Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters	)	WT Docket No. 10-4

COMMENTS OF TRUEPOSITION, INC.

TruePosition, Inc. (TruePosition), submits these comments in response to the Commission's *Notice of Proposed Rulemaking (NPRM)* addressing the deployment of signal boosters.[1] Signal boosters are signal amplifiers deployed to improve the wireless connection between a mobile device and the wireless network, to amplify and distribute wireless signals to areas with poor coverage. The Commission proposes to amend its rules to adopt new technical, operational, and coordination parameters for fixed and mobile signal boosters. It proposes to authorize individuals to use fixed and mobile consumer signal boosters by rule under Part 95, subject to particular requirements.

TruePosition is a leading provider of wireless location solutions and technology. Its Uplink Time Difference of Arrival ("U-TDOA") system is the principal network based location technology deployed in the United States.

The Commission's *NPRM* is an important step to promote wireless communications in rural, urban and suburban areas. Signal boosters can address coverage gaps in rural areas, mitigate service challenges inside buildings and provide coverage to subterranean and other

[1] Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, *Notice of Proposed Rulemaking*, FCC 11-53, WT Docket 10-4 (April 6, 2011).

challenging environments. While signal boosters can be an important part of wireless networks, they are best utilized when properly integrated into the network by the entities that understand and are responsible for network configuration and service, the network operator.

The *NPRM* expresses concern that malfunctioning, poorly designed, or improperly installed signal boosters may harm consumers by blocking calls, including E-911 and other emergency calls, and decreasing network coverage and capacity.[2] As a major supplier of Network based location solutions for E-911 Phase II,[3] TruePosition describes how signal boosters that are not properly integrated into the wireless network can and will impact accuracy and yield of Network based location systems.

The U-TDOA solution employed by TruePosition relies on multi-lateration based on time delay measurements made from a number of cell sites surrounding the mobile device to be located. To accomplish this, very high sensitivity receivers, called Location Measurement Units (LMUs), are deployed at cell sites in the wireless network. Since the signal time delay has to be measured at many sites, the sensitivity of the LMUs are much greater than the sensitivity required of the base station, which only has to be able to "hear" the signal at the serving cell site. This raises two separate concerns particular to Network based location for E-911 with regard to signal boosters.

The first issue is regarding location of the mobile that is utilizing the signal booster. While the higher signal level produced by a signal booster can improve the ability of LMUs to "hear" the signal from that mobile, the delay introduced by the signal boosters can cause relatively large errors in the location computation. This is due to the fact that there are actually two signals being transmitted, one by the mobile, and an amplified (and delayed) version coming

[2] *NPRM* at Paragraphs 2, 19.

[3] Section 20.18(e) of the Commission's rules.

out of the signal booster. Because the LMUs, by design, have very sensitive receivers, some LMUs will detect the signal from the mobile, while other, more distant LMUs, will only be able to detect the amplified and delayed signal from the signal booster. This creates ambiguous TDOA measurements that can degrade the accuracy of locations. The amount of degradation will depend on a number of factors including the delay through the signal booster, the relative signal levels, and geometry of the surrounding cell sites.

Wilson Electronics estimates the possible additional error introduced by the signal delay through three models of signal boosters.[4] In that filing, Wilson down plays the additional 52 meters of error introduced by their signal booster by saying: *"...the additional error introduced by signal boosters is relatively small"*. When the goal of network-based positioning is to achieve 100m accuracy, and in most environments is quite a bit better than that, the addition of 52 meters of error is quite substantial. Furthermore, these numbers are based on just three models from one vendor of signal boosters. Other manufacturer's designs may introduce significantly longer delays, and accordingly larger additional location error. The second, much more critical, issue is the impact that the use of a signal booster by one user can have on the ability to locate other users who are not using signal boosters, or even aware that signal boosters are in use in the wireless network.

As noted, multi-lateration techniques like U-TDOA require the signal from the mobile of interest to be "heard" by multiple nearby sites. At the cell site serving the call this is very similar to what the base station must do as well. But at the neighboring sites, the signal from the mobile of interest arrives at very weak levels. Furthermore, because of frequency reuse, the signal from mobiles served by these neighboring sites act as strong interfering signals with respect to

[4] *Ex Parte* Letter of Wilson Electronics Inc., submitted by Russell D. Lukas, Esquire, WT Docket 10-4 (March 30, 2011) at page 2.

"hearing" the mobile of interest. LMUs are designed to utilize a significant amount of processing gain to overcome this situation, as long as these interfering signals are properly power controlled for normal network operation. If however, a signal from a mobile using a signal booster arrives at one or more of these neighboring sites at power levels above normal network operating levels, then the processing gain in the LMU may not be sufficient to overcome this interference. The loss of one or more time difference measurements can, in some case, severely degrade location accuracy, or in extreme cases, even cause a failure to locate the mobile of interest.

As an illustrative example, Figure 1 shows a case where all the interference signals are power controlled by the network and 4 sites are able to "hear" the mobile of interest. This produces 3 hyperbolic isochrones that intersect at the location of the mobile of interest. Figure 2 shows the same scenario, but with an interfering mobile utilizing a signal booster that produces increased interference levels and causes one of the neighboring sites to no longer be able to "hear" the mobile of interest. The remaining two isochrones no longer produce an unambiguous location solution.

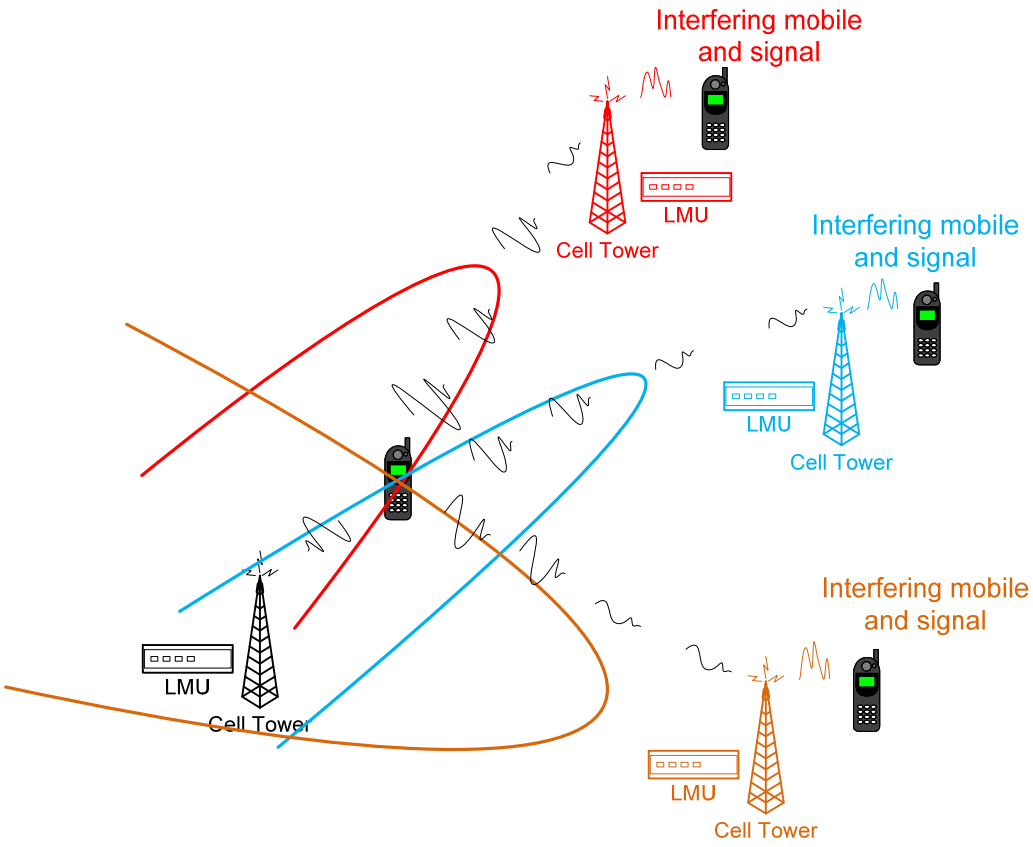

Figure 1. Normal operation. Mobiles are power controlled. Signal from mobile of interest is detected at 4 sites and produces unique solution where isochrones intersect.

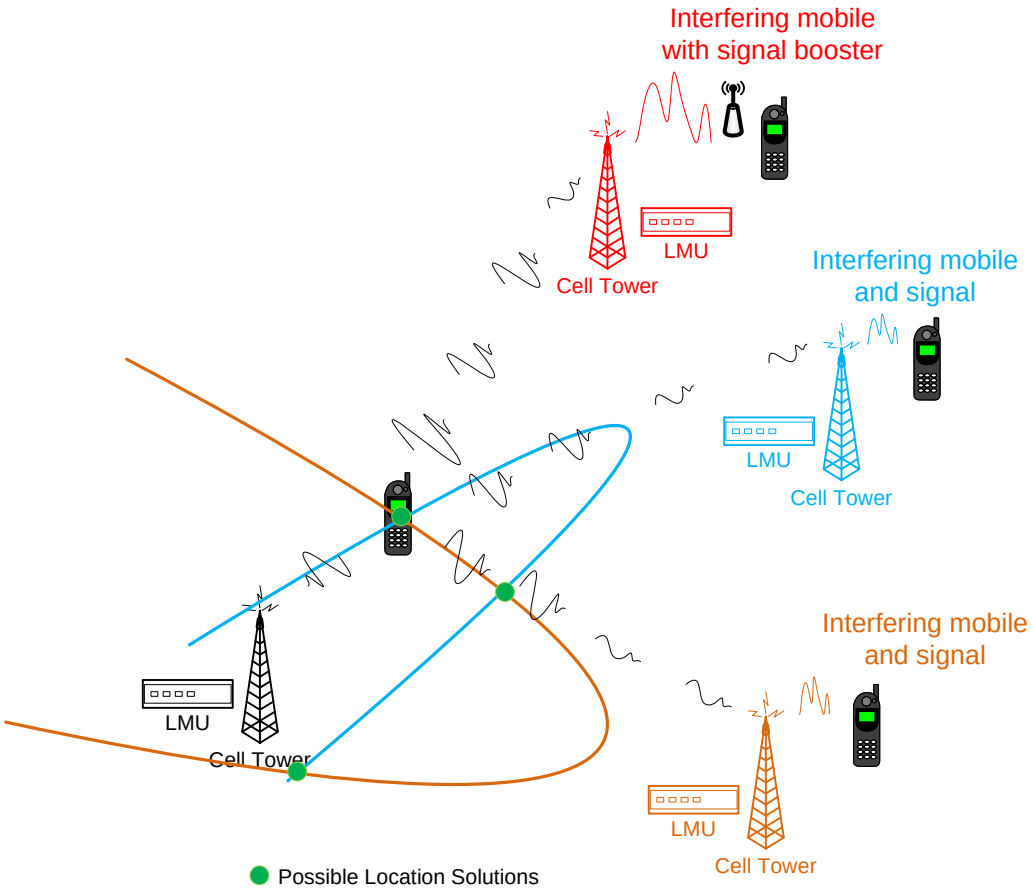

Figure 2. Signal booster operation. Signal booster produces stronger than normal signal at the cell site. LMU is no longer able to overcome the increased interference levels, thus unable to make a TDOA measurement from that site. The remaining two isochrones produce multiple possible solutions.

Due to the possible impacts on critical E-911 systems as described above, as well as normal network operation, the installation and operation of signal boosters are best managed and coordinated under the direct control of the network operators, who are responsible to provide service, including E-911. Network operators are in the best position to understand the design of their networks. They are able to properly integrate a signal booster in a way that optimizes the benefits derived from them without harming the normal operations of their network for millions of users that could otherwise be negatively impacted by improperly designed and integrated signal boosters.

Absent full installation and maintenance by the network operator, the proposal of AT&T as described in the *NPRM*[5] presents a reasonable approach that balances the needs of individual users that could benefit from the use of signal boosters with the needs of the much larger group of users that rely on proper operation of the wireless network unimpeded by improperly designed or maintained signal boosters.

A signal booster is not just a device that connects with the network for a particular subscriber. It becomes part of the network and its effect, as noted, can pervade and harm network operations, including locating devices of individuals summoning emergency response. It can disrupt the network's capacity to control signal power. Ultimate control by the licensee, including ability to identify and locate the signal booster, that it transmit only on frequencies authorized by the wireless provider, that it be capable of detecting when it oscillates and to terminate when oscillation occurs and any that a device failing to meet presumptive authorization

[5] *NPRM* at paragraphs 56 and 57, *Ex parte* letter of AT&T, submitted by Jeanine Poltronieri, Esquire, Assistant Vice President, WT Docket 10-4 (May 28, 2010) at 7.

standards is viewed as illegal in the absence of licensee authorization, are important precepts and should be embraced by the Commission.[6]

Signal boosters are an important facility to promote wireless coverage in several environments. Yet their effectiveness and contribution requires integration into the network. The network provider is in the best position to ensure that harm to critical communications, such as emergency calls, are protected.

Respectfully submitted,

TruePosition, Inc.

Michael Amarosa
Senior Vice President-Public Affairs

John E. Logan
Attorney for TruePosition, Inc.
1050 Connecticut Avenue, NW
Tenth Floor
Washington, D.C. 20036
202.772.1981

July 25, 2011

[6] AT&T May 28, 2010 *Ex Parte* Letter at 7-8.