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

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 techniques	)	Released Jan 6, 2010
used with wireless services	)	
	)	
_____	)	

COMMENTS OF MILLARD/RAINES PARTNERSHIP
("SMART BOOSTER")

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Submitted via ECFS: February 4, 2010

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I. Introduction and Summary

Michael Millard and Jeremy K. Raines, Ph.D., P.E., inventors of the Smart Booster, are pleased to submit comments to the five separate petitions contained in WT Docket 10-4.

Briefly, the petitions echo three major requests. First, the carriers or network providers request that direct sales of handset boosters to consumers be banned or prohibited because they cause frequent and harmful interference. Second, the booster suppliers and manufacturers request that direct sales be allowed, subject to well defined standards yet to be determined. Implicit in the second request is a third one for improved service to consumers in areas with insufficient signal strength. Clearly, these requests are conflicting. Ideally, some middle ground can be formulated that somehow satisfies all of them.

In the sections that follow, each of the petitions will be examined one by one. It will be seen that, indeed, handset boosters can and do cause serious interference when deployed with impunity. That is, they don't know when to deactivate themselves at locations and in situations for which they are not needed. It will further be seen that there is a legitimate need, and a resultant consumer demand, for handset boosters at locations with insufficient signal coverage. In those cases, there is negligible risk of interference to the networks; however, the booster must be sufficiently intelligent to activate itself only at those locations. Further, the booster must also be intelligent enough to know which communication channels to use and which ones not to use, so that it complies with blanket licensing provisions.

In view of the above, an intelligent handset booster will satisfy both the concerns of the providers concerning harmful interference, and the needs of consumers to access service in areas they presently find unusable. Further, it will use technology to relieve the FCC of an untenable enforcement burden. The Smart Booster is just such a device.

Following discussion of the separate petitions, the patent applied for Smart Booster will be described in detail.[1] It offers distinct advantages over present handset boosters on the market today. Existing boosters are either basic or adaptive.[2] The basic booster is activated all the time and causes interference by oscillation or by raising the noise level when in close proximity to base stations. Adaptive boosters use downlink sensing to deactivate close to base stations; however, they do not protect adjacent CGSA's (Cellular Geographic Service Areas), and they can deactivate in response from a strong signal on the wrong channel, failing to provide the consumer with usable service. Clearly, a higher level of intelligence is needed for a handset booster that can simultaneously avoid interference and provide signal amplification, on the correct channel, activating only at locations where service is otherwise unusable.

As the following sections will show, the Smart Booster offers that level of intelligence, and a much needed standard of performance for all handset boosters. It will simultaneously satisfy network concerns about interference, the consumer need for service in unusable areas, and the FCC's need for relief from an impractical burden of enforcement.

[1] USPTO Application: US 12/319,242
[2] See Exhibit 4, Comparison of Booster Capabilities.

II. Comments to CTIA Petition for Declaratory Ruling

On November 2, 2007, CTIA – The Wireless Association® (CTIA)[3] filed a petition with the FCC requesting a Declaratory Ruling. The ruling would confirm that the "unauthorized sale and use of wireless boosters and repeaters is unlawful". The request was made in reaction to documented cases of wireless boosters and repeaters causing harmful interference to the radio uplink environment, that is, to the spectrum used for signals from the subscriber's handset to the carrier's base stations.

While harmful interference is a serious phenomenon that must be remedied, it is also irrefutable that wireless boosters and repeaters, also known as bi-directional amplifiers or BDA's, provide an important, if not essential, way for consumers to maintain usable and robust signal coverage, especially in rural and underserved areas.

Further, we disagree with the fundamental premise of the CTIA petition, namely, that, "The Ubiquitous Availability of Commercial Wireless Service Promotes Public Safety and Serves the Public Interest." There is no doubt that public safety and public interest are promoted; however, there is also no doubt that commercial wireless service is NOT ubiquitous. In fact, it is seriously lacking for many cellular phone users, and that is the reason for the robust emergence of handset signal boosters.

[3] CTIA-The Wireless Association®, is an international nonprofit membership organization founded in 1984, representing all sectors of wireless communications – cellular, personal communication services and enhanced specialized mobile radio. CTIA 1400 16th Street, NW Suite 600, Washington, DC 20036 Phone: (202) 736-3200

We agree with CTIA that cellular jammers, which are distinct from boosters and repeaters, intentionally interfere with licensed radio services and must not be allowed to enter the stream of commerce. Sales of jamming equipment should be limited to the Federal Government, and used only under the strictest guidelines. We also believe that the prohibition against jamming should extend to all licensed radio services, including all CMRS operations.

We strongly and fundamentally disagree that Part 22 and Part 24 licensees are currently empowered to "authorize" or "not authorize" BDA use by individual consumers and by the public in general. In other words, the blanket licensing that applies to handsets does not apply to boosters, because a booster does not satisfy the definition of a mobile station. We further believe that even if the Commission were to affirm such empowerment, then the carriers are still effectively precluded from authorizing BDA use in the mobile environment for the reasons outlined below and throughout these Comments.

We also believe that the handset boosters presently in use should never have been OET certified, for many reasons, and according to multiple FCC Rules, as discussed in the following paragraphs.

The majority of cellular boosters under consideration in these proceedings received their OET Certifications from third party Telecommunications Certification Bodies (TCB)

in accordance with 47CFR2.[4] In all cases of which we are aware, TCB testing of these booster devices did not attempt to measure or account for their operation as intentional radiators. Instead, they were tested only as amplifiers connected to purely resistive loads, which do not radiate electromagnetic energy into free space, and not connected to antennas.

The testing and certification of cellular boosters without antennas attached makes no sense. Each of the OET certified booster devices listed in Exhibit 1 are accompanied by a User Manual posted on the FCC's OET Equipment Certification website. These User Manuals clearly show that these devices were intended for use with attached external antennas. Since it was clear that antennas were connected, and therefore, that the device would operate as an intentional radiator, measurements of that radiation should have been performed. They were not.

As a consequence, we are now left wondering whether the device as tested is the same device that is presently being sold to consumers. Rule 2.1043(a) requires that,

> "…any changes to the basic frequency determining and stabilizing circuitry (including clock or data rates), frequency multiplication stages, basic modulator circuit or maximum power or **field strength ratings** shall not be performed without application for and authorization of a new grant of certification." (Emphasis added.)

[4] See Exhibit 1 for a partial listing of currently authorized BDA devices.

Clearly, the connection of antennas to the device during testing greatly affects field strength ratings.

To the best of our knowledge, none of the devices listed in Exhibit 1 have received new grants of certification which recognize their function as intentional radiators with antennas attached.

In view of the above, the first question is whether booster devices currently on the market violate Rule 2.1043(a).

Besides that rule, Rule 22.923 clearly states that:

> ***Mobile stations communicate with and through base transmitters only.*** *Base transmitters communicate with mobile stations directly or through cellular repeaters. Auxiliary test stations may communicate with base or mobile stations for the purpose of testing equipment.* (Emphasis added.)

According to the above, it is clear that booster, whether tested and certified as an amplifier or as an intentional radiator, may not be inserted between a mobile station (i.e., a handset), and a base transmitter. We explore this concept further in the remainder of these Comments.

In addition to the above two rules, Rule 2.962(e)(5)(i) instructs that a TCB may not…

> *…grant a waiver of the rules, or certify equipment for which the Commission rules or requirements do not exist or for which the application of the rules or requirements is unclear.*

Because it appears that boosters violate Rule 22.923, TCB's have evidently violated 2.962(e)(5)(i) as well. The failure of the TCB's to comply with the obligations imposed by Rule 2.962 likely explains how booster devices were allowed to enter the market.

The above discussion relates to CTIA's request that the Commission "…certify that the mere presence of such equipment in the stream of commerce for some lawful purpose does not mean that wireless repeaters and boosters may be made generally available to the public for any purpose." In view of Rule 22.923, we question whether the devices listed in Exhibit 1 even have "some lawful purpose" at all.

Additionally, all of the booster devices listed in Exhibit 1 are capable of continuous broadband operation on all spectrum assigned to a particular radio service, and therefore, impact all licensees of those services. As will be explained in greater detail later in these Comments, carriers are precluded from extending licensing authority to devices operating on the spectrum of other licensees. Therefore, even if the Commission were to conclude that such equipment complies with the above rules, these devices will necessarily frustrate commission objectives relating to the blanket licensing of devices on carrier networks.

Pursuant to FCC Rule 2.939(a)…

> *The Commission may revoke any equipment authorization: (2) If upon subsequent inspection or operation it is determined that the equipment does not conform to the pertinent technical requirements or to the representations made in the original application. (3) If it is determined that changes have been made in the equipment other than those authorized by the rules or otherwise expressly authorized by the Commission. (4) Because of conditions coming to the attention of the Commission which would warrant it in refusing to grant an original application.*

In light of the foregoing arguments, we urge the Commission to conclude that the booster devices listed in Exhibit 1 violate FCC Rules and that their equipment authorizations should be revoked pursuant to Rule 2.939(a).

On the other hand, we also urge the Commission to recognize that cellular service is far from ubiquitous, as claimed in the CTIA petition, and that some sort of booster ultimately must be deployed to amplify signals at unusable locations. Rigidly enforcing existing rules does not solve the practical problem of unusable service that frustrates the public interest. While the types of boosters presently available violate FCC rules that protect against interference, a more intelligent type and reasonably modified rules could be entirely compatible. We will pursue this line of reasoning later in our Comments.

III. Comments to Wilson Electronics Petition for Rule Making

Wilson Electronics is a leading manufacturer of cellular handset signal boosters. Its innovations have elevated boosters from the basic category to the adaptive one. Basic boosters are activated all the times and at all locations, and they can oscillate spontaneously, causing the most obvious form of harmful interference. Adaptive boosters have anti-oscillation circuitry. More advanced versions have downlink sensing that deactivate the device when a sufficiently strong signal is received.

Wilson Electronics, Inc. has petitioned the FCC to amend Part 20 of its Rules to establish standards for the certification of adaptive mobile power amplifiers and handset signal boosters for use in the Commercial Mobile Radio Services.

Wilson seeks to circumvent carrier review and evaluation of devices used on the networks by asserting that modified FCC Rules can supersede all carrier participation in the approval process. It can not.

Despite Wilson's engineering innovations, we very respectively suggest that their adaptive boosters still do not meet the minimum requirements for an intelligent booster that would eliminate all harmful interference and also provide relief for consumers at locations with unusable service. In particular:

1. The Wilson booster is still fundamentally a broadband amplifier that radiates into the spectrum of licensees other than the one to which a particular consumer subscribes.

2. The Wilson booster can neither recognize, nor protect, the boundaries of Cellular Geographic Service Areas (CGSA's).[5]

3. Those versions of the Wilson booster that offer downlink sensing are susceptible to false positives. That is, they will deactivate in response to a strong signal from the incorrect block of spectrum, depriving the user of amplification where it might, in fact, be necessary.

The above concerns, and others, are discussed In the following.

While we agree signal boosters are essential in certain situations and locations, that does not justify eviscerating carrier stewardship of their licensed spectrum. Indeed, by Wilson's own admission, carriers are unable to allow operation of wideband signal boosters on the networks because they necessarily infringe on the spectrum of other licensees. Rather than design boosters which operate solely on the authorized spectrum of the licensee, and provide for operational control of the devices by that licensee, as required by current rules, the petitioner seeks to change the rules to suit its best economic interests.

[5] Cellular Geographic Service Areas (CGSA's) are defined by FCC Rule 22.911 and are the subject of comments appearing later in this document.

We agree with Wilson Electronics that a properly designed signal booster can prevent harmful interference. Wilson Electronics, Inc. was recently awarded US Patent Number 7,409,186 covering a novel approach to significantly reduce or eliminate oscillation in signal booster equipment.[6] Our review of this patent convinces us that an amplifier equipped with this technology is capable of detecting undesirable oscillation and of subsequently shutting down. Wilson claims this circuit can operate in 10 milliseconds, which if true, is likely fast enough to prevent significant uplink interference events of the sort reported by industry. But it must be understood that oscillation in the uplink is not the only cause of harmful interference.

The fact remains that not every signal requires additional external amplification. Indeed, the advanced air interface standards in use by wireless carriers function best with an uplink signal strength at the minimum power necessary to complete the call. In that regard, unnecessarily amplified signals are a form of harmful interference.

In recognition of this reliance, FCC Rules require that mobile transmissions of Part 24, Subpart E (Broadband PCS) systems comply with stringent power requirements in the uplink.

[6] US Patent No. 7,409,186: Detection and elimination of oscillation within cellular network amplifiers. Inventors: Van Buren; V. Alan (Cedar City, UT), Skrypnyk; Volodymyr (Hurricane, UT), Cook; Patrick L. (St. George, UT) Assignee: *Wilson Electronics,* Inc. (St. George, UT) Appl. No.: 11/457,406 Filed: July 13, 2006

Specifically, FCC Rule 24.232(c) requires that…

> *…Mobile and portable stations are limited to 2 watts EIRP and* ***the equipment must employ a means for limiting power*** *to the minimum necessary for successful communications.* (Emphasis added.)

The Wilson devices specified in Exhibit 1 do not employ any means for limiting power to the minimum necessary for successful communications. Instead, these devices indiscriminately amplify the entire cellular and/or PCS spectrum to the maximum capability of the device.

That Wilson's, and other manufacturer's, amplifiers do not employ any means for limiting power to the minimum necessary for successful communications is yet another reason the devices should not have been certified by the Telecommunications Certification Bodies (TCB's).[7]

Unfortunately, consumers cannot be expected to understand the engineering details and signal processing protocols behind today's broadband wireless networks. Therefore, they cannot be expected to utilize signal boosters solely in areas where such use would not conflict with Rule 24.232(c). More likely, they are apt to believe that if a signal booster improves coverage in marginal areas where signal amplification is truly needed, then it will make reception of strong signals even better. In fact, the opposite is true. Too much amplification where it is not needed unnecessarily restricts the

[7] See FCC Rule 2.960, Designation of Telecommunication Certification Bodies (TCBs).

communication range of individual cell sites, leading to large gaps in coverage between cell sites for all consumers.

Wilson Electronics cites the Mexican Hat, Utah tour bus accident, and a subsequent Safety Advisory issued by the National Transportation Safety Board (NTSB)[8], as further evidence that cellular communications in rural areas benefit from the use of boosters. We agree. Implicit in Wilson's argument, however, is the logical trap that uninformed consumers will use boosters with impunity, believing incorrectly that they are a panacea for improving coverage at all locations.[9]

We agree with Wilson that much confusion stems from the FCC definitions of the terms surrounding the booster problem. This is covered in more detail later in our Comments.

We also agree with Wilson that, in principle, carriers should not be permitted to prevent subscribers from using non-harmful handset amplifiers of their choice. For the reasons cited above, however, and throughout these Comments, Wilson handset amplifiers are not "non-harmful" because they indiscriminately amplify the entire spectrum when such amplification is not needed.

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[8] National Transportation Safety Board (NTSB) "Motorcoach Run Off the Road and Rollover, U.S. Route 163, Mexican Hat, Utah", January 6, 2008 Accident Report NTSB/HAR-09/01 National PB2009-916201 Safety Recommendation H-09-9, issued May 29, 2009.

[9] In fact, not all call performance problems are the result of insufficient signal strength, for example, maintenance issues, or a carrier's call capacity and network loading may be to blame for a dropped call.

An example of interference caused by unnecessary booster deployment is described in comments filed by Wilson's attorneys in WT Docket 10-4.[10] While the filing seeks to discredit the reasons that the FCC's Northeast Regional Enforcement Bureau issued a Warning for Unlicensed Radio Operation to one of Wilson's customers, the filing actually points out a fatal weakness in Wilson's entire product offering.

The Warning was issued in response to the operation of a BDA device at One Call's office located at 726 Grant Street, Troy, Ohio. Operation was not in a sparsely populated area. As of the census of 2000, there were 21,999 people, 8,920 households, and 5,887 families residing in the city. The population density was 2,267.8 people per square mile. By these measures, Troy is a sizable city served by several wireless carriers. Further, we note that the 726 Grant Street location is barely 0.45 miles, or about 2,400 feet, from AT&T's tower located at 229 S. Mulberry Street, Troy, OH, and marked with FCC ASR# 1250671.[11]

In view of the above geography and other factors, it appears almost certain that a signal booster was deployed in an area where amplification was completely unnecessary, and as a result caused harmful interference to the carrier's operation.

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[10] See comments of Lukas, Nace, Gutierrez & Sachs, LLP, attorneys for Wilson Electronics, Inc., LETTER filed January 14, 2010, WT Docket 10-4.

[11] Antenna Structure Registration (ASR) # 1250671 is registered to Cincinnati SMSA Limited Partnership, 5601 Legacy Drive, Plano, TX. This entity is the license holder for AT&T Cellular B-Block, CMA-040 Dayton, OH, FCC Call Sign: KNKA285. The structure height is 53.6 meters above ground level, and a visual inspection via Google Earth™ Street View clearly shows the cellular antennas mounted near the top of the silo. Please see Exhibit 5 for AT&T Mobility coverage map, Troy, Ohio.

It is precisely this situation that Smart Booster technology avoids.

Finally, we note a flaw in Wilson's argument contained in their petition that,

> *"legally speaking, [operation of BDA while roaming] is the same as when a VZW subscriber would use a VZW-approved handset amplifier when roaming in another carrier's service area."*[12]

The argument incorrectly assumes that Verizon (VZW) would approve a broadband BDA device for use in a mobile environment. Even Wilson acknowledges this is not the case. Verizon would only authorize a channelized BDA, if any. But, if the BDA were channelized, then it cannot roam within another carrier's service area because it is not frequency agile. Therefore, the conclusion cannot follow from the premise that is, *reductio ad absurdum*.

[Remainder of page intentionally blank.]

[12] WT Docket 10-4, Wilson Electronics Petition for Rulemaking, pg.16.

IV. Comments to DAS Forum Petition for Rule Making

Generally, the PCIA DAS Forum petition seeks to reduce booster interference through a rigorous carrier coordination and recordkeeping process. It suggests establishing an industry Code of Conduct for installers, and requests that the Commission resolve booster interference without inhibiting the sale and professional installation of repeaters.

We agree with the DAS Forum that improved coordination between professional booster installers and carriers will reduce interference; however, we emphasize that the overwhelming majority of booster related interference complaints received via the FCC's CTIX[13] website result from installations made by consumers or the general public. Therefore, we do not believe a Code of Conduct applicable only to professional installers will materially reduce the number of booster interference complaints.

The DAS Forum petition also requests *"the sale of equipment… shall be accompanied by a notice stating that it is the responsibility of the owner/installer… to avoid harmful interference."* As with the Bird Technologies approach, discussed below, we fundamentally disagree that any device labeling or product packaging requirement will be successful in combating booster interference. It cannot be correctly assumed that owners or installers will voluntarily read, let alone comply with, product packaging, device labels, or even the Instruction Manuals.

[13] CTIX is a process whereby carriers can alert the FCC to interference using an online reporting form administered by the FCC Enforcement Bureau. (Link: http://www.fcc.gov/eb/CTIX/)

Finally, we believe the notification and recordkeeping requested by the DAS Forum petition will be too burdensome for carriers to administer, resulting in database errors and omissions, thus negating any benefit.

We agree with the petitioner that obtaining carrier authorization prior to installation is impractical for many situations, especially if the actual carrier cannot be specified in advance.

[Remainder of page intentionally blank.]

V. Comments to Bird Technologies Petition for Rule Making

Generally, the Bird Technologies petition seeks to amend FCC Rule 90.219 to prevent boosters from causing harmful interference to public safety radio systems, particularly those occupying the Specialized Mobile Radio spectrum. The petition suggests a more stringent equipment certification process, a device labeling requirement, a prohibition against mobile deployment of boosters, a prohibition against direct sales to consumers, and various new recordkeeping responsibilities for the licensee.

We agree with the Petitioner that harmful interference to public safety radio systems and other licensed services can occur from existing signal booster operation; however, we are unconvinced that interference can be adequately controlled by the recommendations outlined in the petition.

We strongly disagree that a prohibition against deployment of boosters in mobile environments is needed for the many reasons outlined in these Comments.

We also disagree that burdensome recordkeeping requirements will result in interference free operation of public safety radio systems or any other licensed service. Such recordkeeping is typically rife with administrative errors and omissions over time. Furthermore, in the case of boosters sold directly to consumers, database accuracy would depend greatly on the voluntary cooperation of the public, which is an assumption that cannot be justified.

Even if recordkeeping could be maintained with acceptable accuracy, the petition would result in many hundreds, if not thousands, of databases administered separately by the various licensees. Clearly, neither industry, nor the FCC's field enforcement bureau personnel have the resources necessary to manage that amount of decentralized information.

We fundamentally disagree that any device labeling requirement will successfully combat interference in the public safety and other licensed radio services. It cannot be correctly assumed that consumers will voluntarily read, let alone comply, with product packaging, device labels, or even the Instruction Manual.

Finally, we note that the majority of the Bird Technologies petition relates to traditional, narrowband public safety communications systems. In such systems, the use of predictive intermodulation models to combat harmful interference can be quite useful, but is wholly impractical for use in the Cellular and PCS spectrum because of the wideband nature of those services.

[Remainder of page intentionally blank.]

VI. Comments to Jack Daniel Co. Petition for Declaratory Ruling

Generally, the Jack Daniel Company petition asks the Commission to clarify that it will not limit or supersede local jurisdictions concerning the installation and operation of signal boosters. The petition requests that local and state governments have the final say concerning the required minimum signal strengths for safety in buildings, in other structures, and throughout certain areas. The requirement would be enforced through local zoning, safety codes and inspections, and similar land use restrictions.

We agree in principle that boosting signal penetration into buildings and other structures is in the public good; however, we believe that delegating radio frequency propagation matters to state and local legislation is a regulatory slippery slope, contradicting and frustrating many Commission rules, policies and initiatives, now, and in the future.

[Remainder of page intentionally blank.]

VII. Introduction to the Smart Booster Technology

The Smart Booster (patent applied for) is a compact, user friendly cell phone accessory that automatically provides signal amplification in weak and marginal areas of coverage, practically eliminating outages and dropped calls. In addition, it automatically refrains from amplification in areas of adequate coverage, and thus avoids jamming and interference with base stations and networks.

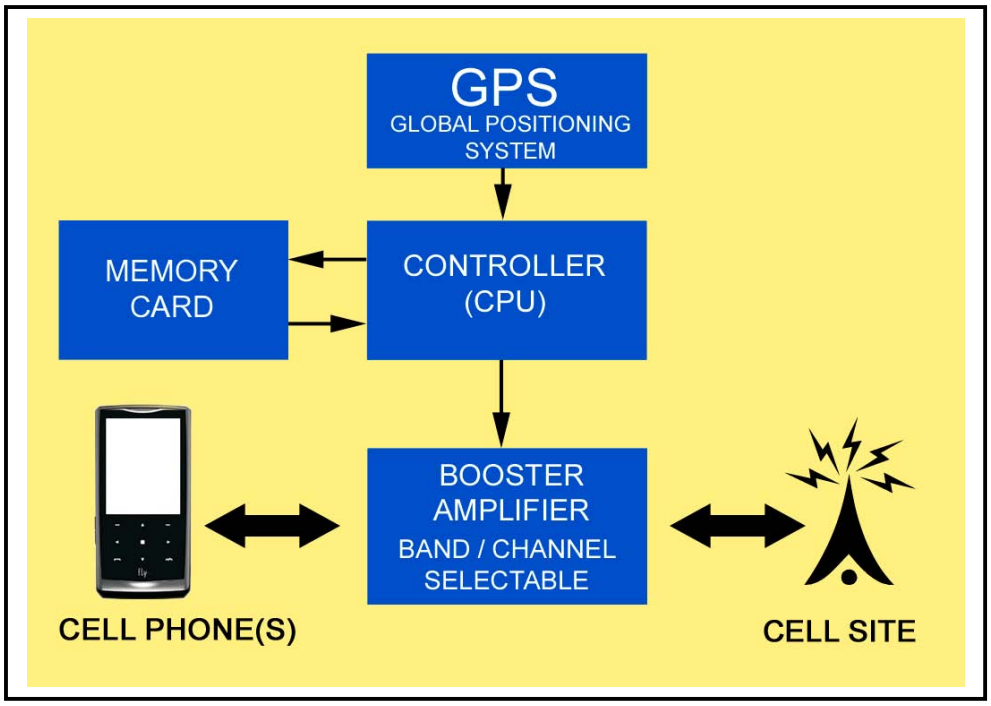

Figure 1. *Block diagram of Smart Booster*

The Smart Booster is a unique combination of an amplifier, a Global Positioning System (GPS) receiver, a Controller, and a removable, updateable Memory Card, as shown in Figure 1. With this architecture, the Smart Booster knows where it is within the cellular network, knows what spectrum it should be amplifying, and knows what level of amplification should be applied. So, amplification is provided only where it is needed and only for the spectrum that is needed. Amplification is deactivated in close proximity

to base stations and at other locations where it might interfere with the network, or other authorized services.[14]

The Smart Booster will satisfy customers' desire for reliable and robust communications at locations that were previously marginal or unusable. At the same time, the network provider will no longer be plagued with outages and dropped calls caused by rogue amplifiers or BDA's, which amplify at locations and in situations where they are not actually needed.

The seamless and interference free operation of the Smart Booster contrasts starkly with the extreme requests made in the five petitions in WT Docket 10-4. The petitions request either that boosters be unconditionally prohibited or that they be permitted subject to only voluntary compliance. The Smart Booster depends upon neither extreme position, and it is the only approach that will deliver better coverage to consumers and simultaneously preserve the carrier's control of their respective spectrum. Further, the Smart Booster does not depend upon any cumbersome carrier authorization schemes, which are largely impractical for reasons to be discussed shortly. By adopting the Smart Booster technology, the Commission will satisfy all interested parties, including consumers, carriers, and equipment providers.

Consumers will have a device that is both FCC and carrier certified. Carriers will control how that device behaves on their respective networks. Device manufacturers will no

[14] For example, the Smart Booster could be deactivated in close proximity to deep-space radio telescope facilities, such as the National Radio Astronomy Observatory located in Green Bank, WV.

longer be at risk for offering products that interfere and are at risk of being decertified by the FCC OET. Rather, device manufacturers will gain an economic interest in the interference free operation of all wireless networks, and this symbiotic relationship will greatly benefit the public. Indeed, once carriers embrace the Smart Booster technology, manufacturers will enjoy a robust sales environment in which boosters sales are no longer relegated to niche marketing via the Internet.

How the Smart Booster Works

The component of the Smart Booster that amplifies is a BDA that has been channelized so that it operates only on the block or blocks within the cellular, PCS, or radio service that has been allocated to a particular carrier. That block may change as the Smart Booster changes location. The selection and amplification of each block of spectrum is under microprocessor control. A Global Positioning System is used to determine the geographic location of the Smart Booster. A memory card provided by the carrier contains a database that refers to the geographic location for instructing the device precisely which block to amplify, and to what extent.[15]

The Smart Booster can be used in both mobile and fixed installations; however, it will likely find most use in mobile environments because other remedies exist to boost in-building coverage, such as distributed antenna systems and femtocells.

The database of geographic points within the service area is prepared in advance by the engineering departments of the carriers which choose to support the technology.

The supporting calculations for that database could be based on the widely accepted Longley-Rice[16] radiofrequency propagation model for irregular terrain but simple protection rings of a certain radius around existing cell sites are an effective alternative.

The database is distributed to consumers on an SD-type flash memory card, similar to the type used in many digital cameras.[17]

Each carrier is responsible for creating and maintaining their respective databases, and each copy of the database is encrypted to prevent fraud and abuse.

[Remainder of page intentionally blank.]

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[15] See Exhibit 2 for a description of the Smart Booster database fields.

[16] The **Longley–Rice model** (LR) is a radio propagation model for predicting the attenuation of radio signals for a telecommunication link in the frequency range of 20 MHz to 20 GHz. Longley-Rice is also known as the irregular terrain model (ITM). LR has two parts: a model for predictions over an area and a model for point-to-point radio link predictions.

A description of the method was published by the U.S. government under the title *"Prediction of tropospheric radio transmission loss over irregular terrain. A computer method-1968"*, A. G. Longley and P. L. Rice, ESSA Tech. Rep. ERL 79-ITS 67, U.S. Government Printing Office, Washington, DC, July 1968. This document followed on an earlier publication titled *"Transmission loss predictions for tropospheric communication circuits"*, P.L. Rice, Volume I & II, National Bureau of Standards, Tech. Note 101. Exhibit 3 demonstrates the creation of the Smart Booster database using this method.

[17] Distribution of the database may take several forms, including a direct mail subscription, Internet downloads, company stores, resellers and self-service kiosks at popular shopping malls. Carriers may also elect to use “over-the-air” programming as a means of distributing periodic updates of the Smart Booster database. SD in this context means a Secure Digital™ flash memory device.

As changes are made to the carrier's network, they are recorded in database updates that are distributed to end users on a periodic basis.[18] Examples of network changes that would be included in the updates include:

- The construction of new cell towers
- The splitting of an existing cell site into many smaller cells[19]
- A change to the cell site's output power, antenna pattern, or antenna height
- Carrier merger and acquisition activity affecting frequency or geographic territory
- Cell site decommissioning, including planned cell relocations.
- Temporary or long-term network outages caused by hurricanes, tornadoes, earthquakes, floods, or other natural disasters, or a terrorist attack.[20]

From the above, it is seen that distribution of the Smart Booster database by the carrier to the consumer is, in fact, carrier consent, authorization and operational control.

Each edition of the Smart Booster database has an expiration date beyond which the device will not operate. This ensures that the Smart Booster always operates in

[18] We anticipate an update frequency no greater than six months. In most cases, carriers plan their networks many months into the future to account for changes in network capacity demands, delays in local zoning and permitting, the ordering and installation of towers, antennas, and radio equipment, etc… The Smart Booster database structure accommodates known future changes occurring to the network. Please see Exhibit-2 for details of the Smart Booster database.

[19] It should be noted that most cell site splits will occur in areas in which the Smart Booster would have already been instructed to deactivate, and would continue to be deactivated after the cell splits. Therefore, a carrier may elect to ignore these splits.

[20] See section: "Public Safety" beginning on page 42.

accordance with the most recent coverage requirements set forth by the carrier's engineering department.

The Smart Booster may be sold to end users with or without a database. This allows distributors to stock and sell devices to consumers without knowing *a priori* the carrier's identity, and completely avoids the burdensome paperwork contemplated by some of the petitioners.

If the consumer purchases a Smart Booster without a database, then he or she can simply contact their carrier to obtain one.[21]

A similar situation arises when a consumer relocates to where service by their former wireless provider is not available. In that case, the consumer simply contacts their new provider for the correct memory card.

No Enforcement Burden on FCC

Historically, licensees constitute the most effective spectrum police in the industry because they possess the strongest financial motivation to maintain interference free networks. But the market forces that drive the need for interference free networks are not necessarily the same forces that maximize profits for BDA equipment manufacturers, leading to inferior products in the marketplace.

[21] It should be noted that a Smart Booster can be equipped with more than one database to accommodate the situation where a user subscribes to more than one telecommunications provider at a time. Multiple SD-type memory card slots are provided so that each carrier can independently update their customers' database without the need for any coordination between different providers.

Clearly the FCC's Enforcement Bureau would be quickly overwhelmed by an ever increasing number of carrier complaints about booster interference, because it is primarily a regulatory agency. Its Enforcement Bureau personnel, including the Field Offices and Resident Agents, are burdened with a myriad of duties. They include, but are not limited to, tower light inspections, the shutting down of pirate FM stations, jammers and other unlicensed operations, broadcaster public file inspections, indecency issues, DTV coverage complaints from consumers, and a host of other tasks.

The FCC has the regulatory authority to address interference through a variety of means, including fines and *in rem* forfeitures. As a practical matter, however, case-by-case interference penalties take time, and it makes much more sense to eliminate the causes of BDA interference by improving the technology of the devices themselves. This approach will eliminate the need for lengthy litigation, Notices of Violation, and Notices of Apparent Liability.

In addition, it is our experience that the FCC does not have ready access to the highly specialized test equipment and technical expertise necessary to track and monitor BDA caused network interference. Indeed, carriers have invested significant capital in automated network monitoring systems designed to continuously observe and evaluate their radio environment. Complementing their specialized instrumentation, the carrier's personnel are highly motivated and uniquely qualified to monitor their spectrum.

Rather than choose a path that inevitably leads to more FCC Enforcement Bureau involvement, the FCC could simply approve the Smart Booster technology, revoke existing broadband BDA device certifications, and put the carriers back in control of their respective spectrum!

<u>"Lock & Key" Approach</u>

The Smart Booster may be sold with or without a current, valid memory or database card.

The Smart Booster is readily regarded as a "lock and key" solution. The signal amplifier is the "lock", and the carrier provided database card is the "key". Consumer can purchase locks anywhere, but must obtain keys from the carriers.

The consumer could purchase the lock and key together in one package, directly from the carriers or from the carriers' authorized agents and resellers. Alternatively, they could purchase boosters separately without memory cards on the Internet, at retail stores, or in the secondary markets such as eBay®, flea markets and garage sales. Then, they would contact their wireless service provider to obtain the most recent memory card needed to make the booster operational.

In the case of wholesalers and system integrators, such as those represented by the DAS Forum petition, boosters may be purchased and inventoried without knowing in advance the identities of the carriers. Databases can subsequently be obtained from the carriers when the booster is put into service.

Database updates can be distributed using a variety of methods, including a direct mail subscription offered by the carrier, in-store service and support, a self-service kiosk in shopping malls, or even a self-directed download via the Internet. Over-the-air remote programming may also prove a viable means of database distribution.

Decoupling the booster from the database offers several advantages:

First, it ensures that carriers will always remain in control of their spectrum, and that any changes to their networks affecting signal amplification are properly registered.

Second, it forces all owners and operators of booster equipment, whether fixed or mobile, to maintain their installations, if for no other reason than to install periodic database updates. This eliminates the undesirable consequences of a “set it and forget it” mentality, and further guarantees that abandoned booster installations will cease to operate when their databases expire.

Third, it creates a potentially robust market for professional installers, who may elect to offer service contracts to inspect and update booster deployments in industrial, commercial, and even residential settings.

Fourth, it allows booster devices to be portable with respect to changing carriers. Consumers who moves across the country can now take their boosters with them, and obtain replacement databases from their new wireless service provider.

CGSA Boundary Protection

The Cellular Geographic Service Area (CGSA) of a cellular system is the geographic area considered by the FCC as served by the cellular system. The CGSA is the area within which cellular systems are entitled to protection and within which adverse effects for the purpose of determining whether a petitioner has standing are recognized. CGSA Boundaries are calculated and established in accordance with FCC Rule 22.911.

Traditional signal boosters, such as those manufactured by Wi-Ex, Inc., Digital Antenna, Inc., and Wilson Electronics, Inc., cannot recognize CGSA boundaries and instead amplify the entire PCS and/or Cellular spectrum indiscriminately.

[Remainder of page intentionally blank.]

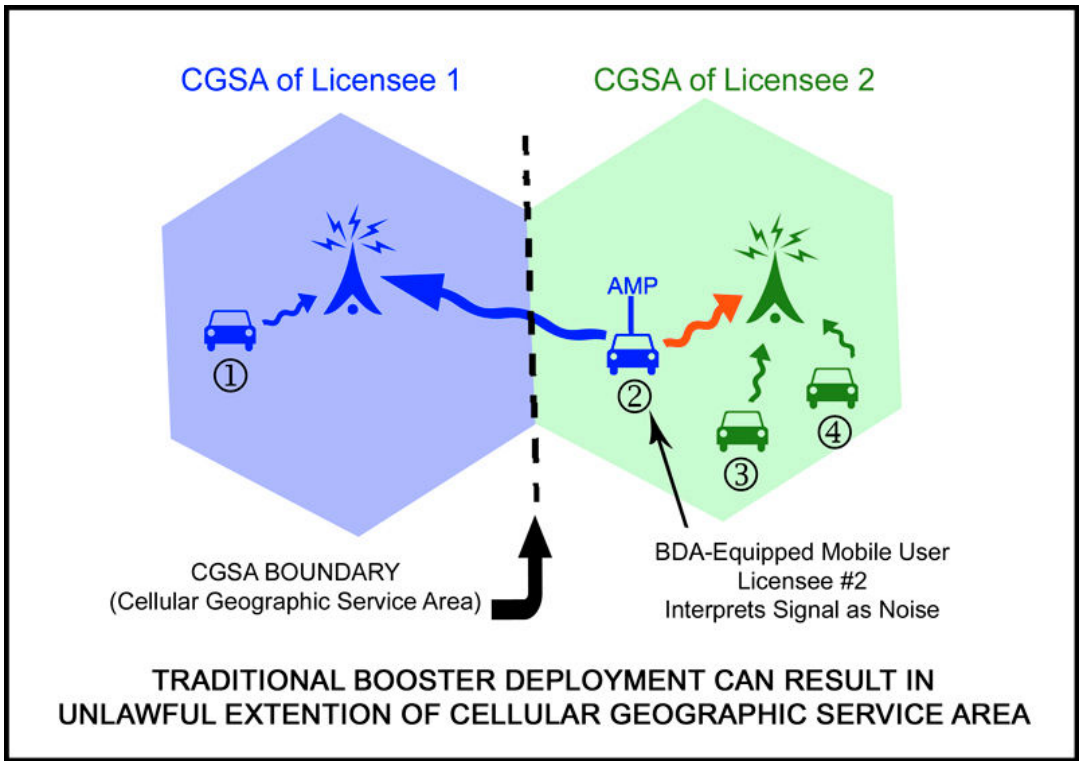

Figure 2. *Unlawful Extension of CGSA Boundary.*

For example, as depicted in Figure 2, a mobile booster in Car #2 has entered a different licensee's adjacent CGSA but has remained locked to its initial CGSA instead of roaming.

From Licensee #2's perspective, the transmissions from vehicle #2 are interpreted as noise, and it has no choice but to instruct all other mobile units within its CGSA to increase power in order to overcome that noise. In this example, vehicles #3 and #4 must increase power. This shrinks Licensee #2's cell site coverage areas because subscribers on the edge of coverage are already transmitting at maximum output and cannot comply with the additional power request. So, those calls are dropped.

The above example illustrates in simple terms that consumers using boosters other than the Smart Booster have no knowledge of CGSA boundaries, and, therefore, cannot exercise control over the interference their devices may cause to adjacent systems.

Pursuant to FCC Rule 22.911, cellular system CGSA's are entitled to protection from co-channel and first-adjacent channel interference, and from capture of subscriber traffic by adjacent systems on the same channel block. To the extent cellular boosters artificially extend CGSA's, Rule 22.911 is obviously violated.

The above example highlights yet another problem with using signal boosters to effectively extend the CGSA of a given carrier: The handset may not be licensed in the extension of the CGSA. FCC Rule 22.927 provides that, *"Mobile stations that are subscribers in good standing to a cellular system, when receiving service from that cellular system, are considered to be operating under the authorization of that cellular system."* However, in the above example, Licensee #1 is not licensed to provide cellular service within the CGSA of Licensee #2, and therefore cannot extend authority to the mobile station as envisioned by Rule 22.927. Thus, the intent of Rule 22.927 is violated.

Rule 22.927 continues to explain that, *"Mobile stations that are subscribers in good standing to a cellular system, while receiving service from a <u>different</u> cellular system, are considered to be operating under the authorization of such different system. The licensee of such different system is responsible, during such temporary period, for*

exercising effective operational control over such mobile stations as if they were subscribers to it." [Emphasis added]. In the example of Figure 2, the mobile station is not receiving service from a different cellular system, and thus, this portion of Rule 22.927 does not apply.

It is for the above reasons, among many others, that signal boosters must deactivate at locations at which the carrier does not have an FCC license. The above example is greatly simplified; however, it is likely that consumers engaged in booster assisted communications have no knowledge of CGSA boundaries and cannot therefore provide accurate commentary on the interference their devices may, or may not, cause to adjacent systems.

FCC Definitions Require Clarification

We believe that much of the controversy concerning whether boosters are permitted by existing FCC rules originates with the definitions of terms, for example, "mobile stations". As is often the case, the rapid pace of technology often renders established definitions either vague or outmoded. In this section, we will explore some of those that especially relate to signal boosters.

It is not clear that either a booster, or the combination of a booster and a handset, satisfies the definition of a "mobile station". In any case, however, a handset alone does indeed satisfy that definition.

FCC Rule 22.923 provides that “Mobile stations communicate with and through base transmitters only.” Originally, this rule was created so that direct handset-to-handset communication is disallowed in the Public Mobile Services (Part-22). It is unclear, however, that a booster may be inserted into the signal path between a mobile station, including a handset, and the cellular base station, and remain in compliance with this Rule.

FCC Rule 22.99 describes a mobile station as “one or more transmitters that are capable of operation while in motion.” Thus, it is unclear that a stationary booster, such as that used inside a building, would qualify for treatment as a “mobile station”, and even if it could, it would still violate Rule 22.923 above.

FCC Rule 2.815 defines an External Radio Frequency Power Amplifier (ERFPA).
A booster appears to satisfy this definition, both in function and in form. It would be appropriate to characterize a wireless booster as two ERFPA’s placed back-to-back, since many boosters incorporate bi-directional amplification. This combination of two ERFPA’s back-to-back is the essential component of all signal boosters, including handset amplifiers, in-building repeaters and distributed antenna systems.

Finally, the Commission may find it useful to distinguish between a fixed and mobile “platform” instead of merely “station”, since a “mobile station” (i.e., handset) can be used inside a building equipped with a booster (i.e., a fixed station installation).

Clearly, these above Rules and definitions require clarification and updating to include the latest advances in technology as the Commission seeks to remedy the booster interference problem.

Additional Protected Areas

Another advantage that follows from the Smart Booster technology is the ability to deactivate at specific locations at the option of the carrier or by request of the FCC.

For example, Smart Booster operation can be disabled for prisons and correctional institutions, FCC Radio Quiet Zones, FCC Monitoring Points, and radio telescope facilities[22]. Operation in secure areas of military installations, blasting areas, or other radio-sensitive areas can also be disabled.

FCC Rule 1.924 was established to minimize interference at the National Radio Astronomy Observatory site located at Green Bank, Pocahontas County, West Virginia, at the Naval Radio Research Observatory site at Sugar Grove, Pendleton County, West Virginia, and at Table Mountain, Colorado. The memory card in the Smart Booster can readily instruct the device to deactivate at those locations.

[22] The National Radio Quiet Zone (NRQZ) was established by the Federal Communications Commission (FCC) in Docket No. 11745 (November 19, 1958) and by the Interdepartment Radio Advisory Committee (IRAC) in Document 3867/2 (March 26, 1958) to minimize possible harmful interference to the National Radio Astronomy Observatory (NRAO) in Green Bank, WV and the radio receiving facilities for the United States Navy in Sugar Grove, WV. The NRQZ is bounded by NAD-83 meridians of longitude at 78d 29m 59.0s W and 80d 29m 59.2s W and latitudes of 37d 30m 0.4s N and 39d 15m 0.4s N, and encloses a land area of approximately 13,000 square miles near the state border between Virginia and West Virginia.

While not raised in the various petitions, the Smart Booster approach can be used to prevent operation aboard private aircraft or at other high elevations since its GPS component continuously monitors altitude and velocity. Operation of handsets aboard aircraft may disrupt the network and is currently prohibited by FCC rules and FAA regulations.[23]

Additionally, because the Smart Booster incorporates GPS technology, it can alert drivers when they enter areas in which local laws or ordinances restrict or prohibit the use of cellular phones while driving. CTIA, a petitioner in these proceedings, contends that the wireless industry is neutral on outright bans of cellular use while driving and hands-free legislation but believes text-messaging while driving is incompatible with safe driving. To that end, the Smart Booster database can be programmed to support these industry positions, at the option of the carriers and CTIA.[24]

Carrier Revenues

At first glance, carriers might object that maintaining a database and distributing memory cards is a financial burden. In fact, however, even the most conservative business models show that this activity is at least self sustaining, and more likely is a highly profitable enterprise. Some of the reasons are as follows.

[23] FCC Rule 22.925 prohibits the use of cellular transceivers while an aircraft is airborne. However, it is unclear that 47CFR24 poses a similar restriction to the operation of PCS transceivers. 14CFR91.21 bans the use of certain portable electronic devices aboard commercial aircraft but this prohibition does not extend to private aircraft. FAA Advisory Circular AC-91.21-1B recommends that aircraft operators blanket ban all intentional radiators, but compliance with the Advisory Circular is optional.

[24] See CTIA Advocacy: http://www.ctia.org/advocacy/policy_topics/topic.cfm/TID/17

The most obvious sources of revenue would be the sales of Smart Boosters and memory cards; however, there are other sources that are even more significant.

For example, by adopting the Smart Booster technology, carriers will be able to extend their signals into coverage areas which were previously experiencing insufficient signal penetration. As a result, carriers will enjoy access to a greater number of customers and increase their subscriber base. Carriers will find it easier to attract and retain customers in these same areas, decreasing network-driven churn[25], and save the dollars spent in advertising to replace customers who do churn.

Another source of indirect revenue is the savings from no longer having to track down and squelch harmful interference from more primitive basic or adaptive BDA's.

In view of the above, carriers could choose to subsidize Smart Booster purchases and/or installations, much as they do for handsets and smartphones today, subject to Early Termination Fees (ETF's). This practice benefits consumers by lowering the cost of devices to a level much lower than is possible via manufacturer-direct sales over the Internet today. As a result, even more customers would be attracted and retained with a commensurate increase in revenues.

[25] Network driven churn is an industry term used to quantify that percentage of subscribers who terminate service in search of better coverage on a competitor's network for reasons attributable to network performance, including the harmful interference caused by existing boosters on the market.

The Problems with Carrier Authorization

As mentioned above, the memory card aspect of the Smart Booster design is the only way that carrier authorization can be successful. Carrier authorization for more primitive basic or adaptive boosters is both technically and practically impossible as discussed in the following.

CTIA has petitioned the FCC to issue a Declaratory Ruling stating that “the unauthorized sale and use of wireless boosters and repeaters is unlawful”. As described in its Petition, “unauthorized sale and use” refers to situations in which a booster device is operated absent carrier consent.

At first glance, it may appear that the carrier authorization approach proposed by CTIA is workable and reasonable; however, closer examination shows that it contains many self contradictions. Perhaps the most glaring example relates to the wideband operation of practically all BDA’s in use today. That is, they operate on all channels licensed to all carriers regardless of whether authorization might be granted for fixed or mobile use. In the case of mobile use, carriers are generally licensed to operate on different frequencies in different markets, or carriers might not be licensed at all in certain markets. Clearly then, authorization of mobile broadband BDA devices must inevitably infringe upon the spectrum rights of other carriers. Such infringement contradicts the carrier's authority to allow or not allow the use of BDA's within its own markets.

Yet another self contradiction is the notion that a device can continue to be regulated if its operation is self sufficient. That is, once a BDA is in the hand of consumers, it does not need to refresh any hardware, software, or other attribute to continue in operation indefinitely. Carriers continue to construct new cell sites and these new sites may eliminate the need for continued booster operation in localized areas. Once the proverbial cat is out of the bag, it is almost impossible to retrieve.

Yet another problem is the realization that carriers do not presently authorize broadband boosters. Therefore, they have no process established for tracking authorizations, even if they were willing to grant them. There appears to be no workable notification process for alerting all other carriers that a particular subscriber has been "authorized" to use a booster, and such notification would be essential to policing the entire authorization process. Otherwise, individuals could simply claim at random that some other carrier authorized their device. Carrier authorization would quickly morph into a wholly unworkable honor system approach negating any benefits.

Similarly, there appears to be no established, or even workable, process to track the millions of subscribers who historically churn each year in search of better coverage on a competitor's network. It is likely that at least some churning customers will take their boosters with them to the new provider, which may or may not be aware of their existence. A subscriber could easily confuse an authorization to <u>purchase</u> a booster from one carrier as an authorization to <u>use</u> a booster on any carrier's network. It would be in the subscriber's self interest to exploit this confusion.

A final obstacle to the concept of carrier authorization is one of fairness. Presumably, all subscribers might enter areas in which signal amplification would be needed. Therefore, the concept of carrier authorization is inherently discriminatory unless all carriers are willing to grant it to anyone who requests it. Obviously, such automatic grants trivialize the approval process, contradicting the original premise for authorization, that is, *reductio ad absurdum*.

All of the above problems with carrier authorization are resolved automatically by the controlled distribution of the Smart Booster memory card.

Benefits to Public Safety

Better coverage in the mobile environment benefits public safety in several ways:

First, consumers increasingly use wireless devices to report accidents. It is estimated that fully half of all calls to 911 now originate from mobile phones, and that percentage is growing.[26]

Second, public safety officials increasingly use cellular systems to supplement their own radio installations.[27] Obviously, improved coverage benefits public safety, just as it does for all other consumers.

[26] Source: http://www.fcc.gov/cgb/consumerfacts/wireless911srvc.html - Revised 10/17/2008

Third, and unique to the Smart Booster, carriers could issue temporary database updates to public safety organizations in emergencies that significantly impair or disable networks, such as hurricanes, floods, earthquakes, other natural disasters, or terrorist attack. For example, temporary Smart Booster database updates could have been issued to New Orleans authorities following the flooding of that city by Hurricane Katrina. Such database cards, perhaps with automatic expirations ranging from 72 hours to a few weeks, would have enabled booster operation where operational cell sites once stood. Temporary cards would have continued to be issued to Public Safety organizations until the networks were fully restored to their pre-storm conditions.

Similarly, it would be in the public interest to provide emergency database updates to Homeland Security officials, the Federal Emergency Management Agency (FEMA), and professionals involved with public safety, including security guards, physicians, nurses, utilities restoration workers, sanitation workers, port officials, animal rescue and control, and tow truck operators.

Distribution of updates could be easily accomplished over the Internet or via satellite telephone links should Internet service be disrupted. Many larger and better funded Police, Fire and EMS Departments already maintain satellite telephone equipment as part of their disaster preparedness planning.

Because public safety is an important business segment for the carriers[28], we would expect carriers to embrace this unique capability of the Smart Booster to assist federal, state and local agencies when disaster strikes.

Carrier Adoption of Smart Booster Approach

In order for the Smart Booster technology to function, carriers must be willing to provide the databases necessary for its proper operation. In the above discussion, we have explained why the carriers should not only be willing, but eager to do so because the Smart Booster can be a highly profitable enterprise for them.

In contrast, Wilson Electronics, Inc. has petitioned to FCC to modify Part 20 of its rules to clarify the technical specifications for CMRS signal amplifiers. Implicit in this request is the notion that once a device is OET certified, then a carrier will have no choice but to allow its operation on their networks. We believe this is a heavy-handed, top-down approach that can harm consumers. What is needed is for BDA manufacturers to have a vested interest in the interference free operation of the networks, and Smart Booster accomplishes exactly that.

The wireless industry has established the PCS-1900 Type Certification Review Board (PTCRB). It is a private type certification review board that tests all handsets on behalf of the carriers for the purpose of ensuring compatibility with North American cellular and

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[27] See Comments of Mark Wagner, Local Emergency Planning Committee Coordinator, Pawnee County Emergency Management, Pawnee County, Kansas. Comment received Jan. 29, 2010, WT Docket 10-4.
[28] For example, see ATT at http://www.wireless.att.com/businesscenter/business-programs/government/state-local/PublicSafety-FirstResponders.jsp

PCS network standards. While PTCRB certification is typically limited to handsets, devices incorporating the Smart Booster technology could be subject to a similar industry evaluation before being authorized for use on the carrier networks. For example OET and PTCRB certification should consider the effectiveness of anti-oscillation circuitry. In the case of the Smart Booster, database encryption techniques and other security measures should be evaluated so that the industry does not experience a repeat of the mobile electronic serial number (ESN) cloning problem of the 1990's.[29]

We urge the Commission to consider the many benefits to consumers and industry alike from a joint OET and industry equipment authorization approach.

We also urge the Commission to place some limit or restriction on carriers to ensure that they certify at least one intelligent booster device within a reasonable period of time. This will prevent carriers from becoming the proverbial fox that guards the hen house. Larger carriers, who are understandably concerned about the harmful effects of BDA interference in major metropolitan areas should not be allowed to exert undue influence over the PTCRB process.

Alternatively, the Commission could simply require that carriers provide databases which, at a minimum, enable amplifier operation at all geographic points falling outside their 32 dBμV/m CGSA contours, as defined by Rule 22.911, but falling within their

[29] ESN is an acronym for Electronic Serial Number. Duplicating a mobile ESN would enable fraudulent use of mobile services provided by CMRS carriers.

market boundaries. Such a requirement would prevent carriers from distributing databases in which all datapoints are disabled, effectively resulting in a complete ban of booster devices.

It should be recognized that not all carriers favor outlawing boosters.

Previously, rural carriers have embraced boosters as a means to entice consumers into giving up their older, higher-powered analog 3-watt bag phones in order to reach the 95 percent digital handset penetration rates required by the FCC.[30] Some have even offered $50 Off coupons to entice subscribers to purchase booster equipment or have conducted customer surveys which clearly demonstrate support for boosters as a means to improve coverage.[31]

[Remainder of page intentionally blank.]

[30] See generally, comments of Cable & Communications Corporation, CC Docket 94-102, Dec 13, 2005, Petition for Waiver of Section 20.18(g)(1)(v) of the Commission's Rules.
[31] Communications Advisory Counsel, LLC, letter, Supplement to E-911 Waiver Request, March 2, 2006, CC Docket 94-102

Figure 3. *Customer invoice insert.*
Cable & Communications Corp (Mid-Rivers Cellular)
March 2006.

That rural carriers embrace boosters should come as no surprise because a booster's function is to improve coverage in fringe reception areas.

With the advent of Smart Booster technology, carriers both large and small, urban and rural, can extend the benefits of improved coverage in marginal reception areas to all its customers.

Drive Test Results

The Smart Booster technology was successfully drive tested over the course of several days in March, 2009. Test authorization, equipment, and technical assistance was provided by one of the major carriers serving the South Florida market.[32]

Drive test results irrefutably confirm that GPS controlled BDA amplification eliminates harmful interference to cellular and PCS networks, while substantially improving network performance in marginal reception areas.

[Remainder of page intentionally blank.]

[32] To avoid violating FCC rules relating to the operation of uncertified devices, the amplifier selected for the field trials was the Wilson Mobile Wireless Cellular/PCS SmartTech Amplifier, bearing FCC Certification ID# PWO8012ASM. This amplifier was placed under GPS and microprocessor control utilizing a database developed specifically for the drive testing in consultation with the carrier's engineering staff.

Wilson Electronics, Inc., a petitioner in these proceedings, was not a party to the drive testing and was not consulted.

VIII. Conclusions

In our comments, we have examined separately the five petitions contained in WT Docket 10-4. They were submitted by members of the cellular network industry, and by manufacturers of cellular handset boosters. The petitioners have made conflicting requests, all supported by logical reasoning. The network industry requests that handset boosters be unconditionally banned in reaction to well documented cases of harmful interference. The manufacturers request that sales of handset boosters to consumers be permitted, subject to as yet undetermined standards, because there is a legitimate demand for them and because they are in the public interest.

The networks are rightly concerned about harmful interference from the present versions of handset boosters. Further, existing FCC Rules prohibit these boosters for many reasons. Rules 2.1043(a), 22.923, and 2.962(e)(5)(i) are just three that are clearly violated by existing boosters. With such multiple violations, they should never have been OET certified.

On the other hand, there is undeniable consumer demand for handset boosters because cellular service is anything but ubiquitous in vast areas of the United States. Millions of cell phone users do not have adequate service. Further, without boosters, their prospects for improved service are bleak because it makes no economic sense for the networks to build expensive base stations in sparsely populated regions. Nonetheless, it is clearly in the public interest to have access to usable and robust service everywhere, and some sort of booster is the most cost effective way. The public

interest especially includes communications relating to public safety, which are presently compromised in areas of inadequate service.

Clearly, existing handset boosters cannot resolve the above conflicting concerns. They amplify across the cellular and PCS bands without regard to what spectrum blocks are allocated to the licensee. The most basic boosters amplify at locations where amplification is completely unnecessary, raising the noise floor of the service area. Even with downlink signal sensing to control amplification, they cannot protect from incursion into the wrong CGSA. Further, downlink signal sensing is subject to false positives. That is, the booster is deactivated in response to a signal from the wrong block of spectrum.

We strongly believe that, as has often happened in the history of electronics and communications, advances in technology have resolved the conflict. The Smart Booster incorporates the technological advances necessary to meet consumer demand without the harmful interference that concern the networks. It is an intelligent booster, in the sense that it knows where, when, and how much signal amplification is needed, or not needed. The Smart Booster knows what blocks of spectrum require amplification, and which ones do not. The Smart booster protects CGSA's.

The intelligence of the Smart Booster derives from the carriers' engineering staff, which ultimately is best suited to determine the database contents. Their determinations

constitute carrier consent, authorization and control, in accordance with FCC requirements.

The memory card of the Smart Booster gives much control to the networks that have the greatest interest in preventing interference, and that have been demanding some form of network authorization. The memory is encrypted with a database describing network attributes in such a way that interference is avoided and amplification is provided where needed. In that way, it is a highly desirable “lock and key” approach. The amplifier is the lock that secures reliable and robust communication. The memory card is the key provided only by the network. The key has an expiration date and must be renewed, guaranteeing that the network attributes are not obsolete.

The creation and distribution of memory cards is a highly profitable enterprise, according to the most conservative business models. Therefore, the networks should have no qualms about accepting responsibility for that component of the Smart Booster.

In view of the above, we recommend that the FCC:

1. Amend Rule 22.923 to permit boosters to be inserted between handsets and base stations, and update certain of its definitions.

2. Require all boosters to have a minimum amount of intelligence so that they know where to amplify, when to amplify, how much to amplify, and within which spectrum blocks to amplify.

3. Require that all intelligent boosters have a provision to guarantee that their intelligence is current.

4. Decertify all boosters that do not meet the above minimum requirements.

5. Require networks to support intelligent boosters by providing databases appropriately encoded on a compatible memory card in a timely manner.

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CERTIFICATE OF SERVICE

I, Jeremy K. Raines, Ph.D., P.E., do hereby certify that on this 4th day of February, 2010, I caused copies of the foregoing "Comments of Millard/Raines Partnership" to be delivered to the following via First Class U.S. mail.

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EXHIBIT 1
Partial Listing of Currently Available Booster Devices

Wilson Electronics				
Part #	FCC ID	Bands	Wideband Operation?	User Manual Shows Mobile Configuration?
Wireless Connect Models				
801101	PWO824WV	Cellular Only	Yes	Yes
801201	PWO8012SM	Cellular & PCS	Yes	Yes
801212	PWO8012SM	Cellular & PCS	Yes	Yes
801213	PWO8012SM	Cellular & PCS	Yes	Yes
801231	PWO271230SA	Cellular & PCS	Yes	Yes
801242	PWO271240SA	Cellular & PCS	Yes	Yes
804002	PWO806WV	SMR Only	Yes	Yes
Direct Connect Models				
811101	PWO824D	Cellular + GPS Pass Through	Yes	Yes
811201	PWO819D	Cellular & PCS	Yes	Yes
811210	PWO819DA	Cellular & PCS	Yes	Yes
811211	PWO819DA	Cellular & PCS	Yes	Yes
811214	PWO819DA	Cellular & PCS	Yes	Yes
812201	PWO819	Cellular & PCS	Yes	Yes
814001	PWO806D	SMR Only	Yes	Yes
814004	PWO8140SD	SMR Only	Yes	Yes
814021	PWO8140SD	SMR Only	Yes	Yes

EXHIBIT 1 (Continued)

Digital Antenna Inc.				
Part #	FCC ID	Bands	Wideband Operation?	User Manual Shows Mobile Configuration?
Vehicular Models				
DA4000	PZODA4000[33]	Cellular & PCS	Yes	Yes
4KMR-10A	PZODA4000SBR[34]	Cellular & PCS	Yes	Yes
Condo & Apartment Booster Models				
DA4000	PZODA4000	Cellular & PCS	Yes	Yes
4KPR-15R[35]	Unknown	Cellular & PCS	Yes	Unknown
Boat & RV Booster Models				
DA4000	PZODA4000	Cellular & PCS	Yes	Yes
4KMR-30M	PZOSDA4000SBR[36]	Cellular & PCS	Yes	Unknown
4KSBR-50M	PZOSDA4000SBR	Cellular & PCS	Yes	Unknown
Home & Office Booster Models				
DA4000	PZODA4000	Cellular & PCS	Yes	Yes
4KMR-30U	PZOSDA4000SMR	Cellular & PCS	Yes	Yes
4KPR-15R	Unknown	Cellular & PCS	Yes	Unknown
4KMR-30M	PZOSDA4000SBR	Cellular & PCS	Yes	Yes
4KSBR-50M	PZOSDA4000SBR	Cellular & PCS	Yes	Yes
4KSBR-50U	PZOSDA4000SBR	Cellular & PCS	Yes	Yes

[33] FCC ID: PZODA4000. Marine installation shown in User Manual.
[34] FCC ID: PZODA4000SMR. Marine and RV installations shown in User Manual.
[35] See: http://www.digitalantenna.com/prods/cellbooster_4KPR-15R_personalrepeater.html
[36] FCC ID: PZOSDA4000SBR appears in manufacturer's online product literature but could not be located via FCC OET online database search.

EXHIBIT 1 (Continued)

Wireless Extenders, Inc[37]				
Part #	FCC ID	Bands	Wideband Operation?	User Manual Shows Mobile Configuration?
Personal Area:				
zPocket YX-110	S04YX110	Cellular & PCS	Yes	No
ZPersonal YX-300	SO4YX300-PCS-CEL	Cellular & PCS	Yes	No
Home / Office:				
YX-500/510	SO4YX500-CEL	Cellular Only	Yes	No
	S04YX500-PCS	PCS Only	Yes	No
	S04YX510-CEL	Cellular Only	Yes	No
	S04YX510-PCS	PCS Only	Yes	No
	S04YX510	Cellular & PCS	Yes	No
ZBoostONE YX400-P	S04YX400-PCS	PCS Only	Yes	No
Automobiles:				
YX230	SO4YX230	Cellular & PCS	Yes	Yes
Professional:				
YX610-PCS-CEL	Unknown	Unknown	Unknown	Unknown
YX600-PCS	Unknown	Unknown	Unknown	Unknown
YX600-CEL	Unknown	Unknown	Unknown	Unknown
YX710*	Unknown	Cellular & PCS	Yes	Unknown

Note: Model YX710 sold only to professional installers, per Wi-Ex website, 02/04/2010

[37] Wireless Extenders equipment is now available for purchase online at RadioShack®.

EXHIBIT 2
Smart Booster Database File Structure

Device:

Database Field	Description	Range of Values
Device ID	Device ID	TBD
Device Serial Number	Device Serial Number	TBD
Firmware Version	Firmware Version	TBD

Memory Card:

Database Field	Description	Range of Values
Freshness Date	Expires on…	Calendar Date
Encryption Array	Card Level Security	4096 kB

Database Files:

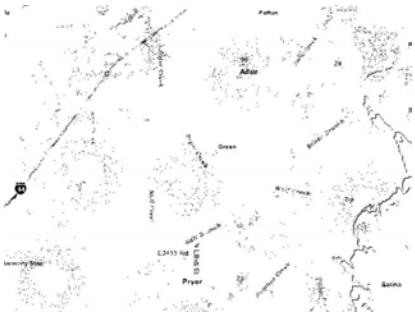
Database Field	Description	Range of Values
Latitude	Latitude Offset	0 to 10,000
Longitude	Longitude Offset	0 to 10,000
Cellular Block – A	Spectrum Use	Enable / Disable
Cellular Block – B	Spectrum Use	Enable / Disable
PCS Block – A	Spectrum Use	Enable / Disable
PCS Block – B	Spectrum Use	Enable / Disable
PCS Block – C1	Spectrum Use	Enable / Disable
PCS Block – C2	Spectrum Use	Enable / Disable
PCS Block – C3	Spectrum Use	Enable / Disable
PCS Block – D	Spectrum Use	Enable / Disable
PCS Block – E	Spectrum Use	Enable / Disable
PCS Block – F	Spectrum Use	Enable / Disable
Power Level	Composite Amplification Level	0% to 100%
Altitude Restriction	Disable Use Above (meters)	0 to 5000 (meters)
Velocity Restriction	Reserved	Reserved
Future Date	Future Date	Calendar Offset
Future Cellular Block – A	Future Spectrum Use[38]	Enable / Disable
Future Cellular Block – B	Future Spectrum Use	Enable / Disable
Future PCS Block – A	Future Spectrum Use	Enable / Disable
Future PCS Block – B	Future Spectrum Use	Enable / Disable
Future PCS Block – C1	Future Spectrum Use	Enable / Disable
Future PCS Block – C2	Future Spectrum Use	Enable / Disable
Future PCS Block – C3	Future Spectrum Use	Enable / Disable
Future PCS Block – D	Future Spectrum Use	Enable / Disable
Future PCS Block – E	Future Spectrum Use	Enable / Disable
Future PCS Block – F	Future Spectrum Use	Enable / Disable
Future Power Level	Future Composite Amplification Level	0% to 100%
Encryption Code	File Level Security	128-bit

[38] Optional: Future Spectrum Use fields allows the Smart Booster to alter its behavior upon the passing of a specified date. Feature allows recognition of known upcoming wireless network changes.

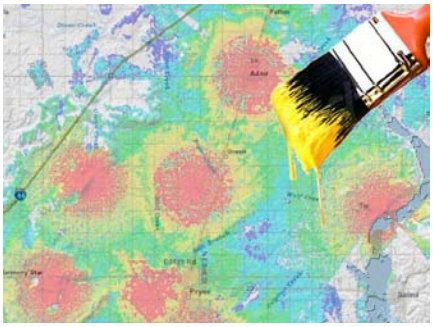
EXHIBIT 3

Creation of the Smart Booster Database File

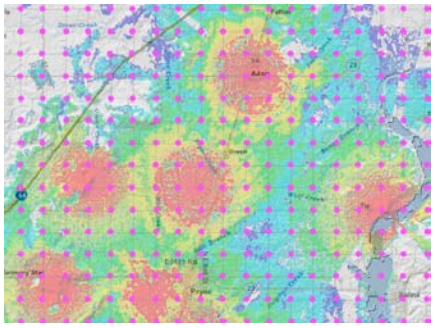
The following illustrations help to visualize the essential steps in the creation of data for the memory card.



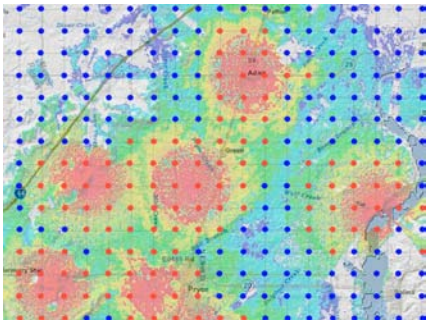
Step 1: Start with a base map….



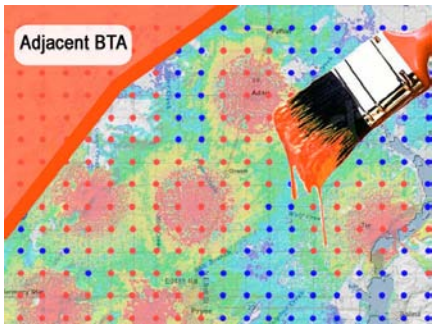
Step 2: Add actual cell site coverage…



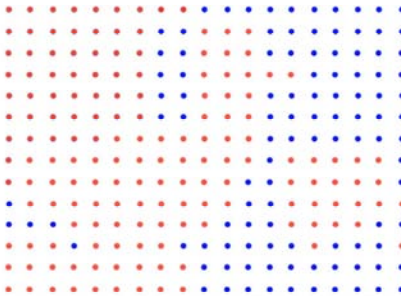
Step 3: Overlay a Grid of Points



Step 4: Assign On/Off values to Points



Step 4: Block out adjacent unlicensed areas and competitor CGSA's.



Step 5: Resulting grid of points, each with an assigned On/Off Value.

Following the above steps, it is a straightforward process to assign Smart Booster operational attributes to each grid point. These attributes include information relating to band, block, and channel utilization, and power level.

EXHIBIT 3 (Continued)

An example of a completed database, using the above procedure.
The data presented here is for illustration only, and not based on actual cell coverage.

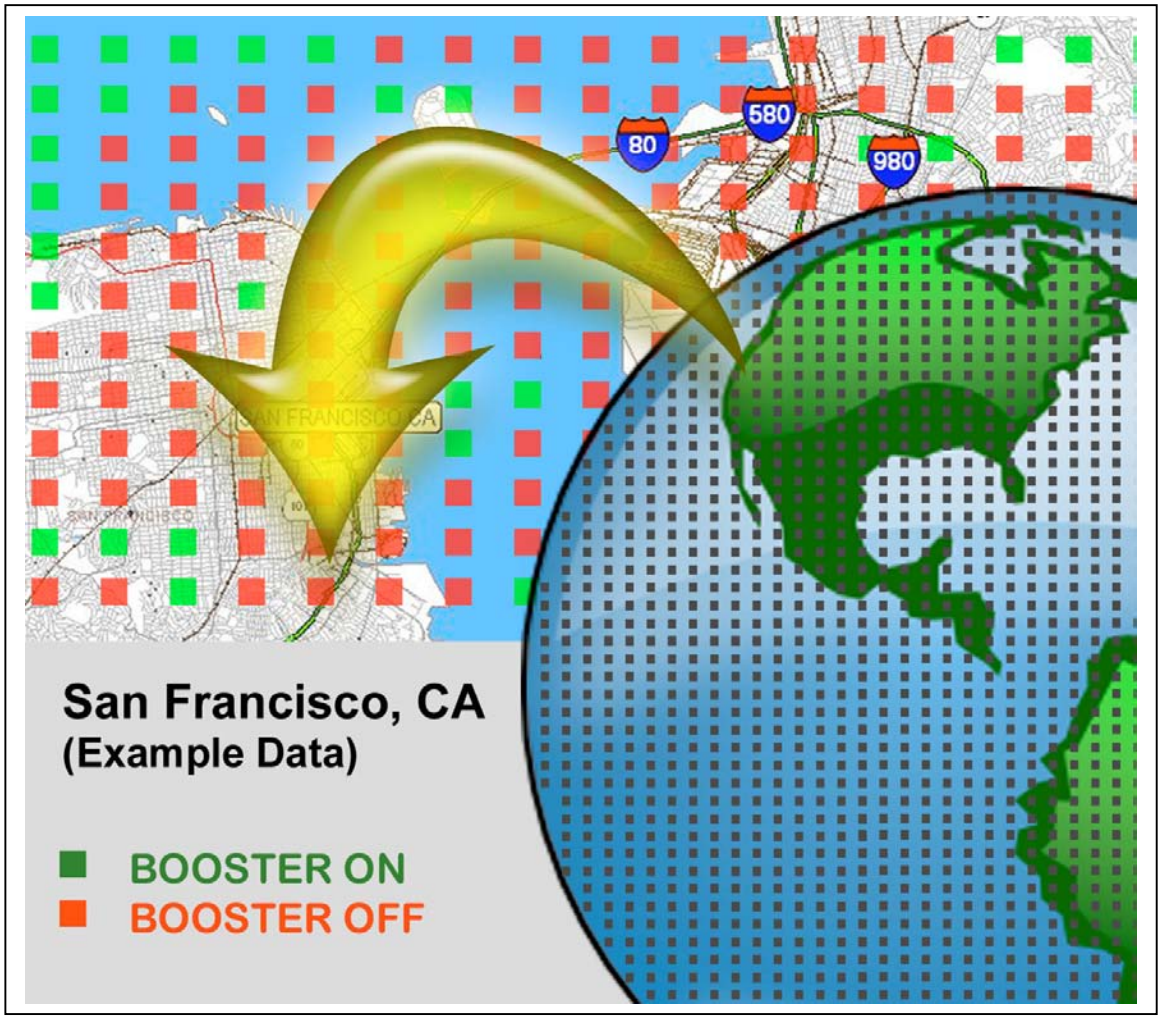


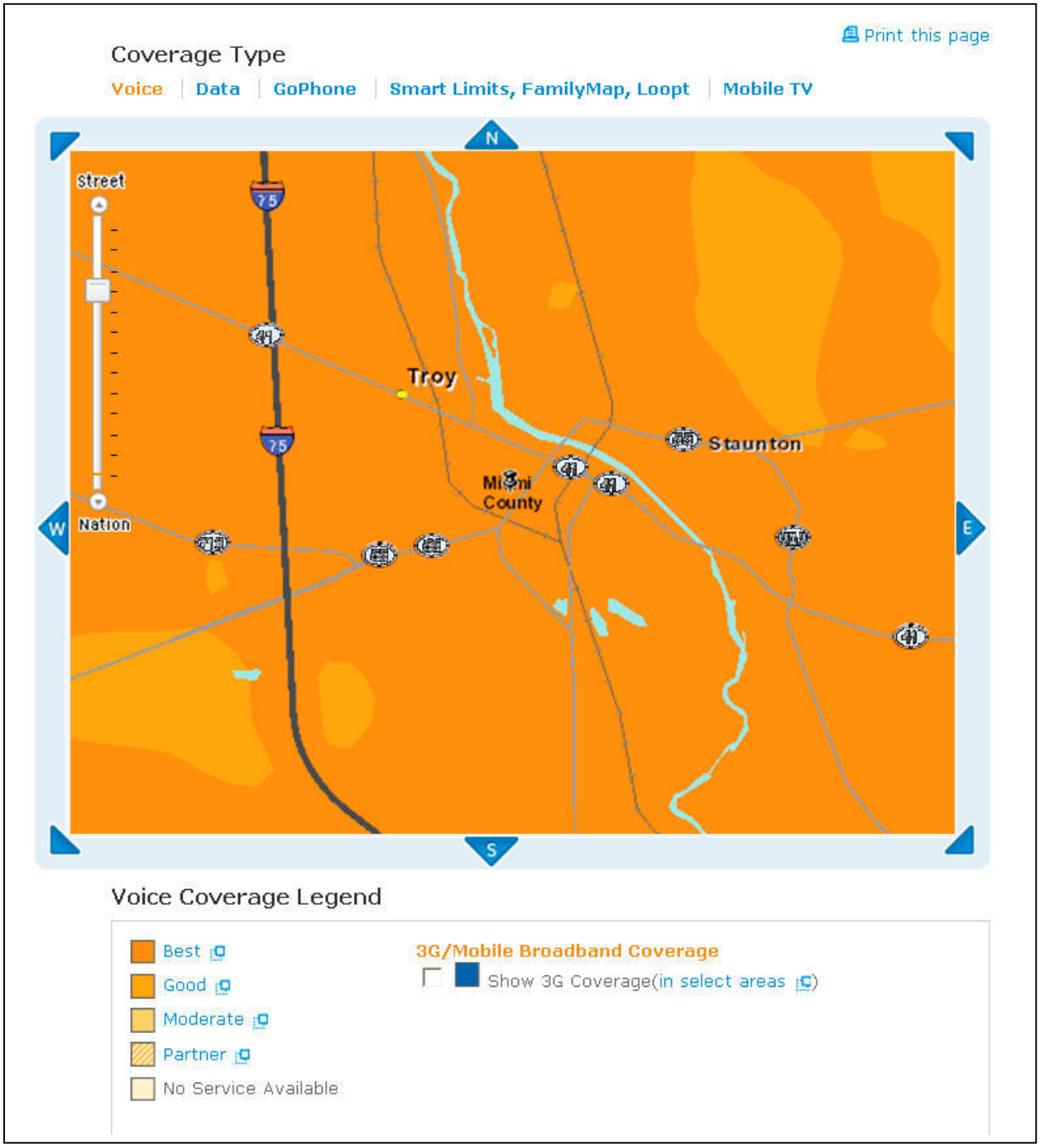
EXHIBIT 4

Comparison of Booster Capabilities

	BASIC BOOSTER	ADAPTIVE BOOSTER	Smart Booster Intelligent Cellular Range Extender
	BDA	BDA DOWNLINK SIGNAL DETECTION	BDA GPS CONTROL KNOWLEDGE OF CARRIER'S NETWORK
Maintains Carrier Operational Control	✗	✗	✓
Carrier-Specific Spectrum	✗	✗	✓
Operation Only Where Needed	✗	?	✓
Respects CGSA Boundaries	✗	✗	✓
Prevents Harmful Interference	✗	?	✓

EXHIBIT 5

AT&T Mobility Coverage Map – Troy, Ohio



Source:
http://www.wireless.att.com/coverageviewer/#?type=voice&lat=40.0361645229414&lon=-84.207179312979&sci=9

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