Cell-Loc Inc.
#207, 12 Manning Close N.E.
Calgary, AB, Canada, T2E 7N6
Phone: (403) 569-0760
Fax: (403) 569-0762
Webpage: www.cell-loc.com

Cell-Loc Inc.

RECEIVED
FEB 16 1999
FCC MAIL ROOM

February 12, 1999

Magalie Roman Salas, Secretary
FEDERAL COMMUNICATIONS COMMISSION
The Portals
445 - 12th Street S.W.
Washington DC 20554
U.S.A.

Dear Ms. Salas:

Re: Cell-Loc Inc.
Formal Comments on Responses Filed In Accordance With
Request for Waiver of Section 20.18(e) of the Commission's Rules
CC Docket No. 94-102

Further to the Public Notice (DA 98-2631) of December 24, 1998 issued by the Federal Communications Commission's Wireless Telecommunications Bureau entitled "Wireless Telecommunications Bureau Outlines Guideline for Wireless E911 Rule Waivers for Handset-Based Approaches to Phase II Automatic Location Identification Requirements", we enclose an original and nine copies of our Formal Comment.

Should you have any questions concerning this matter, please feel free to contact us.

Yours sincerely
CELL-LOC INC.

Michel Fattouche

Michel Fattouche, Ph.D, P.Eng.
President

No. of Copies rec'd 0+9
List A B C D E

RECEIVED
FEB 16 1999
FCC MAIL ROOM

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In The Matter Of:

Revision of the Commission's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Systems	)	CC Docket No. 94-102 RM-8143
Opposition to Request for Waiver of Section 20.18(e) of the Commission's Rules	)	DA 98-2631

Comments of Cell-Loc Inc.

Cell-Loc Inc. ("Cell-Loc") submits these comments to waiver requests made in response to the Wireless Telecommunications Bureau's December 24, 1998 Public Notice.[1] Cell-Loc submits these comments out of concern that the granting of waivers of section 20.18(e) of the Commission's rules will not be in the public interest given the inherent limitations of handset-based automatic location identification (ALI) approaches which use the Global Positioning System (GPS).

The original intention of the Commission's rules regarding ALI for wireless 911 callers was that any ALI technology deployed would be capable of locating any and all handsets. In the Notice, the Commission states that "at the time the original rules were adopted, the parties expected that ALI would be implemented by upgrading wireless carrier's networks, which would allow the carriers to provide ALI for all handsets".

[1] "Wireless Telecommunications Bureau Outlines Guidelines for Wireless E-911 Rule Waivers for Handset-Based Approaches to Phase II Automatic Location Identification Requirements," Public Notice, DA 98-2631, rel. Dec. 24, 1998 ("Notice").

However, as stated in the Notice, concerns have been raised that carriers employing handset-based location technology which utilizes GPS, "may only be able to provide Phase II ALI for new handsets or handsets that have been upgraded to support the chosen technology." Elsewhere in the Notice, the Commission expresses concern that carriers which employ handset-based ALI technology "might not be able to provide reliable ALI service to roamer customers whose home carrier adopts a network-based solution." Cell-Loc agrees with many petitioners that both of these problems may disappear at some time in the future if only GPS-enabled handsets are sold after a certain date. If this happens, which may take a long time, all handsets will be compatible with any carrier's ALI technology whether it be network-based or handset-based (we here make the assumption that the only handset-based technology used will be based on GPS and that handset-based technologies from different vendors will be compatible).

Cell-Loc believes that the real issue to be addressed is the ability of ALI technologies to locate *ALL* 911 calls even when all handsets are GPS-enabled. In the Federal Communication Commission's Memorandum Opinion and Order[2], the Commission clearly states that " as of October 1, 2001, licensees subject to this section must provide to the designated PSAP the location of all 911 calls ... such that the RMS is 125 meters or less, which would represent approximately a 67 percent to 75 percent probability that the reported location would be within a 125 meter radius of the caller's actual location. ... Therefore, we expect that any Phase II ALI technology deployed by

[2] Federal Communications Commission, Memorandum Opinion and Order, FCC 97-402, Released: December 23, 1997.

a carrier, whether it is a network-based approach, or any other approach, would satisfy this requirement."

According to this requirement, location estimates for *ALL* 911 calls must be used in the RMS calculation to determine if the technology meets the 125 m RMS requirement. If a Phase II ALI technology is not able to locate a particular 911 call, a Phase I location estimate is most likely the best available. Such an estimate, however, must be considered in an RMS calculation.

It appears that much confusion still exists regarding the meaning of an RMS accuracy specification. It must be stressed that an RMS accuracy differs from a 67th percentile. In the scenario described above, in which a Phase II ALI technology is not able to locate a 911 call, a Phase I location will likely degrade the RMS accuracy but will not necessarily influence the 67th percentile. If the location errors for a particular ALI technology follow a certain distribution, the RMS accuracy and 67th percentile will be the same. If, however, the nature of a particular ALI technology is such that the vast majority of 911 calls are located very accurately but a small minority are not able to be located, the RMS accuracy will be much poorer than the 67th percentile. Take for example the case where the majority of 911 calls are located with an average accuracy of 50m, while a minority of 911 calls could not be located. Assuming that Phase I location information is used for such a minority of 911 calls with an average accuracy of 1000m, the 125m RMS accuracy is met only when the percentage of 911 calls that could not be located is less than 8%. For an accuracy of 90m RMS, the percentage of 911 calls that could not be located must not exceed 5% of the total number of 911 calls. Whether GPS-enabled handsets can meet such a requirement remains to be seen.

With respect to the discussion over handset-based technologies, to state that a handset-based ALI technology will meet the Commission's accuracy requirement at a certain point in time because 67% of subscribers will have ALI compatible handsets at that time, is a gross misinterpretation of the Commission's rules. In addition, such a statement makes a dangerous assumption - that all GPS-enabled handsets will be located when making a 911 call *no matter where they are.*

It is crucial, therefore, to consider whether a GPS-based handset ALI technology is able to locate a 911 call from anywhere. A number of carriers in their petition for waiver state that there is uncertainty as to whether a GPS-enabled handset will be able to be located indoors. In their petition for waiver[3], AirTouch Communications presents results from a SnapTrak trial. The only results they quote are for tests made in windowed offices. They also quote results for an Integrated Data Communications trial but give no results for indoor tests. US West Wireless[4] also quote the SnapTrak tests in their petition for waiver and state that "the handsets tested were incapable of providing reliable location information (i.e., within 125 meters) for calls initiated deep within the interior of tall office buildings and similar structures." PrimeCo in their petition for waiver[5] similarly say of the SnapTrak trials that "these initial tests were with specially-designed handsets and that some results were less promising, particularly for multi-story in-building settings." Finally, United States Cellular Corporation, in their

[3] "Comments and Petition for Waiver of Section 20.18(e) of the Commission's Rules," AirTouch Communications, Inc., February 4, 1999.
[4] "Petition for Waiver of Section 20.18(e) of the Commission's Rules," US West Wireless, L.L.C., February 4, 1999.
[5] "Petition for Waiver of Section 20.18(e) of the Commission's Rules," PrimeCo Personal Communications, L.P., Dallas MTA, L.P., Houston MTA, L.P. and San Antonio MTA, L.P., February 4, 1999.

request for waiver[6] state that "at present, handset-based technologies have considerable difficulties acquiring satellites from inside vehicles or buildings."

It is Cell-Loc's opinion that acquiring GPS satellite signals within certain structures will continue to be a practical difficulty. Independent research[7] by experts in the GPS field demonstrated that satellite signals are only acquired within some 5 m of an outside window. The same research concludes that to successfully locate with a GPS receiver indoors, technical conditions, which are unrealistic for a wireless handset, must be met. Tests performed by Cell-Loc demonstrated that when attempting to acquire GPS satellite signals indoors, unrelated cables which run to the exterior of the building can cause misleadingly optimistic results.[8] In addition, Cell-Loc has also demonstrated in their labs that under certain SNR conditions it is impossible to acquire any satellites indoors no matter how long the observation interval is.

As a result, Cell-Loc believes that compared to a network-based ALI approach, the feasibility of the GPS-based handset approach is, in one sense, beyond the control of handset-based vendors. In terms of signal availability, the crucial difference between GPS-based handset solutions and network-based solutions is the GPS satellite signal versus the wireless handset signal. Location of a GPS-enabled handset is dependent on the signals transmitted by the GPS satellites. The received power level of these signals is a function of the satellite transmission power and the orbital elevation of the satellites. These parameters are obviously beyond the control of a handset-based ALI vendor. The only course of action, then, is to develop signal

[6] "Contingent Request for Waiver," United States Cellular Corporation, February 4, 1999.
[7] B. Peterson, D. Bruckner and S. Heye, "Measuring GPS Signals Indoors," Proceedings of Institute of Navigation ION-GPS'97, Kansas City, Missouri, September 1997.
[8] M. Fattouche, R. Klukas, K. Oler, B. Peterson, and D. Bruckner, "The Performance of a Novel GPS Receiver Designed for Indoor Use," Internal Cell-Loc Report, January 1999.

processing techniques to pull the satellite signals out of the noise and acquire them. As noted above, this will not be a practical reality for the case of locating a wireless handset calling 911.

Due to the differences in nature between GPS satellite signals and wireless telephony signals, it is very conceivable that a GPS-enabled handset could successfully make a 911 call but not be able to acquire GPS satellite signals. On the other hand, signal availability will not be a critical issue for network-based technologies. If a 911 call is successfully made, at least one base station can hear the wireless telephone. Increased sensitivity has been achieved in a network-based system enabling more distant cell sites to also 'hear' the wireless telephone. In the event that network-based ALI technology is not sensitive enough to hear the wireless telephone at a sufficient number of base stations, more receiving sites could be installed. Understandably such a solution would be expensive. The point we wish to make, however, is that with a network-based ALI technology it is within the control of the carrier or vendor to ensure that all 911 calls are located. This kind of control does not exist for GPS-based handset technologies. It is not possible to increase the power at which satellites transmit nor is it possible to lower their orbits. The number of satellite signals may be increased through the use of pseudolites but this will not increase the received power at the handset since pseudolites must also transmit at low power levels to avoid the near-far problem.

In summary then, Cell-Loc believes that delaying the implementation of Phase II ALI to allow GPS-enabled handsets to enter the market is not in the public's best interest. Even if all handsets were GPS-enabled, which may take a long time, not all 911 calls will be located due to the difficulty of acquiring GPS satellite signals in difficult areas such as indoors, in urban canyons, and in vehicles. Network-based ALI technology, on the other hand, is able to locate all 911 calls and, therefore, is able to comply with the FCC rules under any conditions. As a result, it is not prudent to delay implementation of Phase II ALI to wait for technology which cannot locate all 911 calls.

Respectfully submitted,

CELL-LOC INC.

Michel Fattouche[9], Ph.D., P.Eng.
President
CELL-LOC INC.
204, 12 Manning Close N.E.
Calgary Alberta T2E 7N6
Canada

February 15, 1999

[9] Dr. Michel Fattouche is also a Professor of Electrical & Computer Engineering at The University of Calgary, 2500 University Dr. N.W., Calgary Alberta T2N 1A6, Canada.