAP information sent to the client so it will not transmit. Due to the nature of deployments (macro as opposed to micro or pico), the master has the vantage point of listening to the entire coverage area thus mitigating any chance of a hidden node.

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.

[RDL] The AN-80i master performs the spectrum detection prior to any transmission after cold start or warm start (reset). As in normal operation, the base station will not transmit until the channel is deemed clear.

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

[RDL] In operational mode, the master transmits based on the frame duration and the downlink ratio (based on TDD). The spectrum detection mechanism is used for each frame.

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

[RDL] Yes, the master detects on every frame.

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?

[RDL] If there is no data to transmit, the master will transmit just a short time at the beginning of each frame and slaves will occasionally transmit for a short time at the beginning of the uplink sub-frame (approximately middle of the frame) thus leaving the channel open for other systems to transmit. As more and more data is to be transmitted, the master and slave transmissions will get longer and longer. However, the detection slot will be present every frame even under heavy traffic saturation.

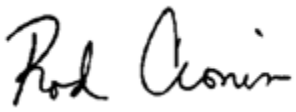
2.4.5 Describe if there are any limitations imposed by the contention protocol on what applications are used (i.e. limitations on Quality of Service).

[RDL] There are no limitations imposed by the contention protocol on the system operation. When a transmission is deferred because the presence of another system on the same channel is detected, the data delivery in both uplink and downlink direction will only be deferred. Therefore, when sharing the channel with other occupants, the system capacity will be reduced and the latency will be increased. In this case the master scheduler will prioritize traffic (based on packet classification rules) accordingly as it does in case of oversubscription.

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?

[RDL] Redline already has many of the lower 25 MHz band operators implementing their systems in this manner, even using different vendor's equipment. The operators have collaborated in sharing of the spectrum for the benefit of their subscribers. For systems that are not synchronized, if one is transmitting, the second system will transmit its payload in the next frame. Statistically, the contention will be equal if the loads are equal. With the detection algorithm in place, the master will not perform unnecessary re-transmits of the same data thus further utilizing the spectrum more efficiently.

Sincerely yours,



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