Before the

**Federal Communications Commission**

Washington, DC 20554

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| In the Matter of | ) | |
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| Facilitating Opportunities for Flexible, | ) | ET Docket No. 03-108 |
| Efficient, and Reliable Spectrum Use | ) | |
| Employing Cognitive Radio Technologies | ) | |
| | ) | |
| Authorization and Use of Software | ) | ET Docket No. 00-47 |
| Defined Radios | ) | |
| | ) | |

NOTICE OF PROPOSED RULE MAKING AND ORDER FCC 03-322

**Comments of WaveRider Communications Inc.**

WaveRider Communications Inc., a Nevada Corporation, hereby submits these Comments with respect to the Notice of Proposed Rulemaking and Order ("NPRM") issued in the above-captioned proceeding.

I. Introduction

WaveRider is a leading global provider of high-speed fixed wireless Internet access products. The company's Last Mile Solution® products have been deployed by service providers throughout the world as a cost-effective alternative to traditional 'wired' telecommunications networks. The success of WaveRider's Last Mile Solution® product family lies in its quality, speed, ease of deployment and its ability to support a cost-effective business model for all types of operators. In particular, the company's non-line-of-sight (NLOS), self-installable solutions operating in the license-free 902-928 MHz

spectrum, are gaining increasing acceptance in the market place. In January 2002, WaveRider's technology, which operates in the 902-928 MHz band, was the recipient of two awards from the Wireless Communications Association. These WCA annual advanced technology or community service awards, known as "The Wemmies, " are selected by WCA's jury of distinguished carrier or diversified engineering consultants. WaveRider won two awards, one for NLOS performance and another "Plug & Play" capability.

With more than 300 network systems utilizing the 902-928 MHz band installed in the United States supporting tens of thousands of users, WaveRider's Last Mile Solution® products are helping Internet Service Providers, independent telephone companies, municipal governments, utility companies, and other operators to bring immediate broadband access to their region, and realize a rapid return on their investments. WaveRider continues to deploy several systems each month, as service providers strive to meet the need for broadband services in underserved areas.

These networks in the United States, which operate in the 902-928 MHz band utilizing equipment regulated by Part 15 Rules, provide high-speed Internet access to communities, where there is little or no cable modem or DSL service. WaveRider's fixed wireless solutions in the 902-928 MHz band support a key initiative of the Commission, namely that of providing high-speed Internet services to rural and under served communities. Network operators, utilizing WaveRider's solution have been able to provide their customers with the type of broadband service usually available only in the

larger cities, and they are doing so at an affordable price. They also are providing broadband service to schools, hospitals, and local governments, giving those entities the ability to use broadband to deliver better and more cost-efficient services to their constituents and enhance the quality of life in their communities.

As a leading developer of equipment operating in the 900 MHz unlicensed band, WaveRider has developed considerable expertise in the challenges and opportunities that have been made available through the Part 15 regulations. WaveRider has noted with interest the strong interest by the Commission in modifying the rules, as new applications and technologies develop. We share the concern of the Commission that these changes properly reflect the balance between improving the quality of service that various applications can provide to their respective users, while at the same time keeping strong cognizance of the importance of the shared nature of the unlicensed bands.

WaveRider believes that continued success of the unlicensed bands in meeting the social needs of the country can best be achieved if there are strong regulations that support the industry's adherence to what could be called a "good neighbor" policy. Specifically, the keys to this "good neighbor" policy can be summarized as follows:

1. Services should be provided using as little of the available spectrum as possible
2. Spectrum should only be used when services are actually being delivered
3. Power levels used should be limited to that required to provide the service
4. Regulations should take into account all users of the spectrum

5. Regulations should be enforceable, and crafted such as to make deliberate or inadvertent violations difficult

In this NPRM, the Commission seeks to make rule changes to allow unlicensed devices employing certain cognitive radio capabilities to transmit at higher power levels in rural areas and other areas of limited spectrum use. We are pleased to submit the following comments, occasionally using the good neighbor tenets as a basis.

## II. Discussion

While WaveRider supports the goal of providing increased service coverage in regions where spectrum is “underutilized”, we have serious reservations about the proposed rule changes designed to achieve this objective. We are concerned that the net result will be an increase in total interference level, to the detriment of all users, an increase in the net cost per device to operate in the new environment, and a loss of incentive to achieve higher range through other, less impacting, applications of modern communications technologies.

Specifically, we make the following points:

1) The **Introduction and Executive Summary** makes a generic case for the potential of cognitive radio technologies to make possible more intensive and efficient spectrum use, and, specifically of interest to WaveRider, permitting the use of higher power by unlicensed devices in rural or other areas of limited spectrum use.

Part of the **Background** of the supporting case is contained in paragraph 25, which supports the concept of Dynamic Frequency Selection (DFS) as a relevant key enabling cognitive radio technology, quoting references to new signal level detection techniques that can allow the detection of energy levels of unknown modulation formats below the receiver noise level. Specifically the comment is made that

*"With such a detector capable of receiving signals more than 30 dB below the noise floor the hidden node problem that might result in missing the presence of a signal becomes much less likely…".*

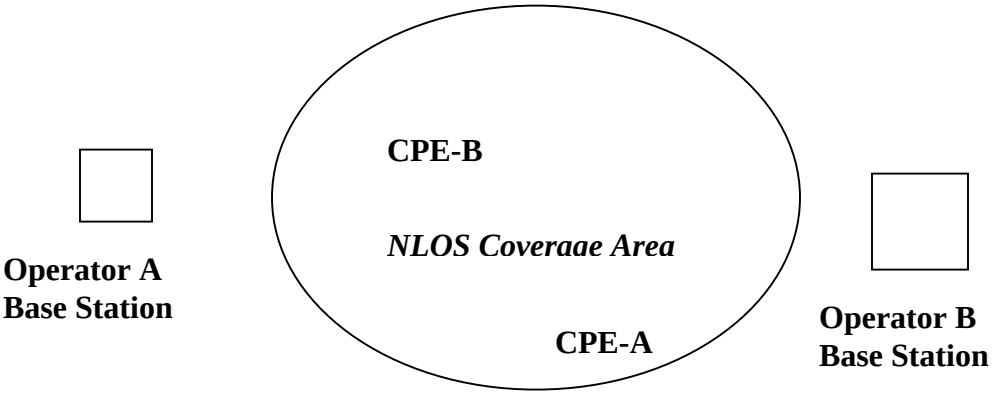
These general statements may be true, but do not support the proposed rule change that accepts a threshold of signal detection 30 dB above the thermal noise level. Since practical communications systems used in the unlicensed bands today can readily operate well below a 30 dB signal to noise ratio, this threshold would allow a system (say System B) to increase its power by 8 dB even in the presence of a viable existing service (by say System A), potentially ending the service for many of the existing system's customers. So while the action may increase the ability of the new operator to service more remote customers, it comes at the expense of service for the existing system's customers.

2) As a specific example, WaveRider Customer Premise Equipment (CPE) have a typical receive sensitivity of better than –90 dBm in a 4.7 MHz noise bandwidth. As measured in a 1.25 MHz bandwidth detection system this would appear as a signal level of –90 – 10log(1.25/4.7) = -95.8 dBm. The proposed threshold

specification of 30 dB above the thermal noise floor equates to a signal level in 1.25 MHz bandwidth of –83 dBm, fully 12.8 dB above the threshold working level of the CPE device. Thus a signal level that ranges from threshold to one that provides 12.8 dB operating margin is, by this proposed rule change, ignored.

The figure illustrates how easily this scenario can result. A key advantage of the 900 MHz band is its superior NLOS performance. At the same time, such NLOS links can be difficult to deterministically predict. In a typical installation, Base Station A, operating under the current rules, will provide NLOS service to CPE devices, such as CPE-A, to the limit of the sensitivity of the CPE device, plus a few dB of margin. With the advantages of diversity antenna technology and/or ARQ, this margin can be quite small. For a typical WaveRider CPE, the operating signal level at CPE-A might be – 86 dBm in the 4.7 MHz system noise bandwidth, providing a nominal 4 dB operating margin. In the proposed 1.25 MHz detection bandwidth, this would correspond to about –91.8 dBm. As per the figure, it is readily apparent that Base Station B might see the transmission from Base Station A as no more, or even less than the signal received at CPE-A, but in fact unless the signal is detected at a level at least 8.8 dB higher, the transmission will be deemed “not present”, and Base Station B will transmit at a signal level 8 dB higher than that of Base Station A in order to serve CPE-B. Since CPE-A is closer to the Base Station B transmitter than the Base Station A transmitter, it could be completely denied service as a result of interference from the enhanced signal level of Base Station B. Operator B may have achieved the objective of

extending its operating range, but in this case at the expense of the operating range of Operator A. It should be noted that CPE-B may not be able to increase its output power, depending on whether the signal it receives from Base Station A and/or CPE-A is above the threshold. If CPE-B cannot increase its output power, the link between CPE-B and Base Station B is only improved in one direction, a marginally positive result, but with a catastrophic result for CPE-A.




Of course, if Base Station A is a cognizant system, it may recognize that it needs to increase its power to serve CPE-A. There are two possible scenarios:

- Operator A sees the transmission of Operator B now at higher than –83 dBm in a 1.25 MHz bandwidth, and cannot increase it's power (Operator B "wins"), or
- Operator A is able to increase its power, thus both Base Stations are transmitting 8 dB more power, CPE-A may again have service, CPE-B

may no longer have service, the general interference level for all users is increased, and it is not at all clear that there is a "winner".

3) Over the past three years, WaveRider has successfully introduced new technology to improve the receive sensitivity of its radio devices, thus improving the coverage range for the users of the equipment. These changes have caused no increase in the interference levels of the unlicensed band in which we operate, and in fact now position us to be able to implement more refined Transmit Power Control (TPC) algorithms that will in fact lower the interference footprint of the product. At the same time, we have been able to reduce the cost of the CPE device, further increasing the applicability of the technology as a low cost solution for high-speed Internet services in rural/underserved residential as well as small business environments. We believe the same can be said of many of our competitors in this space. These are positive results. However, the adoption of the proposed rulings will clearly render such investments much less meaningful. In fact, the proposed rules would discourage the use of system wide Transmit Power Control (a key cognizant radio technology) since the very act of lowering the required signal powers can result in other users/operators increasing the interference levels, and negating the advantages of the improved sensitivities that would otherwise allow the reduction of power levels. Attention will have to turn to making higher power the objective, with the attendant negative results of higher equipment costs and higher general interference levels. This appears to be a "zero-sum" game.

4) In a “Greenfield” application, such as might be ideally intended for this higher output power capability, the first user of the spectrum, say Operator A, might set up to operate at the highest possible power to gain as much coverage as possible. A second user, say Operator B, who may subsequently want to use the spectrum for similar or different services, would see the higher output power/interference level as an increased barrier to use of the spectrum. Operator B does not know if Operator A is using the higher power level, so cannot predict that the interference level will decrease by 8 dB with a new band user. Thus, the new rule serves as an increased barrier to the equal access/use of the spectrum, a barrier to entry.

   The associated consideration would suggest it is quite risky for Operator A to plan network deployment based on using the higher power rule, knowing that at any time he may have to reduce this power, thus denying service to customers previously served.

5) The system proposed could result in instabilities. Consider two “cognitive” systems such that they are just out of detection range when transmitting at 36 dBm EIRP. System A declares the band “unused” and increases its power to reach a distant station (interfering with System B and ensuring that it never transmits at the higher power and thereby announcing itself to System A). A brief pause in transmission by System A allows System B to declare the band “unused” and increase its power, so now System A can no longer reach whichever station(s)

required the higher power. The cycle then repeats in the opposite sense. If the pause never occurs, it is simply unfair.

6) The concept is not useful for detecting any non-symmetric system (FDD, listen only, different signal types up and down). The objective is to avoid interference – that is for one system not to impact another system's receiver. This detection scheme is based on measuring the lack of transmissions in a band, as detected at your location, and assuming that this implies a lack of receptions in the band at another location. The argument that there isn't any other way to do it may be true, but it doesn't make a good solution.

7) The proposal to use a 1.25 MHz measurement bandwidth appears somewhat arbitrary, and discriminates against products that use wide bandwidth signals (e.g. 802.11b at 22 MHz). To make precise measurements in a rigidly defined narrow bandwidth would require a parallel narrow band receiver architecture, adding considerable cost to the product.

Notwithstanding our views as to the shortcomings of the proposed approach, we recognize that the FCC may deem these shortcomings to be an acceptable price to pay to achieve other objectives. If this is the case, we would request that serious attention be paid to methods of reducing wherever possible the negative impacts. In particular we would ask that the FCC consider:

a) The use of TPC would seem fundamental to reducing (though not eliminating) the overall increase in interference “noise” resulting from the proposed increase in power. This point is brought forward in the proposed rule of section 15.206 (c) (iv) (page 44 of NPRM). However this rule does not provide guidance as to what is meant by the phrase *“..level necessary for reliable communications.*”. Further, the proposal suggests that a “device” can make this determination, whereas it seems clear that this can only be determined by a pair of devices that are able to exchange link information. Again, no guidance is given as to how this might be standardized and regulated.

   For point-to-multipoint systems we would propose that the increased power only be applicable to systems that make unicast transmissions between the base station and CPE devices, and systems that can learn the maximum required power for each individual link, such that the increased power be only enabled as required. Further, we would recommend that for broadcast traffic that must be sent to all CPE devices, the lowest modulation level available be used and at the minimum power level required for that modulation to reach all CPE devices.

b) In response to the NPRM request for input as to the nature of the antenna that should be used to monitor the band, it seems only suitable that the same type of antenna be used, and in the same orientation, as will then be used to transmit the higher output power

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c) The proposed rule suggests that the increase in power is at the antenna port of the transmitting radio. A less damaging result would occur if the increased EIRP were required to be the result of higher gain antennas, thus ensuring that the increased interference is limited as much as possible in geographic scope.

d) Finally, the NPRM asks for comments re deleting the rule that prohibits the synchronization of the timing of hop sets to prevent a group of devices from monopolizing the use of the spectrum and blocking other devices from transmitting. Notwithstanding our disagreement with the principle of such synchronization, since most new systems that incorporate cognitive capabilities will likely be approved under the new digital modulation rules, and the FCC is currently allowing these systems to be certified with this synchronization capability, it is not clear why this remains a materially outstanding matter for discussion.

Respectfully submitted,

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