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

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In The Matter of	)	
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Wireless E911 Location Accuracy Requirements	)	PS Docket No. 07-114
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COMMENTS OF INTRADO INC.

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EXECUTIVE SUMMARY

Intrado strongly supports efforts to address the challenge of accurately locating wireless 9-1-1 calls made indoors. In order for first responders to provide assistance to indoor callers in need, they must know the exact address (a dispatchable address). The need to provide Public Safety Answering Points (PSAPs) with dispatchable addresses is the same whether the caller is making the call from a traditional wireline phone or from a wireless phone. While significant financial investment in new 9-1-1 location technology can be made to marginally increase the accuracy of X,Y coordinates, if the X,Y is not accurate enough to locate which door the emergency caller is behind, there is little additional value to the first responder. X,Y coordinates provide sufficient information to locate wireless calls made from outdoors, but they do not, by themselves, lead the first responder to the precise address. Technology exists that can be leveraged to provide reliable dispatchable addresses for wireless callers. In the course of evaluating increased X,Y location requirements, the Commission should consider how industry stakeholders can use existing technologies and work together to provide precise and reliable address information to locate indoor wireless 9-1-1 callers.

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COMMENTS OF INTRADO INC.

Intrado Inc., on behalf of itself and its affiliates (hereinafter referred to as "Intrado"), hereby submits the following comments in response to the Federal Communications Commission's ("FCC" or "Commission") Third Further Notice of Proposed Rulemaking ("Third FNPRM") in the above-referenced proceedings.[1]

In its Third FNPRM, the Commission's stated goal is to "revise [its] regulatory framework to require delivery of accurate location information to PSAPs for wireless 911 calls placed from indoors."[2] In the near term, the Commission seeks to provide "approximate location information sufficient to identify the building for most indoor calls."[3] To achieve this, the Commission proposes to require CMRS carriers to increase the accuracy of horizontal X,Y coordinates and to meet new vertical accuracy requirements. Intrado agrees that indoor location determination for wireless 9-1-1 calls is a critical challenge facing the nation today. However,

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1 *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114, Third Further Notice of Proposed Rulemaking, FCC 14-13 (rel. Feb. 21, 2014) ("Third FNPRM")

2 Third FNPRM at ¶ 2.

3 *Id.*

Intrado urges the Commission to consider current capabilities to provide dispatchable addresses for wireless callers when addressing future accuracy requirements.

I. Dispatchable addresses are necessary to provide accurate indoor location.

The evolution of Enhanced 9-1-1 (E9-1-1) began in the 1970s in an environment consisting solely of fixed wireline telephone service. Customers would receive telephone services at a fixed address where the phone company installed the equipment. The customer's name and service address were provisioned into the 9-1-1 system at the time the phone service was established. The proper responding "Fire", "Police", and "Rescue" were also provisioned when the service was established and PSAP routing boundaries were determined. Due to the static nature of fixed wireline services, pre-provisioned address information was sufficient for the First Responder to locate the emergency caller.

With the introduction of wireless service, E9-1-1 evolved. When wireless service was first integrated into the E9-1-1 environment, the phones were not seen or used as a landline replacement. It was assumed that in most cases, the call was placed from outdoors. Location of the emergency caller was dynamic, therefore requiring the location determination of the emergency caller at or near the time of the call. Latitude and longitude (X,Y) were determined to be the best method to locate these outdoor emergency calls.

Today, around 70% of all 9-1-1 calls are placed from wireless cell phones, and a large portion of those wireless calls are now placed from indoors.[4] Additionally, consumers are rapidly replacing their fixed home phones with wireless telephones as their primary phone

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[4] Third FNPRM at ¶ 29 (referencing comments from CalOES Workshop, King County Workshop, and NENA Workshop Oakland Workshop on 9-1-1 wireless call statistics).

service.[5] This trend decreases the delivery of pre-provisioned addresses to PSAPs and increases the use of X,Y coordinates for dispatch purposes. The use of X,Y, rather than fixed addresses, presents significant challenges in locating and dispatching to wireless 9-1-1 callers indoors. An X,Y coordinate, by itself, is not sufficient for first responders to effectively respond to a time-critical emergency. Responders need an address that will get to them to the door where the emergency has occurred. A valid dispatchable address is the most accurate form of location for indoor calls. Unlike the X, Y coordinates, a valid dispatchable address has no error rate and identifies the precise location of the caller seeking assistance. An X,Y coordinate can assist in validating addresses, determining the nearest responding agency, and providing valuable secondary data, but more information is needed to provide a precise, reliable location at which to render assistance to the caller.

As the chart below depicts, there are two levels of location that provide value to PSAPs and first responders. The first level of location accuracy is the level that properly identifies the PSAP to which the call should be routed. This can typically be provided by cell site level location. The next level of location accuracy that is valuable to first responders is the caller's exact location. When a caller is outdoors, typically an X,Y is sufficient to find the caller, but when the caller is indoors, a much more precise level of location accuracy is needed—the door

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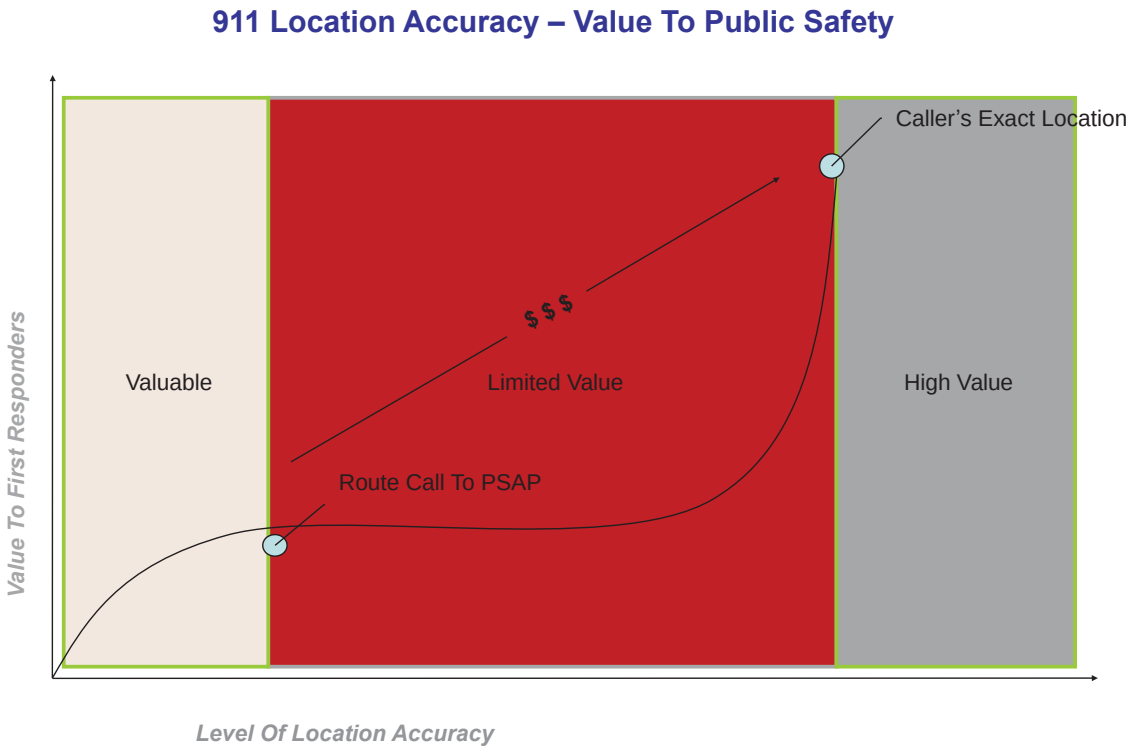
[5] *See Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, Sixteenth Report*, 28 FCC Rcd 3700, 3724 (March 2013) (citing a July-December 2011 National Health Interview Survey that approximately 32.3 percent of all adults in the U.S. lived in wireless-only households); *see also Stephen J. Blumberg, Ph.D. et al., Wireless Substitution: Early Release of Estimates from the National Health Interview Survey*, January-June 2013, Department of Health and Human Services, National Center for Health Statistics, (rel. Dec. 2013) ("Nearly two in every five American homes (39.4%) had only wireless telephones…during the first half of 2013—an increase of 1.2 percentage points since the second half of 2012.").

the responder needs to kick in to render aide to the caller. While significant financial investment can be made to marginally increase indoor X,Y accuracy, if the X,Y coordinate is not accurate enough to locate which door the emergency caller is behind, there is little additional value to the first responder.



In the Third FNPRM, the Commission discussed several new technologies that could be deployed to meet the proposed indoor location accuracy requirements.[6] The new technologies that would be deployed solely for 9-1-1 to improve X,Y coordinate accuracy are not cost effective if they cannot produce that dispatchable address needed during an emergency. The provision of accurate X,Y coordinates are a means to an end, not an end in itself.

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6 Third FNPRM, ¶¶ 12-17 (discussing the *CSRIC Indoor Location Accuracy Test Bed Report* testing the Qualcomm, Polaris, and NextNav location technologies).

Some of the technologies discussed below will be sufficient, individually, to provide dispatchable address information for indoor wireless 9-1-1 calls. Alternatively, use of complementary technologies can assist the industry in providing dispatchable addresses to PSAP and first responders when needed.

II. Methods for providing dispatchable addresses for wireless calls.

Reverse geocoding, the primary technology used today to derive dispatchable addresses from X,Y coordinates, does not provide sufficiently reliable results on its own. However, technology that exists can be leveraged to provide reliable dispatchable addresses for wireless callers. Available technologies include use of wireless network access points, associated addresses, beacons and commercial location.

A. Reverse Geocoding

Reverse geocoding is the process used to derive the closest address to a specific latitude and longitude point. The accuracy of the derived address is only as accurate as the underlying base map data that was used to determine the address. For the address to be accurate, the base map data must be built using data defining the geographic envelope of the structure the emergency caller is within and the dispatchable address of that structure. Some PSAPs are developing and implementing these databases; however, they are very expensive and it takes a long time to locate and code the location data for the PSAP territory.

Intrado has built point structure base maps where it determines the X,Y of the center of the primary structure of an individual address based upon the PSAPs existing street centerline data. It does this through automated and manual work including satellite imagery, tax parcels, other commercial base map data and actual physical site verification. This is not as accurate as building envelope mapping would be, but it is the best that can reasonably be done today. In

many cases building these base maps can cost as much as one dollar a structure and require frequent updates as new structures are developed.

The vast majority of PSAPs utilize commercially available or their own generated and verified street centerline data to do mapping within the PSAP boundary. The street centerline data map is great for plotting addresses and defining resources. It is also good for providing nearby addresses, but it often provides very misleading information when trying to reverse geocode an X,Y coordinate to provide a dispatchable address.

Intrado conducted a study in which it took a large number of addresses for which it already knew the latitude and longitude of the primary structure at a specific dispatachable address. It then took the latitude and longitude of the primary structure and ran that data through a reverse geocoder using two types of base map data. The first base map data is typically what a PSAP uses for its mapping systems. In this case it is extremely accurate street centerline data that a municipality generates that locates all the roads, address ranges, and other resources such as fire hydrants, gas shutoff valves, water mains etc. The second base map data is the best commercially available data, which includes a combination of many data sources including street centerline data, point structures, tax maps, etc. It then compared the addresses returned by the reverse geocoder, from each of the data sets, with actual address of the latitude and longitude. The study was conducted individually in rural, residential and urban areas. The following was the result of that study.

Dataset #1 – Typical PSAP Centerline Data

RURAL

- Street Name & House # Match: 2%
- Street Name Match but Different House #: 88%

- Incorrect Street Name & House #: 9%

SUBURBAN

- Street Name & House # Match: 2%
- Street Name Match but Different House #: 91%
- Incorrect Street Name & House #: 7%

URBAN

- Street Name & House # Match: 21%
- Street Name Match but Different House #: 65%
- Incorrect Street Name & House #: 14%

Dataset #2 – Premium Commercial Data

RURAL

- Street Name & House # Match: 38%
- Street Name Match but Different House #: 52%
- Incorrect Street Name & House #: 10%

SUBURBAN

- Street Name & House # Match: 37%
- Street Name Match but Different House #: 52%
- Incorrect Street Name & House #: 11%

URBAN

- Street Name & House # Match: 85%
- Street Name Match but Different House #: 10%
- Incorrect Street Name & House #: 5%

The study showed that using the base map data that PSAPs often use for their mapping systems, reverse geocoding will more often than not provide the wrong address. Even commercial base map data led to significant mismatches. In the best case, using commercial data, one out of ten times, first responders would be kicking down the wrong door. Providing

addresses that are unrelated to the emergency caller causes first responders to mistrust address information.

A dispatchable address is considered a very precise location. When a dispatchable address is provided to a first responder, it implies that the emergency caller is behind the door defined by that address, not the door across the street or down the block or 10 floors up. First responders need to be able to trust that the address they are given is the caller's address, not the address down the street. While reverse geocoding is a piece of the solution in determining a dispatchable address, it cannot be used solely by itself.

B. Femtocells

The use of femtocells to provide dispatchable addresses is an option that is available today. Femtocells are typically consumer installed devices that provide small radius coverage (less than 100 meters) in residences where cellular coverage may be poor. The femtocell, for normal operation, must also have a GPS that must receive a signal before it can operate. Some carriers provide the dispatchable address of the femtocell along with the X,Y of the mobile device when a 9-1-1 call is placed using the femtocell. By providing the pre-provisioned dispatchable address of the femtocell cross referenced with the GPS location of the femtocell or handset to verify that the femtocell has not moved, a wireline equivalent level of 9-1-1 service could be provided to every mobile device served by that femtocell. In provisioning the femtocell address, it will be necessary to ensure PSAPs can differentiate the femtocell address from larger macrocell addresses.

C. Small Cells

Indoor small cell deployments can also be utilized to provide dispatchable addresses. Carriers are expected to deploy hundreds of thousands, if not millions, of small cell devices in

the near future. These are effectively enterprise-level femtocells that are deployed and managed by the carriers, not end users. They are primarily being deployed to boost network capacity and coverage. Because small cells are being provisioned in the carriers' 9-1-1 systems in a manner similar to macro cells, systems are already in place today to provision addresses. There would need to be procedural or ALI format changes made at the PSAP so that the PSAP would know that these are dispatchable addresses originating from small indoor cells versus Phase I macrocell addresses.

D. Address of Association

"Address of Association" is a third solution that can contribute to production of a dispatchable address. When individuals call 9-1-1 outside of femtocells and small cells, and the cellular network determines that an associated address such as their cellular billing address or home or work address falls within the 9-1-1 determined location area (Phase 1 or Phase 2 location), the carrier could provide this associated address to the PSAP. The association of the address could be through the carrier or user provided data or through public record searches. Sources such as subscriber home, work or utility billing addresses could be cross referenced to help provide intelligence on the location of the caller. Customer provided address data or carrier provided address data could be utilized to further define an accurate location. This solution could be facilitated by an application or a website where a user would input their important address information.

E. Caller Name

The caller's name is not often consider a form of location, but as with wireline phones, the caller's name is often used as a very valuable form or location. There are many real world examples where calls are made from large office or apartment buildings where the first

responders may have to search floor-by-floor for someone in need. Having the caller's name can help identity the possible unit number of an apartment or the office or cubical location of someone calling from an office building. The caller's name is often already being provided by the carriers to CNAM databases for purposes such as caller identification.

F. Commercial Location Technology

Over the years, large investments have been made in the development and deployment of commercial location technologies. While these technologies cannot determine a dispatchable address today, they can provide a more accurate X,Y, especially for use indoors when GPS signals are not available. Also, because these technologies have been developed and deployed for other commercial purposes, they could be utilized for public safety with minimal financial investment.

Commercial location technologies have been undergoing continuous improvements to support the needs of commercial services. The most capable of the commercial location technologies are hybrid handset based solutions that are provided as application program interfaces (APIs) for application developers on Apple iOS based devices and Google Android based devices. In the short term, with some significant limitations, an application on the handset, utilizing these APIs, could be used to determine the X,Y location of the emergency caller and pass that location information to the PSAP. This application could utilize all of the evolving technologies available to commercial location. Eventually, standards could be developed and software developed within the phones operating systems that reduce most of the limitations. By utilizing the 9-1-1 Phase 1 and or Phase 2 location to validate that the commercial location, the possibility of spoofing can also be greatly reduced.

While 9-1-1 today mainly utilizes cell ID location and GPS location, commercial location utilizes additional technologies, such as WiFi location. Crowd sourced location of WiFi access points provides accurate location information when GPS signals are not available. The crowd sourced locations are typically very accurate because of the large number of contributions and verification of locations from participating mobiles. Finally, Bluetooth Low Energy Beacons have emerged for use as commercial location technology. Bluetooth Low Energy Beacons typically have coverage areas of less than 50 meters. They are being deployed in large numbers to support other commercial activities in business, residential and public locations.

Commercial location could be further enhanced to support registered addresses of Bluetooth LE Beacons and WiFi access points. Dispatchable address could be provisioned for Bluetooth LE Beacons and WiFi access points that would provide the same advantages as femtocell registered addresses. Crowd sourced location techniques could be used to verify registered addresses and allow automated management of the registered addresses thereby reducing the management overhead of the addresses and greatly increasing the validity of the provisioned addresses. This type of solution could be implemented in conjunction with commercial X,Y location.

Bluetooth Low Energy Beacons could provide wireline equivalent 9-1-1 location at a low cost. Existing deployments of the Beacons could be used and additional Beacons could be deployed for purposes of 9-1-1 indoor location. They could be installed in residences, offices and college dorms with the specific purpose of providing addresses for wireless 9-1-1 calls. Blue Tooth Low Energy Beacons could also be installed in other devices that are already being associated with addresses such as power meters, cable boxes, DSL modems, cable modems, and satellite receivers to help with locating indoor 9-1-1 callers. Municipalities could consider

requiring these Beacons to be installed as part of local building codes, similar to requirements for other safety systems such as smoke detectors and fire alarms.

III. PSAPs operational/system changes will facilitate the use of these solutions

Effective utilization of dispatchable addresses requires a partnership between service providers and PSAPs. Just as wireless carriers will need to make changes to incorporate available technologies, PSAPs will need to make changes to their systems and processes to address new indoor location solutions. The PSAPs systems may need to be enhanced to be able to understand the nature of dispatchable wireless addresses and their sources and how they are different from macrocell addresses. Changes may include how automatic location information is delivered to the PSAP.

The industry should also consider no longer sending cell site addresses unless that address is truly a dispatchable address and the cell site is covering a definable indoor space. Cell site addresses for Phase I were originally sent because, at the time, most PSAP systems could not accept an X,Y and plot it on a map. Today the cell site addresses are not often needed and the X,Y of the cell site is a better representation of the location of the cell. The cell addresses often cause confusion between other dispatchable addresses. The only addresses that should be passed to the PSAP are truly dispatchable addresses and those should be passed along with X,Y and uncertainty data. When a dispatchable address is not available, only X,Y and uncertainty data should be passed.

New Class of Service (COS) categories may need to be created to help clarify the validity of an address. The COS could be set to a known address for addresses derived when utilizing femtocell or small cell solutions. A COS defining a lesser level of certainty could be provided if an associated address is delivered and the uncertainty of the X,Y location is very large. Finally,

different COS could be used when the address is user provided but not validated, such as the registered address provided with interconnected VoIP calls today.

Work needs to be done to better educate all PSAPs on value and use of X,Y and uncertainty data. A location as determined by a location system is never a point but is always an area. That area is defined by the X,Y and uncertainty data. With the introduction of femtocells and small cells, the concept that a Phase I location is less accurate than a Phase II location is not always true. Particularly for indoor locations, often a Phase 1 cell site location may actually be much more accurate than a GPS location. The practice of delivering an indication of Phase I or Phase II to the PSAP should be replaced with solely the delivery of X/Y and uncertainty. Whether it is a Phase I or a Phase II call, the data should be delivered with the same COS and the PSAP should look at the uncertainty data to determine how much to trust the location. Alternatively, one COS could be sent for lower levels of uncertainty while a different COS could be sent for higher levels of uncertainty to assist the PSAP Telecommunicator in understanding the level of uncertainty.

The industry should consider no longer sending a variable confidence value to the PSAP, but define a fixed confidence value, such as 90%. A standard, industry-approved confidence value will eliminate difficulty PSAPs experience today when trying to interpret location information using different confidence levels from wireless carriers.

PSAPs should also be evaluating rebid processes and procedures. Currently Phase II information is displayed when a wireless caller dials 9-1-1. As the 9-1-1 Telecommunicator is taking down the caller's information, he/she will sometimes replace the Phase II data and insert the caller's address information. When a rebid occurs, the address entered by the Telecommunicator is replaced in the CAD system with the updated Phase II data.

Telecommunicators are understandably reluctant to use the rebid system for fear of overwriting valuable dispatchable information. PSAPs should work with their CAD vendors to ensure that rebids for more accurate location does not overwrite manual address information previously entered by the PSAP.

IV. Conclusion

Many technological solutions exist today that could be utilized to increase indoor location accuracy without significant financial investment by the wireless industry and the public safety community. These solutions can be implemented in combination with one another to effectively address challenges with determining indoor location for wireless callers. In the course of evaluating increased X,Y location requirements, the Commission should consider how industry stakeholders can use existing technologies and work together to provide precise and reliable address information to locate indoor wireless 9-1-1 callers.

Respectfully Submitted,

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