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January 27, 1994

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, D.C. 20554

RE: Ex Parte Communication in Gen. Docket 90-314

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules, this is to notify the Commission that representatives of the Association of Public-Safety Communications Officials-International, Inc. ("APCO"), the National Emergency Number Association ("NENA"), the Texas Advisory Commission on State Emergency Communications ("TX-ACSEC") and the Telocator Technical and Engineering Committee met with the FCC's Chief Engineer, Dr. Thomas Stanley, and his staff on January 27, 1994, to discuss Enhanced 911 capability for wireless telephone services. The TX-ACSEC presented Dr. Stanley a memorandum regarding Wireless E911 Communications, two copies of which are attached hereto for the Commission's records.

Please contact the undersigned should the Commission have any questions.

Respectfully submitted,

WILKES, ARTIS, HEDRICK & LANE,
Chartered

By:
Robert M. Gurss

Attorneys for APCO

cc: Dr. Thomas Stanley (without enclosure)

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Mary A. Boyd , Executive Director

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

MEMORANDUM

TO: NENA Standards Committee

FROM: Mary A. Boyd, Executive Director

DATE: January 26, 1994

SUBJECT: Wireless E9-1-1 Communications

The Texas Advisory Commission on State Emergency Communications (ACSEC) presents to you an outline of our concerns on wireless communications and 9-1-1 systems. The mission of the ACSEC is to protect and enhance public safety and health by facilitating the local implementation of enhanced 9-1-1 emergency communication services throughout the entire state of Texas. The Commission approaches its mission with a deep sense of purpose, commitment and responsibility. The Commission must constantly adjust to emerging telecommunications technologies in order to assure compatibility with proposed and existing 9-1-1 systems.

The Commission believes that its commitment to preserving the health, safety, and property of the citizens of Texas is a commitment all 9-1-1 administering agencies across the nation hold for their constituents. It is with these concerns that we approach the subject of wireless communications.

Please contact this agency at (512) 327-1911 if you have any questions.

WIRELESS COMMUNICATIONS AND E9-1-1 SYSTEMS

Abstract

Enhanced 9-1-1 (E9-1-1) systems have evolved to provide a quick response mechanism for landline telephone service subscribers. When it comes to providing the same level of emergency service for wireless (cellular/mobile and potentially PCN/PCS) customers, enhanced 9-1-1 systems will encounter several impediments. These impediments include the lack of caller Automatic Number Identification (ANI), the absence of Automatic Location Identification (ALI), and the inability to selectively route (or class mark) incoming 9-1-1 calls to the appropriate 9-1-1 PSAP. This paper will present a brief overview of 9-1-1 systems and the features inherent in those systems. It will then focus on the specific problems facing 9-1-1 agencies when dealing with wireless communications. Solutions to those problems will be addressed. The regulatory aspects of the proposed solutions will conclude the paper.

Overview of 9-1-1 Systems

Since its initiation in 1968, Nine-One-One (9-1-1 hereafter) service has evolved to become a commonly known feature to telephone users across the United States. The benefits of 9-1-1 services include:

- a single, universally utilized three-digit number to dial to is easy to remember and dial in emergency situations;
- calls are sent to emergency service providers over special telephone lines;
- calls are recognized and answered as emergency calls;
- a single telephone number to summon emergency assistance provides travelers and newcomers to easy access to emergency services in areas where the telephone number for the various emergency service providers is not readily known;
- calls are answered by professionals trained to assist callers in need of emergency assistance; and
- overall response time to emergencies is shortened.

Additionally, not only does 9-1-1 provide ubiquitous access to emergency service providers, 9-1-1 systems have other features that are not as tangible or apparent to the average citizen. Those features include sending the calling party's telephone number to the responding 9-1-1 system and the ability for the 9-1-1 call taker to call the calling party back if the call is disconnected. These less recognized features have evolved to become essential elements of enhanced 9-1-1 systems.

9-1-1 systems come in three levels of functionality: Basic, Enhanced and Fully Enhanced.

- Basic 9-1-1 systems are call forwarding arrangements in which calls dialed to the 9-1-1 telephone number are sent to the nearest Public Safety Answering Point (PSAP) for answering purposes. Basic 9-1-1 systems allow callers that dial the universal emergency service code, i.e. 9-1-1, to be connected to emergency service providers. Most systems today, however, are striving towards one of the following enhancements.

- With Enhanced 9-1-1 systems, the caller's voice call and telephone number (Automatic Number Identification - ANI) are received at the PSAP.

- Fully Enhanced 9-1-1 systems display, not only ANI, but also address information (Automatic Location Identification). Fully Enhanced 9-1-1 systems have specialized Customer Premises Equipment (CPE) which display the calling party's ANI, ALI, class of telephone service (e.g. business, residential), and which agency should respond for law enforcement, fire, or emergency medical service (EMS).

For the purposes of this paper Enhanced and Fully Enhanced 9-1-1 systems will be combined and abbreviated to read E9-1-1.

One other important feature to E9-1-1 systems is selective routing. Selective routing is a telephone feature that enables calls from a defined geographical area to be sent to a predesignated PSAP based on the originating telephone number of the call to 9-1-1. Basic 9-1-1 systems are limited by the inability to selectively route incoming 9-1-1 calls. Although E-9-1-1 systems have the capability to utilize the selective routing feature, not all E9-1-1 systems have, or need selective routing. The need for selective routing arises when telephone exchange boundaries extend into two or more PSAP jurisdictions. In order to route 9-1-1 calls to the proper PSAP, selective routing is needed (see glossary entry "class marking").

Historical Approach to 9-1-1 Systems Design and Required Changes

Historically, public access to the Public Switched Telephone Network (PSTN) was provided on wired basis that was fixed in regard to location. Specifically, a telephone number had a fixed, specific location associated with it. With the onset of services being provided on a wireless basis, such as mobile and cellular systems and the recent advances in Personal Communications Services (PCS), the location of entry into the PSTN is no longer fixed. Wireless access is mobile or in transit. Thus, the traditional view of a telephone number being associated with a specific location is no longer a constant. With these new services, public access to the PSTN is migrating from a "wired" to a "wireless" medium. Although there has been a change in the manner in which access to the PSTN is obtained, 9-1-1 services are still designed and set up to function at full capability. Examples of the full capability of E9-1-1 in the wired environment are: utilizing ANI and the associated fixed ALI and selective routing of incoming 9-1-1 calls to the proper PSAP. In a wireless environment, location is no longer a constant and thus, the manner in which 9-1-1 service is provided, specifically ALI, is no longer useful in its present form. As a result of these changes, the E9-1-1 systems currently in place are likely to require modifications or

some form of alteration to accommodate the evolving telecommunications industry.

The Nation: 9-1-1 And Wireless Communications Background

Throughout the country calls to 9-1-1 from cellular and mobile telephones are on the increase. Applications for cellular/mobile service in the U.S. are increasing at a rate of approximately 300,000 new unit in service per month. In major metropolitan areas as much as 10 percent of the 9-1-1 call volume are originating from wireless communications service subscribers. In Los Angeles County 600,000 cellular/mobile 9-1-1 calls were placed in 1992. Of those 9-1-1 calls, over 25 percent of those callers could not identify their location.

It is estimated that between 30 and 60 million people in the United States will use some form of wireless communications, be it either cellular/mobile or PCN/PCS, by the year 2002. Even an increase in 10 million wireless subscribers will potentially double the wireless call volume of E9-1-1 centers. This potential can fundamentally change the manner in which 9-1-1 calls are delivered to and handled by PSAPs.

Current Methods Of Sending Calls From Wireless Communications Services To 9-1-1

Presently, calls to 9-1-1 originating from wireless telephones are being transferred to a PSAP using several methods: routing with the digits 9-1-1, converting the digits 9-1-1 into a 7-digit telephone number, converting the digits 9-1-1 to the digit 0, or using tandem translations. A synopsis of the wireless routing methods follows:

- Wireless calls can be sent as 9-1-1 calls. This sounds logical unless you have a basic knowledge of the wireless communication system. In a wireless communication system, all calls are gathered at a central switching facility (Mobile Telephone Switching Office or MTSO) prior to entering the PSTN. The MTSO acts as a dialing center for all cellular/mobile calls. When wireless 9-1-1 calls are outpulsed by the MTSO as 9-1-1, the PSTN recognizes only that the MTSO dialed 9-1-1. Therefore, the PSAP sees a call as originating from the MTSO and not from a wireless subscriber. Furthermore, if selective routing is utilized the likelihood of the call being directed to the proper PSAP diminishes.

- A frequently used method of routing 9-1-1 wireless calls is to convert the 9-1-1 call into a 7-digit telephone number. This method is the equivalent of Basic 9-1-1. Under this arrangement the MTSO recognizes that a wireless subscriber is dialling 9-1-1. The MTSO then converts the digits 9-1-1 into a 7-digit telephone number. The MTSO then dials the converted 7-digit telephone number. The 7-

digit telephone number is then sent to a PSAP. The 7-digit telephone number used will be an emergency number for the PSAP. To the PSAP, the call from the MTSO appears as though the caller had dialed the published 7-digit emergency telephone number. No data information, such as ANI, is transferred in such an arrangement. Thus, this arrangement makes E9-1-1 systems to the level of fundament service level of a Basic 9-1-1 system because it provides no caller information.

- Wireless 9-1-1 calls can also be converted to operator assisted calls (Dial 0). In this scenario, a wireless subscriber dials the digits 9-1-1. The wireless 9-1-1 call is then processed through the MTSO. The MTSO converts the dialed digits 9-1-1 into the digit 0. The MTSO subsequently dials 0. Instead of reaching trained emergency personnel, the wireless subscriber is connected to a telephone operator. The telephone operator then must forward the call to an emergency responder. In this case, wireless 9-1-1 communications systems regresses to pre-basic 9-1-1 days.

- The most sophisticated method of sending wireless 9-1-1 calls to a PSAP is through tandem translations. The call process for wireless 9-1-1 using tandem translation occurs as follows: A wireless subscriber places a 9-1-1 call. The closest cell site (depending upon environment conditions) receives the 9-1-1 call. The cell converts the digits 9-1-1 to a pre-determined pseudo ANI (NXX-XXXX). The pseudo ANI is sent to the MTSO. At the MTSO, the pseudo ANI is sent to the LEC serving tandem office which converts the pseudo ANI back into 9-1-1. The call is then sent to a predetermined PSAP where the call appears to the E9-1-1 network as though a subscriber with the pseudo ANI has dialed 9-1-1. If ALI capabilities are available, a fictitious record, which has previously been associated with the ANI, will display at the PSAP. The fictitious ALI may identify the call as a wireless call and show the cell site location. Tandem translations enable selective routing based upon cell site location.

- In PSAP areas that do not have access to tandem routing facilities, a similar method is available utilizing the remote call forwarding feature. The remote call forwarding feature allows for a comparable call routing. In both instances, i.e., tandem transfer and remote call forwarding, the PSAP will be able to identify the call as originating from a MTSO (e.g., wireless subscriber). In PSAPs with an ANI only capability, identification of wireless calls is done through the identification of the unique ANI. In an ANI-only system, the telecommunicator is trained to recognize a specific ANI as a wireless call. In ANI/ALI systems, the class of service identifies the call as wireless.

In each of the routing scenario described above the PSAP telecommunicator must follow specific operating procedures to handle the wireless 9-1-1 call. The pseudo ANI or ALI must be quickly recognized and all location information must be gathered directly from the caller.

For wireless 9-1-1 calls, the E9-1-1 features utilized to provide a timely response for calls received from wired telephone service customers are often either unavailable, limited, or are not designed to provide the same quality of information from calls originating from wireless callers. Selective routing transfers (the ability to transfer voice and data to other PSAPs) may not be available. The lack of ANI and ALI from wireless 9-1-1 callers is universal. Perhaps the most challenging aspect of wireless 9-1-1 calls is the inability of the PSAP to reestablish contact with a disconnected caller. Once contact with a wireless caller is lost, the PSAP is unable to regain contact with that caller.

The difficulties of wireless 9-1-1 communications go beyond the problems associated with routing methods. For 9-1-1 agencies, database issues are the most difficult aspect of wireless communications; specifically, a lack of pertinent data. Currently, E9-1-1 PSAPs only receive information on the class of service and perhaps fictitious ANI and/or ALI identifying the cell site for wireless 9-1-1 calls. The class of service will read either cellular or mobile, and the fictitious ALI may identify the cell from which the call is originating. For E9-1-1 PSAPs today, this is the best data available for them from wireless 9-1-1 callers. This data may provide some insight on the general location of the caller. However, for PSAP personnel who are accustomed to ANI/ALI features conveying pertinent information for all callers, it is a step back in functionality.

State Approaches To Accepting 9-1-1 Calls From Wireless Communications Services

A cross section of the United States reveals that there is no standard approach to routing wireless 9-1-1 communications. In California and Massachusetts, cellular 9-1-1 calls are sent to centralized facilities (California Highway Patrol and State Police respectively). Other states, such as Maryland, Oregon, Montana, and South Carolina, route wireless 9-1-1 calls to the PSAP nearest to the cell site. Connecticut sends wireless 9-1-1 calls to a regional PSAP. In Texas, variations of all of the previously discussed methods are employed. Because of its diversity, the situation in Texas may typify the nation when it comes to E9-1-1 wireless communications.

One other aspect of Texas' cellular communications systems, similar to many other states, is the absence of cellular E9-1-1 mandates. According to a nationwide study on cellular 9-1-1 communications (released in February 1993 by the Illinois Commerce

Commission) only Massachusetts, South Carolina, and New Jersey currently have legislation mandating access to 9-1-1 by cellular/mobile subscribers. Texas, along with California and Maryland, does not mandate cellular access to 9-1-1, but instead feels that it is implicit in the definition 9-1-1 access. Texas 9-1-1 agencies, as well as all other 9-1-1 agencies, face a difficult task when dealing with wireless 9-1-1 calls.

Solutions to Cellular 9-1-1 Problems

The ideal solution for wireless 9-1-1 calls is to have the wireless subscribers ANI along with locational (e.g. latitude/longitude) information sent to each PSAP with the 9-1-1 call. The ability to transfer ANI to a PSAP is inherent in most, if not all, MTSOs. (Note: Further identification of the capabilities of MTSOs is required to make a definitive statement on ANI availability.) The ability to send locational coordinates, such as latitude and longitude, require technological advances along with data protocol changes. Consideration on the feasibility to send locational coordinates follows a discussion of callers ANI.

Provision of Wireless ANI

Providing ANI to the PSTN for passage to a 9-1-1 PSAP is a feature inherent in many MTSOs. This feature is currently blocked by the cellular mobile carriers (CMC) at the MTSO. One reason for the ANI being blocked from reaching the PSTN is the fact that many cellular callers are roaming. When roaming, the caller's ANI provides no useful information unless a roaming access code is transferred. The reason for roaming numbers being of little use is due to number assignments by the CMC. The number assigned to a wireless subscriber may be duplicated in any other CMC's region. This is similar to the reuse of central office code exchange in different area codes. If you tried to call an individual in another region of the country you would have to use the area code for that region in order to route correctly. With wireless subscribers, if the subscriber enters foreign territory (outside of home region), they are no longer in their respective service provider's access area. Without a roaming access code, the subscriber cannot be reached.

E9-1-1 agencies frequently need to reestablish contact with 9-1-1 callers. Currently, it is impossible for a PSAP to reestablish contact with wireless callers who are disconnected. Again, this is due to the lack of ANI specific to the wireless 9-1-1 call. In order to overcome this problem, additional ANI digits need to be sent to the PSAP. The additional digits may include the access code or area code of the caller. The supplemental ANI digits will allow for the PSAP to dial the subscriber if contact is lost.

It is the understanding of this agency that some currently deployed telephone switching facilities may be incapable of handling 10-digit ANI. These facilities would have to be upgraded to handle the digits transferred. In addition 9-1-1 Customer Premises Equipment would have to be modified to accept the additional ANI digits. Most 9-1-1 CPE is capable of handling 7- or 8-digit ANI (NPD-NXX-XXXX). The 9-1-1 CPE would require either software or hardware modifications to accommodate any additional digits.

Provision of Wireless ALI

There are several theoretical applications which may be able to provide caller location information. Caller location gathering methods may include using: Global Positioning Satellites (GPS), triangulation upon caller's signal, or triangulation upon signals received by a caller's handset. To provide a wireless caller's ALI to a PSAP would mean advancement in these technologies.

Although GPS would be useful in locating wireless caller, there are limitations associated the system. For example, GPS will not work in buildings or in obstructed areas because of satellite signal attenuation. In all cases for GPS to be able to locate a caller within 100 feet requires the transmission of at least 12-digits of latitude and longitude information. If a wireless communications system is to transfer locational information, the digits transferred to a PSAP would grow substantially. Clay Paxton, Executive Director 9-1-1 Emergency Services of Pacific Bell, describes the process in the January, 1994 APCO Bulletin:

> **An idea to consider would be hanging latitude and longitude on the back of the existing multi-frequency signaling. The current network would ignore it until the enhanced 9-1-1 tandem router or a front end adjunct processor uses that data to selectively route the call based on its geographic location. The data stream would then be passed off to the PSAP located where the latitude and longitude is processed, and the customer information would be retrieved.**

Currently, triangulation methods are hampered by interference and reflection of signal. In triangulation methods the callers signal is timed for delay and location is derived based upon the signal delay. However, technology will likely overcome the obstacles:

> **It is a fair assumption that the rapid advances of signal and information-processing technology will make locating a mobile phone caller easy and inexpensive. But for this to happen, designers must have design standards,**

> **and the people implementing the systems need a reason to include the capability.** ***(ibid)***

Whether triangulation is the preferred method or not, is yet to be determined.

Multiple technologies exist which may be used for locating wireless 9-1-1 callers. However, any data generated by the location technology must be compatible and, also, integrate seamlessly with the E9-1-1 network and CPE. To date, none of these three possible solutions can "piggyback" onto a call to 9-1-1, i.e., the location information is a separate transmission and will not be carried on or associated with a call to a 9-1-1 PSAP. In addition, to initiate ALI capabilities may require replacing existing wireless phones as well as 9-1-1 CPE modifications. Each of the methods for delivering ALI to the PSAP has weaknesses that can be overcome once there is a known and formally established design requirement standard.

<u>Technical Standards Issues</u>

As stated in ACSEC's Petition for Reconsideration and reiterated in ACSEC's Reply to Opposition to Petition for Reconsideration in CC Docket No. 90-314, ACSEC requested that calling party location information to E-9-1-1 systems be sent in a format the local E-9-1-1 system can interpret and use. However, as an industry, a standard format for such information has yet to be established. In addition, most of the 9-1-1 hardware and software is designed to accommodate seven or eight-digit Automatic Number Identification ("ANI"), not ten-digit. With interchangeable area codes set to be incorporated into the public switched telephone network sometime in 1995 and with the FCC allocating the 500 service access code for use by the PCS industry, it is imperative that technical standards to best meet the needs of the 9-1-1 community be established. At a minimum, the following technical standards in regard to wireless communications need to be established:

- Data format for 10-digit ANI along with an additional 12-15 digits for Location Identification purposes (these additional digits would be used to convey V&H or X&Y coordinates);

- Protocol and signaling requirements and transmission parameters for sending 10-digit ANI with additional 12-15 digits for Location Identification purposes;

- Interface requirement for direct connection from wireless service providers into 9-1-1 PSAPs; and

- Interface requirements for direct connection from wireless service providers to Local Exchange Carrier ("LEC") for routing to 9-1-1 PSAPs.

Although this is not a complete list of standards, the above list indicates work that still needs to be completed, before authoritative bodies can confidently mandate technical standards for E-9-1-1 systems.

Currently, these technical standard requirements are being developed by the NENA standards committee and should be completed and available sometime in March, 1994. The T1P1 standards group is anticipating publishing these standards for comment after July, 1994. The publication of proposed technical standards for comment is considered to be stage two of the standards setting process. Stage three is the formal acceptance and adoption of proposed technical standards.

Regulations, 9-1-1, and Wireless Communications Services

In order to address the concerns of sending ANI and/or ANI/ALI, the 9-1-1 community is currently working with the wireless service providers, standards-setting bodies, and regulators to try to respond to the needs of providing emergency services from calls originating from wireless communications service customers. Specifically, the Federal Communications Commission (FCC) is contemplating initiating a proceeding to address the issues of E9-1-1 and wireless communications service providers. Actions being proposed for this proceeding is to have the FCC require that wireless communications service providers send calling party location information in a single, uniform format that can be interpreted and is useful to 9-1-1.