

**Before the
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554**

In the Matter of)	
)	
Petitions Regarding the Use of Signal)	WT Docket No. 10-4
Boosters and Other Signal Amplification)	
Techniques Used With Wireless Services)	
)	

REPLY COMMENTS OF WIRELESS EXTENDERS, INC.

Wireless Extenders, Inc. (“Wi-Ex”) hereby respectfully submits its reply to comments to the Wireless Telecommunications Bureau’s (“WTB”) Public Notice¹ in the above-captioned proceeding regarding the use of signal boosters and other signal amplification techniques that are used with wireless services.

As discussed in further detail below, Wi-Ex is firmly convinced that properly-designed signal boosters benefit consumers and serve the public interest by providing a cost-effective and consumer-friendly means of mitigating the effects of poor wireless coverage for Commercial Mobile Radio Services (“CMRS”). Broadband signal boosters that work across different spectrum bands allow consumers to extend coverage in their homes for multiple service providers, enhancing competition in the marketplace and saving consumer’s money while actually improving carrier network capacity. Like the Commission, Wi-Ex subscribes to the principles of innovation, competition, consumer choice, and incentives given through light regulation. We believe that sufficient evidence

¹ Public Notice, Wireless Telecommunications Bureau Seeks Comment on Petitions Regarding the Use of Signal Boosters and Other Signal Amplification Techniques Used With Wireless Services, WT Docket No. 10-4, DA 10-14 (rel. Jan. 6, 2010).

exists to conclude that these principles are at work in the area of CMRS signal boosters leading to a trend of effective, industry self-regulation. Wi-Ex is not seeking to have the Commission write its regulations to exclude competitors or alternative solutions, as the solutions proposed by some commenting parties would do; however, we do devote the bulk of our comments and recommendations to the primary area of our business in which we are market and technical experts – fixed-location, CMRS, consumer signal boosters. With the marketplace working to weed out inferior boosters, the Commission should not take the drastic step of prohibiting signal boosters that are not pre-approved by carriers as this would severely harm the growing market for these consumer-friendly devices. Wi-Ex believes that many interference fears are largely the product of past experiences with very-high-gain, high-power boosters and repeaters with older technology and that the magnitude of these fears is not applicable to low-gain, low-power boosters utilizing modern technology. The Commission has acted wisely in allowing market forces to work to mitigate both the coverage problems experienced by consumers and the negative side-effects of a few coverage solution products. The Commission should not “throw the baby out with the bath water” by effectively prohibiting numerous devices that serve the public interest because of a relatively-few reported cases of interference from poorly designed devices. Such a decision would be anti-innovation and anti-consumer.

I. BACKGROUND AND INTRODUCTION

A. About Wi-Ex

Founded in 2002 and headquartered outside of Atlanta, GA, Wi-Ex (<http://www.Wi-Ex.com>) develops, manufactures and distributes zBoost[®], a cell phone

signal booster for the home, office or car. The zBoost product line will Extend Cell Zones[®] for users by improving signal strength for better voice and data transmission while maintaining the integrity of the carriers' networks using multiple, patent-pending technologies. As the leader in consumer boosters, Wi-Ex continues to innovate including ease-of-use, consumer education, signal quality, and network protection. In early 2006, Wi-Ex was recognized as one of Georgia's top 10 Innovative Companies. We were selected by the 2007 International Consumer Electronics Show (CES[®]) as an Innovations 2007 Design and Engineering Awards honoree and a finalist for the CTIA Emerging Technologies (E-Tech) Award at CTIA WIRELESS 2007 and 2009 - Mobile Accessory category. Wi-Ex is a proud member of CTIA, CEDIA, and CEA.

The zBoost product line includes:

- zBoost YX510 for the Home & Office supports multiple users up to 2500 sq. ft.
 - Single Band: Supports PCS/1900 MHz or Cellular/800 MHz - \$299
 - Dual Band: Simultaneous PCS/1900 MHz and Cellular/800 MHz - \$399
- zBoost-ONE - the FIRST and ONLY ONE PIECE signal booster
 - YX400-P for PCS (e.g. Sprint) 1-4 users up to 1200 sq. ft. - \$249
- zBoost YX230 for the Car – Dual Band , multi-user - \$179
- zBoost zP Series – Dual Band, Window-mount, single-user
 - zPocket (YX110) boosts a device's signal in a pocket/cradle, for handsfree-use with speaker or headset - \$119
 - zPersonal (YX300) creates a Cell Zone in a workspace - \$169
- zBoost CI YX710 for Custom Installation in large (up to 10,000 sq. ft.) homes & offices

B. The Need for Signal Boosters

The Commercial Mobile Radio Services (“CMRS”) has been an amazing success in many respects. CMRS is no longer just a convenience; it has become as essential as the public telephone utility, a.k.a. the “landline.” In fact, the number of “cellular”

subscribers has already surpassed the landline numbers and the former is growing while the latter is declining – yet another example of the power of competition, innovation, and consumer choice. And every success introduces new challenges.

Consumers have come to rely on their wireless phones not just to communicate with their friends, family, and co-workers, but also in cases of natural disasters and other emergencies. Yet, consumers regularly face poor signal coverage not just in remote areas, but often in their residences and places of work. Instances of “dropped calls” have become all too frequent, resulting in lost productivity and, potentially, danger if consumers cannot place a 911 call. In fact, 67% of cell phone owners experience problems with their cell phone service, including dropped calls and data (39%), poor signal reception or dead zones in their home (32%) and poor signal reception or dead zones at work (25%).²

As stewards of the public spectrum, one could argue that the wireless carriers have an obligation to do their best to provide service availability to every American. No doubt this is a monumental challenge; perhaps even impossible depending upon how “service” availability is defined and with the present constraints including zoning restrictions and modern, energy-efficient, signal blocking glass and building materials. If carriers were required to provide reliable indoor service for all customers, they would be motivated to consider any technology or device that would meet the objective while minimizing any negative side-effects with the best possible economic outcome for all involved and the public good would prevail to extend wireless signals where the customers want it. Wi-Ex asserts that signal boosters (low-gain, low-power, bi-directional amplifier systems) are, in fact, a viable solution to benefit consumers’

² The “State of the Cell Signal” survey was conducted online by Harris Interactive® fielded the study on behalf of Wi-Ex from December 8 – 10, 2009 via its QuickQuerySM online omnibus service, interviewing a nationwide sample of 2,212 U.S. adults aged 18 years and older.

satisfaction which would reduce churn and associated costs to Cellular Carriers.

Wi-Ex was founded simply because of consumer (end-user) demand for in-home signal extension. So, the fundamental question is "Why do so many consumers demand [affordable] boosters?" The fact that consumers have been motivated to seek-out, pay for, and install signal boosters only serves to illustrate a serious problem of the current service model. If signal levels were as portrayed in advertisements, there would be little demand for boosters. And broadband boosters are the most sensible consumer choice; who would want to pay even more money to further lock themselves into a single carrier? Moreover, in households in which different family members subscribe to different wireless service providers, a broadband booster allows all members of the household to benefit from a single device, saving consumers both money and the hassle of having to install multiple devices. Unfortunately, wireless carriers' incentives may not always align with those of consumers, as individual carriers want to promote products that boost only their signals, not those of other carriers.

Wi-Ex was also founded upon the principle that helping one to the detriment of others is not a path to long-term success. We whole-heartedly agree that non-interference is critically important, but we must also point out that several commenters seem to suggest that boosters should be held to a standard that no other electronics are held to: absolute-zero spurious emissions (potential interference). Wi-Ex has met with executives and/or technical directors within many CMRS carriers, including the top four, and the concern of interference is always discussed. On each occasion, we ask for them to notify or involve us in any alleged interference caused by Wi-Ex products, yet we still have no knowledge of any confirmed cases. Wi-Ex's patent pending technologies focus on

protecting the public airwaves. In fact, non-interference is a higher priority than helping the user. When (we assume when, not if) a consumer improperly installs a zBoost product, the microprocessor reduces the unit's performance and indicates that the user needs to take additional steps to achieve maximum signal coverage: to read the manual or call our customer service. We consider it a normal part of doing business to support the user or accept the return if they are dissatisfied due to the performance consequences of installation and non-interference.

Having multiple service providers from which to choose helps many, but 56% of Americans claim to have done something special in order to make or receive a call at home.³ When base station antennas reside upon the same tower, multiple service providers may not provide a meaningful choice with respect to avoiding "dead zones" in coverage. With increasing local zoning restrictions on antenna and tower locations, carriers may have limited options to make significant improvements. Competition between service providers is typically a regulating factor, but the present economic model has reached an unhealthy equilibrium such that annual churn rates of 18% to over 36% are considered normal! These churn levels are so stunning that the industry reports them as monthly figures.⁴ Numerous issues lead to the large number of dissatisfied customers, but signal coverage regularly ranks in the top two or three reasons. Furthermore, the problem of signal coverage should not be allowed to lead to a solution which further exacerbates the Digital Divide. Simple economics encourages improved signal and data-speeds in more affluent areas and areas with greater population densities. What options

³ The "State of the Cell Signal" survey, Dec. 2009

⁴ These annual churn numbers were calculated by multiplying the monthly percentages found in the Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, FCC DA 09-54, Jan. 16, 2009 by 12 months.

do lower-income citizens have especially when their only phone is often a mobile phone?

The telecom industry faced strikingly similar challenges in the 1950s and 60s and it was the Commission's bold *Carterfone* Decision that paved the way for an amazing revolution of features, devices, and services that consumers now take for granted. At the time, the industry didn't know how it would adapt and prosper, yet it did so in a grand way. And it did so through the power of openness and innovation spurred by competition from a whole new group of entrepreneurs seeking to receive the prize of the consumers' choice with the guidance from the Commission in the form of the Part 68 Rules.

II. THERE IS NO NEED FOR COMMISSION ACTION AT THE MOMENT AS THE MARKETPLACE IS WORKING

Wireless Extenders (Wi-Ex) was founded to meet the wireless signal needs of the individual with the over-arching principle to do no harm to other users of the public spectrum. After satisfying hundreds of thousands of users, Wi-Ex has not been made aware that any of its products have ever caused interference. The few reports received have always turned out to be equipment from other companies. Wi-Ex takes complaints alleging interference very seriously.

Many companies in the emerging consumer booster industry have already shown that they understand that non-interference is essential to maximum customer satisfaction and to their long-term market success. They have demonstrated their responsibility by choosing to self-regulate through costly engineering development and additional cost to their products self-regulating. Wi-Ex led the way at the start of 2005 with the first consumer booster kit which included non-interference technology (and did so at about half the price of simple amplifiers/boosters). Wi-Ex further understands that mere non-

oscillation is not enough. The zBoost product employs multiple techniques to provide a stability margin from oscillation and continually monitors itself in the event that the environment or installation changes. In addition, zBoost adjusts and protects against excessive signals from both mobile devices and network base stations in order to maintain linear operation. Wi-Ex would be willing to work with the Commission or other manufacturers to develop a Code of Best Practices as a way to promote non-interfering boosters in the marketplace.

Some CMRS Licensees, including the three largest, submitted comments to Docket 10-4 and several provided specific data on cases of interference including verified instances of interference due to boosters. While all of the carriers asserted that the problem of interference due to boosters was rapidly growing, none provided data to support these allegations. To the contrary, the “RF Interference Log” data provided by AT&T in South Florida from August, 2007 through November, 2008 shows a constant rate of 6.5 instances per month. In fact, the number of cases of interference that were identified as being from boosters seems to have rapidly declined, from 73% of the cases in 2007 to 35% in 2008. Due to the rapid growth in zBoost sales, including in Florida, it appears that the percentage of boosters causing interference is actually declining.

As a practical generality, wireless boosters also have several self-regulating natural forces. First, a severely oscillating amplifier will quickly overheat and self-destruct. Second, a mildly oscillating booster also interferes with or fails to benefit the purchaser which most often leads to a phone-call to customer service or a product return. All of these appropriately penalize the manufacturer’s finances, reputation, or both.

The foregoing suggests that there is no need for the Commission to act at this time since the marketplace is working to develop robust, non-interfering products that benefit consumers while also weeding out poorly designed products that cause interference. The Commission should be careful not to stifle innovation by prohibiting the introduction of new, helpful products or requiring that they have been pre-approved by carriers for their sole benefit. As discussed above, carrier's incentives may not align with the interests of consumers, particularly with respect to broadband booster devices that boost the signals of multiple service providers. Given the relatively few and dwindling number of cases of interference complaints, the Commission should be careful not to "throw the baby out with the bath water" by adopting a rule which effectively shuts down the market for innovative new products that serve an important consumer interest.

III. IF THE COMMISSION DECIDES TO ACT, IT SHOULD BE CAREFUL TO ADOPT A SOLUTION THAT ACCOUNTS FOR THE DIFFERENCES AMONG BOOSTERS

Wi-Ex sincerely believes that properly designed wideband signal boosters best serve both the public interest and the licensees' interest. Technology has advanced, as it always does, to find solutions which did not exist when the regulations were debated and written. Wi-Ex maintains that the marketplace is working for consumer CMRS boosters. However, should the Commission decide that action is necessary to further promote the public benefit, it could consider initiating a rulemaking proceeding in order to develop equipment certification requirements to protect against interference appropriate to the differing types of boosters.

Should the Commission adopt standards addressing wireless boosters, it is important that such standards account for the differences among boosters and the

environments in which they are used. The use of boosters raises different issues depending on the technology employed by the booster device, the applicable spectrum band, and/or the environment in which the boosters are used. Any solution to interference concerns should recognize such differences and be careful not to prohibit boosters that raise no concerns of interference. In other words, a solution should not affect a majority of harmless devices because a minority of devices with different characteristics may raise interference concerns.

The following discusses different categories of boosters and their different potential impact. Wi-Ex believes that sensible options can solve all reasonable potential interference concerns for the affected parties while also placing appropriate responsibility on the appropriate parties.

A. CMRS vs. Public Safety

The airwaves used by Public Safety personnel deserve elevated consideration for stricter standards as well as operational priority. Wi-Ex has chosen not to market booster products for Nextel users because of the interleaving with Public Safety channels. As an example, we consider here the needs of Public Safety boosters in the Rebanded 800MHz region (“PS800”) along with the Part 22 CMRS 800MHz (“CMRS800”) frequencies (824-849 & 869-894 MHz). PS800 needs the protection afforded by better filtering to maintain a higher consistency of operation in the presence of various transmitters, especially with the proliferation of CMRS800 handsets and devices. This need does not preclude broadband (Class B) Public Safety boosters. Due to the Commission’s wisdom of including guardbands, standard frequency conversion to an Intermediate Frequency (IF) and SAW filters can still facilitate broadband boosters at a low cost and with low

delay (~1 μ S) [thus, avoiding the problems of narrow-band boosters, as highlighted in other comments]. This filtering also plays an important part in an innovative method to facilitate CMRS and Public Safety equipment being used in close physical proximity. Even ideally installed CMRS & Public Safety boosters in close proximity can cause each other to oscillate in regions of UL/DL frequency proximity (around 849-851 MHz, for example). A very simple, but thoughtful technique can solve this dilemma without excessive cost burden. Slowing down the interference (oscillation) response time from Public Safety booster equipment would effectively cause CMRS consumer boosters to reduce gain or shut-down first, thereby giving Public Safety equipment higher priority without cost-burdening consumer equipment. Filtering these close frequencies is unnecessary and quite cost prohibitive for consumer devices – adding around \$100 to the consumer cost. From other comments, other benefits arise from stricter filtering standards for Public Safety and Commercial CMRS systems and would still allow these two systems to cohabitate without cross interference. This type of technique will require additional timing and filtering analysis for various installation cases and frequency bands in order to choose the specific requirements, but it should be clear that this solution can address the needs of nearly all applications in a “win-win” fashion.

B. Mobile vs. Fixed-Location Boosters:

Mobility introduces environmental differences compared to fixed installations, including rapid changes in downlink signals (from BTS) and changing reflections from surrounding objects like metal-bodied transfer trailers. Also, due to the problematic nature of locating mobile devices should they malfunction, wireless mobile boosters logically may deserve unique standards.

C. Plug-in and Cradle-based vs. Wireless Boosters:

Direct plug-in or cradle-type boosters with under 30dB of gain pose almost no threat of interference. This low gain would mitigate UL noise rise and make feedback virtually impossible even if particular anti-oscillation measures proved inadequate.

D. High-gain vs. Low-gain Boosters:

High-gain devices have a higher probability to oscillate and affect the noise floor for a farther distance, it is logical to place appropriate restrictions upon these devices. Wi-Ex suggests that “high-gain” should be defined as above 75dB of System gain (see Attachment #3).

E. High-power vs. Low-power Boosters:

Since high-power devices have a higher probability to negatively affect other users or networks at a farther distance, it is logical to place restrictions upon these devices. Wi-Ex suggests 0.5W for the amplifier and existing Commission levels for radiated power (e.g. 2W peak for PCS).

IV. RESPONSE TO SELECT COMMENTS

It is noteworthy that all of the commenting manufacturers who support explicit carrier approval also have business models in which the carriers are their primary or only customers. It is, therefore, not surprising that they dismiss consumer boosters out-of-hand as competitive alternatives.

A. Nextivity Comments of February 3rd:

Nextivity correctly points out that 3GPP has standards for repeaters; however, those standards are based upon the foundation of outdoor repeaters with typical gain of

90dB, which are not appropriate for the consumer boosters produced by Wi-Ex. Despite the 3GPP underlying assumption, TR 25.956 does include system calculations for an example of a repeater for indoor coverage with a reasonable, 70dB of gain. This example is included in the Attachments (#1). The calculations assume near worst case parameters and show that the repeater neither overdrives the handset nor has any impact upon a near BTS's noise floor. Nextivity also suggests a few technical requirements, all of which can be easily met by low-gain boosters.

B. Verizon Wireless Comments of February 4th:

Verizon asserts that oscillation prevention is inadequate due to a few failures from one manufacturer's methods. Wi-Ex agrees that non-oscillation is necessary, but not sufficient to adequately prevent interference. A feedback system which is 1dB shy of oscillation adds signal distortion and significantly elevated noise. Even worse is that that 1dB is easily lost and [re-]gained over time due to changes in propagation. A system must guarantee a minimum stability margin (generally called "gain margin"). However, we also must point out that the information given by Verizon fails to show that the newer products have generated an increasing number (or percentage) of interference cases.

Verizon's footnotes on page 6 highlight a repeater referral program. Wi-Ex would like to point out that the 3,000 square foot solution, provided by Juni, costs \$1,295.00. In addition, the Verizon femtocell (Network Extender) does not provide broadband data connectivity, but, like all consumer femtocells, requires that the carrier receive access to the subscriber's existing broadband connection. Why would a consumer pay so much for a device which only functions for Verizon (or any one carrier)? Is this indicative of consumer choice and robust competition or the opposite?

Verizon argues in section “C” that simply because a specific manufacturer’s anti-oscillation feature did not prevent interference in all cases, that, therefore, anti-oscillation features are not possible. This is logically false. In addition, Wi-Ex methods are superior and we are always innovating for continuous improvement. More importantly, we again highlight the obvious lack of data showing any rise in interference cases, much less any rise in percentages or indication that the data presented is the “tip of the iceberg.”

Verizon also makes errors in their technical calculation for the impact of uplink noise on a BTS in section “C.2.a.”. Firstly, using a generous 6dB Noise Figure and 40dB of gain yields a rise to the thermal noise floor from -174dB/Hz to -128dB/Hz. This level then diminishes by about 60dB (10dB below the thermal level) after propagating (using best case p.f.=3.0, industry uses 3.0-4.0 for coverage) a mere 3 meters away from the booster antenna; hardly a threat to any BTS. Even using Verizon’s method of noise power in a 1.25MHz channel and using the -69dBm transmitted level propagating through a vacuum in free-space (p.f.=2.0) and in the 800MHz band, it attenuates to the -111dBm BTS noise floor in about 7 meters. In addition, the booster feature of lowering its UL gain in the pre a strong DL (for link balance), further reduces this improbability, even for higher gain or higher NF boosters. See also the attachment from 3GPP TR 25.956 mentioned in the above discussion of Nextivity. Furthermore, the “near-far” example fails to mention the more common benefit to the network. A mobile handset has its highest absolute level of Adjacent Channel Power (“ACP”) and the highest ACP relative (dBc) to the channel carrier when it operates in its higher power settings, which it does when it is “far” from the tower. Adding a booster causes the network to lower the mobile handset power, thereby lowering its ACP output and lowering the total ACP level

reaching all “near” towers. Wi-Ex booster amplifiers are more linear than those in handsets and do not add ACP.

Additional oversights are found in section “C.2.b.” While the example is not erroneous, it should indicate that the booster SYSTEM gain is 10dB. A wireless booster may require 47 to 62dB of amplifier gain to achieve 10dB of system gain (depending upon the frequency band, length of coaxial cables, and distance between handset and interior booster antenna). A booster with a physical, plug-in connection to the handset is more likely to achieve this system gain. The example also does not indicate how rare it is for the network to communicate with a handset at its -50dBm setting (or even -40dBm). See Attachment #2 for publically available graphs from two reputable manufacturers of handset amplifiers and components showing the probabilities (Probability Distribution Function or PDF) of handset output power. The second graph indicates that the PDF originated from the CDG (CDMA Development Group) which almost exclusively focuses on the EV-DO technology used by Verizon (and Sprint and others). The first graph also compares handset power for voice and data and is about 6-8dB higher for data which is what all cellular traffic is becoming.

Furthermore, modern 3G and 4G network technologies use mobile power control in a more sophisticated way to improve spectral efficiency. The higher signal [level & quality] users get scheduled in bursts with the highest data rates for shorter transmissions. So, Wi-Ex argues that modern boosters are an indispensable component of the national broadband networks that the Commission is promoting. And, we are certainly not alone; see Attachment #3 for one example of a technical article detailing some of the benefits of indoor systems supported by extensive system measurements with partial sponsorship by

Nokia Siemens Networks. As shown here, 70dB indoor repeater systems (55dB + 17dBi antenna) do not always provide maximum benefits compared to higher gain systems, but they are not shown to cause any harm whatsoever.

V. CONCLUSION

Commercial Mobile Radio Services (CMRS) has proven to be one of the more successful utilizations of public airwaves – now an indispensable part of modern living and public safety. CMRS carriers face an impossible necessity: providing a reliable signal inside of every building within their licensed areas of stewardship. Furthermore, the carriers face numerous opposing and increasing challenges: the difficulty of signal propagation to overcome zoning restrictions, energy-efficient, reflective building materials, and ever higher data speeds in an economically feasible way. And the carriers argue, just as they did in the 1950s and 60s, that the only solution is for them to have total control. History has refuted that argument time and again. Industry has innovated and developed cost-effective products which can meet the need of individual consumers and businesses while also reducing infrastructure requirements on CMRS carriers and maximizing new spectrum efficiencies of 3G & 4G technologies.

The reports and surveys of spotty coverage and the success of companies like Wi-Ex clearly demonstrates the need and demand for CMRS signal boosters. Reports of interference are limited and declining, so the Commission should be wary of acting in a way that stifles innovation and denies consumers access to products that mitigate the too common effects of poor signal coverage. Even in light of all of the public comments, Wi-Ex confidently maintains that all of the potential interference mechanisms can

reasonably be overcome in broadband, consumer-grade boosters using low-cost electronics and modern technology and are, in fact, already being addressed by Wi-Ex. The Commission has shown that it has the wisdom and authority to empower the American consumer through choice provided by competition and innovation, and it should do the same with respect to the market for signal boosters.

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Respectfully submitted,

WIRELESS EXTENDERS, INC.

March 8, 2010