In the Matter of	)	
	)	
Wireless Telecommunications Bureau seeks	)	
comment on petitions regarding the use of signal	)	WT Docket No. 10-4
boosters and other signal amplification	)	Released Jan 6, 2010
techniques used with wireless services		

Before the FEDERAL COMMUNICATIONS COMMISSION Washington, D.C. 20554

COMMENTS ON EXPARTE COMMUNICATION BY MILLARD/RAINES PARTNERSHIP ("SMART BOOSTER")

Introduction

On June 3, 2010 Michael Millard and Jeremy K. Raines submitted an *Ex Parte* Communication to WT Docket 104. The document particularly singles out my client Wilson Electronics, Inc. ["Wilson"] for criticism.

The purpose of this document is to review the misstatements, errors and/or misinterpretations embedded in the Millard/Raines document [the "Smart Booster" document].

> *"We continue to advocate intelligent boosters, and in particular our version called the Smart Booster, as shown in Figure 1."*

Indeed the entire Smart Booster document is a blatant attempt to sell a product. That product is not only unproven, but is in fact impractical and unmarketable, as I shall demonstrate below.

Intelligent Boosters Must Be an Integral Part of Future Wireless Networks

> *"...Unfortunately, these boosters cause interference problems because they are not intelligent. ... Only an intelligent booster has the capability to avoid these problems."*

Most if not all boosters currently marketed by reputable companies, including the Wilson Electronics products, use downlink signal strength monitoring and amplifier gain control. That this constitutes "intelligent" functionality is self-evident. Processors in Wilson products currently execute 17 pages of computer code.

Present Boosters Are Not Sufficiently Intelligent to Avoid Causing Interference to Cellular Networks

> *"While [Wilson's "forward link sensing"] methodology may initially seem logical, in fact it creates at least two significant problems in real world situations. They are: (1) false positives and (2) unnecessary signal boosting in densely populated areas."*

False Positives

> *"... If the downlink signal from that other carrier is sufficiently strong, then the Wilson booster will shut itself off. The undesired consequence is that, if the subscriber is located where the use of a signal booster is truly required, then that subscriber will experience dropped calls. This will occur whenever the Wilson booster passes in close proximity to a vehicle[,] occupants may experience dropped calls every few minutes due to false positives."*

Wilson has answered this issue, pointing out in part that shutoff would typically occur about 700 feet from the cell tower. "The likelihood that a vehicle traveling on the freeway with a booster would experience a dropped call, due to forward link shut off, is remote. When an occasional shut down occurs, the coverage just reverts to that which the phone experiences without the booster." To Wilson's comment I will add that the probability that shut down will cause a dropped call is still low,

since highways with relatively closely-spaced base stations will have close spacing for all carriers. Further in many areas it is common for carriers to share a common tower or space, in which case the "false positive" will have no effect whatever. Wilson reports that it has received no reports of dropped calls as a result of booster shut down.

> *"In cases of fixed installations, for example inside a building, the Wilson booster will <u>never</u> activate if it detects a sufficiently strong downlink signal from a competitor's base station. As a result, the installation inside the building is rendered useless."*

Wilson has several approaches to solving this problem: "...the booster can be reactivated by reducing the downlink signal into the booster with the use of a directional outside antenna pointed away from the offending cell site or by reducing the boosters gain. This will allow the installation to function properly without causing interference. Wilson estimates that no more than 3% of its units remain shut off after these steps have been taken. The 3% can be reactivated by the use of channelized boosters."

Undesirable Signal Boosting in Densely Populated Areas

> *"...Unfortunately, this means that the booster will be activated practically everywhere, including locations where it is definitely not needed... That is, the booster would be activated at all distances greater than 700 feet from a tower."*

In going from its introductory remark on "false positives" Smart Booster switches its stated "problem" from "unnecessary" to "undesirable" signal boosting. In so doing it highlights its own confusion; "unnecessary" is not necessarily "undesirable", to which I might add "undesirable" does not necessarily mean "illegal". However, confusing its adjectives is the least of Smart Booster's errors.

Smart Booster misses the entire point of its own "false positive" scenario by failing to recognize that, though the mobile may be 700ft. from one base station, it may be quite distant from the base station of the carrier to which it is subscribed. Additionally, regardless of distances between the mobile and the two base stations, its "own" signal may be more obscured by terrain or buildings than that of the other carrier. In these cases it would be untrue that the booster is "definitely not needed".

> *"...will not limit booster use solely to geographic areas where boosting is actually required..."*

Smart Booster fails to observe that weak signals can occur just about anywhere in an urban environment including locations very close to the user's own base station. Within the same "geographic area", for example in a large building, signal strengths will vary significantly from one point to another just a few yards away, and certainly from one floor to another.

> *"...consequently, will continue to frustrate carriers' engineering departments who must design their networks for nonboosted user handsets..."*

Smart Booster fails to offer a scrap of evidence that any carrier's engineering department gives any consideration to signal boosters. In my experience, they certainly do not. To the extent that Smart

Booster has observed frustration in these departments, it may have originated in other annoyances such as being "helped" by useless inventions.

> *"...will not meet Verizon's 15 Amplifier specification, discussed below..."*

Wilson has demonstrated that Smart Booster's faulty analysis and math render this comment untrue.

> *"...will not comply with FCC Rules mandating use of the minimum power necessary for successful communications..."*

Smart Booster offers no evidence for this assertion. Signal boosters that vary amplifier gain and hence transmitted power in response to downlink signal strength monitoring can be engineered for conformance to FCC Rule 24.232(c).

> *"...cannot be lowered to a more reasonable value and still adequately cover rural America, especially in situations where competing carriers construct facilities on opposite ends of town..."*

It would be a small town indeed where each carrier finds the need for only one base station. In that instance it is unlikely that the "near-far" scenario would pertain.

> *"...is no substitute for an intelligent booster that relies upon GPS positioning instead of forward link sensing."*

As I pointed out in an earlier comment, within the same "geographic area", for example in a large building, signal strengths will vary significantly from one point to another just a few yards away. In this situation GPS sensing would be useless even if its "database" were very finely divided and even three-dimensional. Any such database would fail to anticipate changes in environment that occur continually due to movements of people and objects. For example, in one instance I observed that moving a metal filing cabinet in an office changed nearby signal strengths drastically.

Further, in urban environments and particularly within buildings GPS systems are notoriously inaccurate due to multiple reflections, and indeed may lose satellite signals altogether. Even if cellular-assisted GPS location is used, it could fail in exactly the places where location signals are weakest and a signal booster would be most needed.

Figure 2 -
Cell tower located in a typical shopping mall.

"The cell tower is clearly visible, in close proximity, and with unobstructed line of sight. It is clearly unnecessary for the Wilson amplifier to be activated under these conditions."

Examination of the tower in question suggests that several if not all the local carriers are sharing the same tower, in which case the "near-far" scenario would not apply. In this type of situation, while operation of a signal booster may be unnecessary, it will also be completely harmless.

"...the Wilson booster would be activated, even though the downlink field strength is about a million times stronger than the field at the FCC defined CGSA contour. Clearly, in the proximity of every base station, regardless of the serving carrier, the Wilson booster will be on when it should be deactivated. Thus, it will contribute to ambient noise and over amplified signals, both forms of interference. Further, because the Wilson booster is broadband, it will be on within the CGSAs of adjacent carriers' FCC licensed territories when it should be off."

By definition signal boosters function independent of carrier or technology. It is permissible to operate them in any and every carriers' licensed territories, provided that no harmful interference is caused. In this context the phrases "it should be deactivated" and "it should be off" cannot apply.

In this docket the various complaints and arguments concerning interference pertain to specific situations. Wilson has demonstrated that they can be taken care of by downlink signal monitoring, automatic oscillation shutdown, automatic noise floor protection, and transmitter power control. In the case of fixed boosters these techniques can be augmented by using directional antennas and channelized boosters. Other than in these specific situations there is no rule that mandates "the...booster... should be deactivated".

"It will be on inside FCC mandated Quiet Zones when it should be off."

Quiet Zone designations are generally frequency-specific and I know of none that prohibits the use of cellular or PCS frequencies. There is nothing in the record of this docket that any harmful interference has occurred in a quiet zone due to signal booster operation or, for that matter, due to operation of mobile units. Smart Booster's comment is irrelevant.

"It will be on in general aviation aircraft flying at altitudes where not only boosters but all cell phones should be off."

It is not the responsibility of a signal booster or cellphone manufacturer or, for that matter, of a carrier, to police illegal uses of its products. The FCC is mandated to deal with infractions of this sort.

> *"It will be on in sports stadiums and similarly high concentrations of cell phone users when it should be off."*

Smart Booster repeatedly insists that signal boosters "should be off" when they are not needed. There is no FCC rule or regulation that requires this. For example, most cellphones are on all the time and transmitting periodically, including when they are "not needed". Further, as I have commented before, changes in environment occur continually due to movements of people and objects. The resultant fluctuations in signal strength may make the use of a booster desirable at one moment though it was unnecessary at another, even if the mobile does not move. Notwithstanding Smart Booster's repeated assertions, there is no evidence that a booster should be on or off as a function of its geographical location.

Smart Booster's "Mathematical Exercise"

In a separate filing (June 28, 2010, document 10-4_06-28-2010_Wilson_Electronics,_Inc._7020513962.pdf) Wilson has shown that Smart Booster's math is in error. I concur. The "mathematical exercise" is invalid, and the so-called "smart booster" is nothing more than a myth.

Intelligent Boosters Avoid Future Band Clearing Obstacles

Under this heading Smart Booster attempts to "sell" its GPS/geographic database concept. I have commented above that the basic concept is flawed because geographic location is not a reliable indication of the moment-to-moment need for a booster.

I further take issue with Smart Booster's assertion that it can obtain cooperation from the carriers. In my experience although the location and other technical parameters of base stations must be registered with the FCC, beyond this basic information carriers consider their coverage design, drive test data, customer complaint tickets and other pertinent information to be strictly proprietary and confidential. Carriers are most unlikely to release this data to a third party for the purpose of having it distributed widely (even if it is encrypted), and will be even less inclined to update the information frequently enough to be useful. Smart Booster has offered no compelling reason why it would be in a carrier's best interests to cooperate.

The FCC's own wireless regulatory operations are flooded with information from carriers, as a result of which the location of a new base station may take months to appear on FCC databases. In a recent consulting assignment I found no record of two base stations of which I had current photographs and GPS locations, and which I was told had been installed for some months.

Conclusions

> *"In one form or another, boosters almost certainly cannot be excluded from wireless networks."*

I agree wholeheartedly. Signal boosters demonstrably serve useful purposes, including safety of life, against which the regulation of minor interference issues must be carefully weighed.

> *"...Haphazardly designed boosters will become an increasingly serious handicap..."*

That is precisely why petitioners in this Docket are calling for new rules.

> *"...Intelligent boosters will become an essential enhancement."*

To the extent that "intelligent boosters" are typified by the mythical Smart Booster, this prediction is very unlikely to be realized, as I have argued above. No doubt there are other approaches that will in the future prove to be "smart".

The FCC has the statutory power to eliminate from the market all signal boosters that cause harm to the operation of licensed mobile networks. Wilson has proposed certification testing and changes to Part 20 of the FCC's rules to ensure that only non-harmful equipment may be offered on the open market. In my opinion the changes are an essential set of minimum requirements to which currently available and future boosters should comply:

- Handset amplifiers must be bi-directional and have balanced gain in each direction
- Automatic oscillation shutoff is required.
- Automatic noise floor protection is required

In the meantime the FCC should resist recommendations with no basis in fact or law from industry associations and ignore the promise of "smart" magic bullets that have no technical merit.

Signed this 13th day of August, 2010

Ray W Nettleton

Faculty :: Assistant Professor :: Ray Nettleton

Bio

Ray W. Nettleton has been a leader in the Telecommunications Industry for over 30 years, during which time he has served as an engineer, manager, consultant, entrepreneur, corporate officer and educator.

Dr. Nettleton received his Ph.D. from Purdue University in 1978. His thesis, on using CDMA techniques for cellular telephone systems, was controversial at the time, but has now won worldwide acceptance with the advent of third-generation cellular systems (3G). He was granted the first two patents on the technique.

Dr. Nettleton has taught undergraduate and graduate courses in mathematics, probability theory and electrical engineering full-time at Michigan State University and part-time at the University of Maryland, The Johns Hopkins University, the University of Colorado and the University of Denver. He is a frequent guest speaker at conferences and symposia, and has published some 80 papers and presentations.

Dr. Nettleton's career has also encompassed work for the US Armed Forces on marine and airborne radio and satellite communication systems and for NASA on scientific satellite systems. He has advised the FCC and many regulators worldwide on matters pertaining to spectrum allocation. He came to Colorado in 1991 to direct the wireless R&D efforts at US West Advanced Technologies, building the PCS National Test bed in Boulder. He has worked with many graduates of CU's Interdisciplinary Telecommunications Department. Most recently he was a co-founder of Formus Communications, a broadband fixed wireless loop company operating in Europe and Latin America.

Dr. Nettleton is a consultant providing technical expertise and strategic advice to industry. He has also provided expert testimony in patent litigation cases and in public hearings before regulators.

Courses

No current courses.

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