

NENA VoIP E9-1-1 Deployment and Operational Guidelines

Operational Information Document (OID)



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NENA's Operations Committee has developed this document. Recommendations for change to this document may be submitted to:

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TABLE OF CONTENTS

1 EXECUTIVE OVERVIEW6

2 INTRODUCTION.....7

2.1 PURPOSE AND SCOPE OF DOCUMENT7

2.2 REASON TO IMPLEMENT7

2.3 REASON FOR REISSUE7

2.4 RECOMMENDATION FOR STANDARDS DEVELOPMENT WORK.....7

2.5 COST FACTORS.....7

2.6 ACRONYMS/ABBREVIATIONS7

2.7 DEFINITIONS8

3. VOIP DEPLOYMENT PROCEDURE.....9

3.1 OVERVIEW9

3.2 PSAP PREPARATION9

3.3 VSP PREPARATION10

3.4 DEPLOYMENT PLANNING10

3.5 TESTING10

 3.5.1 Preparation10

 3.5.2 Implementation.....11

 3.5.3 Documentation11

3.6 TRAINING.....11

3.7 TECHNICAL AND MAINTENANCE ISSUES12

 3.7.1 MSAG Validation for call routing12

 3.7.2 Geospatial Data12

 3.7.3 Default, Overflow and Alternate Routing.....12

 3.7.3.1 Default routing12

 3.7.3.2 Overflow routing.....12

 3.7.3.3 ESGW Trunk Alternate Routing13

 3.7.3.4 PSAP Alternate Routing13

 3.7.4 Grade of Service.....13

 3.7.5 Service Problems –13

 3.7.5.1 Types of Service Problems.....14

 3.7.5.2 Problem reporting and resolution14

4 REFERENCES.....15

4.1 FIRST REPORT AND ORDER AND NOTICE OF PROPOSED RULEMAKING 05-116, IN THE MATTERS OF IP ENABLED SERVICES, WC DOCKET 04-36 AND E911 REQUIREMENTS FOR IP-ENABLED SERVICE PROVIDERS, WC DOCKET 05-196, FEDERAL COMMUNICATIONS COMMISSION, ADOPTED MAY 19, 2005.15

4.2 TITLE 47 CFR PART 9, INTERCONNECTED VOICE OVER INTERNET PROTOCOL SERVICES.....15

4.3 NENA 08-001, INTERIM VOIP ARCHITECTURE FOR ENHANCED 9-1-1 SERVICES15

5 EXHIBITS16

5.1 VOIP IMPLEMENTATION CHECKLIST16

 5.1.1 Planning and Preparation.....16

 5.1.2 Initial contact16

 5.1.3 Deployment Planning16

 5.1.4 Testing17

5.2 SAMPLE SHELL RECORD18

1 Executive Overview

This document is has been developed to assist 9-1-1 Governing Authorities, PSAP Managers/ Administrators and VoIP Providers with the process of VoIP E9-1-1 deployment. As such, its primary goal is to set expectations and improve communications among the parties involved in the deployment process. Guidance is provided on the following topics:

- PSAP and VSP Preparation
- Deployment Planning
- MSAG Validation
- Testing
- Training
- Technical and Maintenance Issues

A checklist outlining VoIP implementation and a sample shell record are provided as Exhibits.

2 Introduction

2.1 Purpose and Scope of Document

This document has been developed as a best practice for the deployment of VoIP E9-1-1 service. As such, its primary goal is to set expectations and improve communications among the parties involved in the deployment process. The intent of this document is to offer guidance to VoIP Providers, 9-1-1 Governing Authorities and PSAP Managers/Administrators prior to and during the process of VoIP E9-1-1 deployment. This document specifically addresses VoIP E9-1-1 deployments using dynamic ALI. It does not cover static VoIP using traditional wireline ALI.

2.2 Reason to Implement

Packetized voice communication using Internet Protocol (commonly referred to as VoIP), is being interconnected with the Public Switched Telephone Network (PSTN) by VoIP Service Providers (VSPs). FCC Order 05-116 requires interconnected VoIP providers to deliver 9-1-1 voice calls, the call back number and the caller's "registered location" to the PSAP via the dedicated wireline E9-1-1 Network. To establish standards for interconnection with the native 9-1-1 network, the NENA VoIP/Packet Committee issued NENA Technical Standard 08-001, Interim VoIP Architecture for Enhanced 9-1-1 Services (i2), on December 6, 2005. This document outlines the operational steps necessary to ensure smooth deployment of VoIP Enhanced 9-1-1 Services in the interim. All stakeholders involved in the VoIP E-911 deployment process should consider using this OID to help avoid miscommunication.

2.3 Reason for Reissue

NENA reserves the right to modify this document. Whenever it is reissued, the reason(s) will be provided in this paragraph.

2.4 Recommendation for Standards Development Work

Standards for delivery of MSAG data, ALI data (to include the layout of the subscriber name field), call routing, IP-PSAP calls and troubleshooting procedures are standards that may be considered for development.

2.5 Cost Factors

Implementation costs include provisioning of trunks and interconnection fees to the native 9-1-1 network for the VSPs. Additional PSAP costs may be incurred when establishing dedicated lines for the default routing of VoIP calls.

2.6 Acronyms/Abbreviations

Some acronyms/abbreviations used in this document have not yet been included in the master glossary. After initial approval of this document, they will be included. Link to the master glossary is located at http://www.nena.org/9-1-1TechStandards/nena_recommended_standards.htm.

The following Acronyms are used in this document:	
AEAN	Alternate Emergency Access Number
ALI	Automatic Location Identification
ANI	Automatic Number Identification
ESGW	Emergency Services Gateway
ESN	Emergency Service Number
ESQK	Emergency Services Query Key
ESZ	Emergency Service Zone
FCC	Federal Communications Commission
GIS	Geographic Information System
IP	Internet Protocol
LEC	Local Exchange Carrier
MSAG	Master Street Address Guide
PSAP	Public Safety Answering Point
PSTN	Public Switched Telephone Network
SR	Selective Router
VoIP	Voice over Internet Protocol
VPC	VoIP Positioning Center
VSP	VoIP Service Provider

2.7 Definitions

A definition used in this document has not yet been included in the master glossary. After initial approval of this document, it will be included. Link to the master glossary is located at

<http://www.nena.org/pages/ContentList.asp?CTID=5>

The following definition is used in this document:	
AEAN	Alternate Emergency Access Number – A 10-digit unlisted number, answered on a 24/7 basis, used to receive VoIP calls until these calls can be delivered to the selective router serving the PSAP. After E9-1-1 implementation, these lines should only be used for specific routing circumstances (as defined in NENA VoIP Deployment and Operational Guidelines OID, 56-504, section 3.7.3 Default, Overflow and Alternate Routing) It can also be utilized to receive misrouted calls from other PSAPs not within the selective routing service area, operator-assisted emergency calls, default-routed wireless calls, calls routed to the PSAP via private call centers, and calls relayed from telecommunications relay services. Caller identification should be included as an option.

3. VoIP Deployment Procedure

3.1 Overview

IP-enabled communications services are the latest entries in the communications landscape. It is imperative that consumers who use such services continue to have access to the E9-1-1 network and emergency services. As part of a cooperative effort by state and local governments, Public Safety Answering Point (PSAP) administrators, 9-1-1 systems service providers, and interconnected VoIP providers, NENA is taking steps to ensure that new technology will lead to improving delivery of emergency services. VoIP 9-1-1 deployments can be completed with minimal difficulty when standard processes are understood and employed. The following are steps recommended during the deployment process. A checklist is provided as Exhibit 5.1.

3.2 PSAP Preparation

VoIP providers are required by FCC rules to deliver 9-1-1 calls to the appropriate PSAP, even if the PSAP is not capable of receiving or processing either ANI or location information. Typically, there are calls of an emergency nature that cannot be delivered to the PSAP with ANI or ALI information. These calls include misrouted calls from other PSAPs not within the selective routing service area, operator-assisted emergency calls, default-routed wireless calls, calls routed to the PSAP via private call centers, and calls relayed from telecommunications relay services.

Due to the emergency nature of these calls, we consider it a best practice for these calls to be identified to the telecommunicator on emergency lines in order to receive priority call handling. Accordingly, we recommend that PSAPs provision at least one such 10-digit, 24/7 unlisted number for these purposes, hereinafter referred to as an Alternate Emergency Access Number (AEAN). When provisioned, caller identification should be included as an option. It should be made clear to those entities that are provided with this number that it can only be used for the routing of emergency calls, and is not intended for calls of an administrative nature. These lines should only be used for routing VoIP calls until these calls can be delivered to the selective router serving the PSAP. After E9-1-1 implementation, these lines should only be used for default routing (see section 3.7.3 Default, Overflow and Alternate Routing) or for routing other calls of an emergency nature as listed above.

The 9-1-1 Governing Authority may opt to make this number available for call delivery only upon request of the provider in the event of system impairment, and only for the duration of the impairment. The 9-1-1 Governing Authority should also make it clear to the entities that are provided with this number that it is for their exclusive use, it may not be disseminated to third parties, nor is it to be used for additional VoIP providers without the prior consent and approval of the 9-1-1 Authority.

The 9-1-1 Governing Authority needs to determine the ESNs that will be used to route VoIP calls to their PSAP(s). A minimum of one ESN per PSAP is required. Wireline or wireless ESNs may be used, or new VoIP ESNs may be developed, which could assist in troubleshooting calls, absent other data. It is recommended that VoIP calls be routed over existing wireline PSAP trunks.

3.3 VSP Preparation

VoIP Service Providers shall provision an interconnection through the existing 9-1-1 service provider, typically an incumbent LEC; indirectly through a third party such as a competitive LEC; or through a solution that allows a VSP to offer E9-1-1 service as approved by the 9-1-1 Governing Authority. In addition, trunk grouping and sizing from the ESGW (or equivalent) to the Selective Router is subject to approval by the 9-1-1 Governing Authority where authorized.

3.4 Deployment Planning

It is essential to establish a working relationship and ensure it continues beyond implementation. To this end, 9-1-1 Authorities and VSPs should:

- Identify the primary contacts for all players in the system so that everyone knows who to keep in the loop. Identify the specific individuals in each entity that will be managing their portion of the implementation. Obtain telephone numbers, pager numbers and email addresses for all participants, specifically to include:
 - VSP Testing Coordinator
 - 9-1-1 Authority/PSAP contact
 - VoIP Positioning Center (VPC) provider
 - Emergency Services Gateway (ESGW) provider
 - Private Call Center, if used by the VSP or VPC
- Identify the NENA Company ID and 24 x 7 emergency contact numbers for each VSP and each VPC, if appropriate. Ensure that these numbers are available to PSAP personnel prior to testing so that additional subscriber information may be obtained in the event of exigent circumstances and for troubleshooting.
- Identify the NENA Company ID and 24 x 7 emergency contact numbers for each ESGW provider to facilitate emergency troubleshooting.
- Identify administrative contact numbers so that the VSP or their designee can be contacted for non-emergency troubleshooting purposes.
- Exchange information necessary to develop a shell record for each Emergency Services Query Key (ESQK) used to route calls to the PSAP, and containing information clearly identifying it as a shell record (see Exhibit 5.2).

3.5 Testing

3.5.1 Preparation

Prior to providing E9-1-1 service to a PSAP, a VSP or its designee shall contact the 9-1-1 Authority for that jurisdiction to schedule testing. The VSP or its designee will only schedule testing after agreement with and approval by the 9-1-1 Authority. The VSP testing coordinator will be responsible for coordinating the testing schedule with the 9-1-1 Authority and 9-1-1 service provider and discussing the general plan for the testing to include the following information:

- Who will be involved with the testing
- How many test calls will likely be made and over what period of time, and

- If a conference bridge will be utilized during the testing.
- Other information that may apply in a specific circumstance, such as how to preempt testing if a real crisis develops during testing, etc.

3.5.2 Implementation

If a conference bridge will be used, and upon request by the 9-1-1 Authority, the VSP or its designee should provide the bridge number and permit the 9-1-1 Authority or designee to participate on the bridge. To ensure that all ESQKs have been provisioned as expected, The VSP (or designee) shall test each ESQK that has been provisioned for the PSAP. On the initial test (prior to E9-1-1 service activation), new trunks between the ESGW or VSP and SR should be placed in all trunks busy status to test an overflow condition. If new dedicated SR to PSAP trunks have been provisioned that are not shared with wireline or wireless calls, alternate routing shall be tested by placing trunks in busy status. If trunks are shared between the S/R and PSAP, the trunks should not be placed out of service to check alternate routing as a live emergency call may be blocked. The VSP (or designee) shall also ensure that their third-party provider and the E9-1-1 service provider have loaded all ESQKs (made them available for testing) and activated ALI steering tables at least 24 hours prior to scheduled testing. The VSP testing coordinator and the 9-1-1 Authority shall identify the data elements that are requested for validation by the telecommunicator at the time of testing. These data elements may include:

- The ESQK(s) (p-ANIs)
- The address provided
- The call back number
- The class of service (see NENA Technical Document 02-010)
- The ESN
- The VoIP service provider's NENA Company ID

3.5.3 Documentation

The VSP shall be responsible for documenting the completion of testing with a letter to the 9-1-1 Governing Authority (with a copy to the other stakeholders) within seven (7) days of deployment. The documentation should note any outstanding issues that are still to be resolved by the VSP or third-party provider with a schedule for the resolution of those items. The 9-1-1 governing authority should define the type of information and reporting expectations for VSPs or third-party providers pertaining to submission of actual test results to ensure the data are complete and correct prior to accepting test results and authorizing service activation.

3.6 Training

The 9-1-1 Governing Authority shall provide any specialized training required for telecommunications personnel prior to activation of VoIP calling. The content of this training is beyond the scope of this document, but should include a description of the VoIP data elements provided to the PSAP. Additionally, a standard operating procedure for processing VoIP calls should also be developed which should include the method of obtaining subscriber information, and if applicable anything to contacting the VSP in the event that need arises.

3.7 Technical and Maintenance Issues

3.7.1 MSAG Validation for Call Routing

The 9-1-1 Governing Authority shall provide or authorize provision of MSAG data to the VSP or its designee for the PSAPs within their jurisdiction for validation of customer service addresses to facilitate routing of calls to the appropriate PSAP and to enable the display of accurate location information to the telecommunicator. The VSPs (or designees) shall validate their customer service address with the MSAG at the time initial service is provisioned and when the customer changes their address. The VSP (or designee) is expected to provide an MSAG valid address with each 9-1-1 call delivered to the PSAP. Updates to the MSAG data shall be made available to the VSPs (or designees) on the same basis as wireline MSAG updates. Routing of calls based on MSAG validated addresses is the preferred method.

3.7.2 Geospatial Data

If the 9-1-1 Governing Authority agrees to route calls to the PSAPs within their jurisdiction based on geospatial data, they shall provide the VSP or their designee with access to their geospatial data. These geospatial data should include the PSAP boundaries, including ESZs within their jurisdiction, and street files with sufficient address detail for routing determination and/or to support conversion of location information to geolocation for routing determination. In the event these data are not available in electronic GIS format, paper maps shall be provided.

Since the geospatial data provided to the VSPs are only a snapshot of the geographic boundaries and street files at the time the data were provided, it is imperative that updates be made available to the VSPs (or designees) any time changes are made. This will ensure that the VSP has the most up-to-date data available.

3.7.3 Default, Overflow and Alternate Routing

3.7.3.1 Default Routing

Default routing occurs when there is a failure of standard E9-1-1 routing methods; for example, the VSP is unable to deliver the call to the selective router because of a data failure between the ESGW and the VPC. In this event, if the destination PSAP can be identified, the call should be delivered to the Alternate Emergency Access Number (AEAN) established for the PSAP (see Section 3.2). If the destination PSAP cannot be identified, it is recommended that the call be routed to the VSP's designated call center (if one exists) or a fast busy signal be provided.

3.7.3.2 Overflow Routing

Overflow routing occurs when all of the trunks are busy. When all trunks between the ESGW to the SR are busy, a call may simply be provided a fast busy signal. A fast busy signal is most common and is recommended in most situations for congestion control.

3.7.3.3 ESGW Trunk Alternate Routing

ESGW Trunk Alternate routing can occur if the ESGW to SR trunks are out of service or otherwise impaired. Invoked alternate routing shall be to a) “fast busy” or, where this capability is not available, b) route to appropriate recorded announcement advising that the call cannot be completed.

When technically feasible and permitted, it is desired that the switch translations (based on alarm conditions sent to the ESGW NOC) be invoked to route the calls to a secondary pre-designated PSAP over existing ESGW / SR trunks. The process must be pre-planned to ensure appropriate router-to-router call and data handling, ESQK/pANI rebid capability, communications networking (voice and data) and related SOP’s are in place between the PSAPs. Notification to the affected PSAP(s) should be made, by the VSP, VPC and/or ESGW, within (15) minutes of the alarm threshold notification.

Where this capability is not available, the call may be alternate routed to the AEAN. Administrative numbers shall not be used for this purpose. Where technically feasible, trunks “failed out of service” conditions should be differentiated, via alarm thresholds, from trunks that are traffic busy at the ESGW.

3.7.3.4 PSAP Alternate Routing

PSAP alternate routing is also an issue that must be addressed though it does not involve the VSP. Many 9-1-1 Governing Authorities have a plan in place to reroute 9-1-1 calls to another PSAP or location should an evacuation of the primary PSAP become necessary. The 9-1-1 service provider typically performs this rerouting of the 9-1-1 calls. Whatever the arrangement, if alternate routing is provided for wireline and wireless 9-1-1, the same accommodations should be made for alternate routing the VoIP line(s) or trunk(s) as well.

3.7.4 Grade of Service

9-1-1 Governing Authorities and/or their PSAPs should require periodic traffic studies on their Alternate Emergency Access Number (AEAN) to ensure that they have a sufficient number of lines to support an adequate level of service. VSPs (or designees) shall monitor their systems to ensure that there are a sufficient number of ESQKs available to accommodate traffic. The ESGW provider shall monitor their systems to ensure and that there are sufficient number of trunks between the ESGW and the Selective Router (S/R) to maintain an adequate level of service. Any change in the number of trunks from the ESGW to the SR should be coordinated with the appropriate VSPs (and their designees) in consultation with and as approved by the 9-1-1 Governing Authority where authorized.

Comment: The optimal grade of service is P.01: The probability that no more than one call in 100 attempts during the average busy hour will be blocked by busy trunks.

3.7.5 Service Problems

An impairment that affects VoIP E9-1-1 PSAP service can result from a failure at several points. The failure can occur in equipment owned by the VoIP Service Provider (for example, a VoIP soft

switch), the VoIP Positioning Center (for example, the GIS software or hardware failure), the Emergency Service Gateway (ESGW) provider (hardware or software), E9-1-1 SSP (for example, the selective router or ALI database), or by the PSAP (for example, the Customer Premise Equipment).

3.7.5.1 Types of Service Problems

The most common types of service problems that affect PSAPs are:

- “No Record Found” screen display
- Misrouted calls
- Inaccurate or missing VoIP subscriber information
- Incorrect ALI display content
- Customer address not MSAG valid
- E9-1-1 calls received on a non-emergency line rather than 9-1-1 trunk, or if applicable, the Alternate Emergency Access Number

3.7.5.2 Problem Reporting and Resolution

Service problems should be reported in a timely manner to the entity designated by the VSP to receive these notifications. All designated entities should provide trouble reporting contacts before service is provisioned to the PSAP. Local protocol may dictate that resolution of all problems are coordinated by the 9-1-1 Governing Authority and/or the 9-1-1 System Service Provider.

3.7.5.2.1 Misroutes and Other Impairments

Typically, the VPC serving the VSP originating the call will be instrumental in trouble isolation and resolution of issues causing the misrouted calls or other problems. In the event the VPC and/or VSP can be identified from the call data, and local protocols dictate their direct involvement in resolution, the VPC should be contacted for calls in progress or alerted to call problems via ANI/ALI discrepancy processes similar to those in use for wireline and wireless problem reporting. In the event the call data does not identify the VSP or VPC, the following procedure is recommended:

- The ALI information and any caller-supplied information are provided to the 9-1-1 System Service Provider and/or the 9-1-1 Governing Authority.
- The 9-1-1 Service Provider is requested to find the call in the selective router using the information from the PSAP ALI.
- The 9-1-1 Service Provider determines the trunk group that routed the call, and the CLEC or LEC that delivered the call to the router (also known as the ESGW provider).

If the ESGW provider can be identified, the procedure shall be:

- The responsible ESGW provider should be contacted and requested to locate the call in their switch
- The ESGW provider then works with the serving VPC or VSP to correct the problem.

- .
- The PSAP is notified what was causing the problem and the actions taken to prevent recurrence.

3.7.5.2.2 Error Rate

The failure of a customer record entry to match the MSAG shall constitute a data entry error. It is recommended that the accuracy rate of the ALI content relative to the MSAG be as established for wireline as defined by the 9-1-1 Governing Authority or by state regulation. If none exists, it is recommended that a standard of 98% be established. Any inserts, deletes, or changes to the customer records should be available to the 9-1-1 Governing Authority within one (1) business day.

4 References

- 4.1 First Report and Order and Notice of Proposed Rulemaking 05-116, In the Matters of IP Enabled Services, WC Docket 04-36 and E911 Requirements for IP-Enabled Service Providers, WC Docket 05-196, Federal Communications Commission, Adopted May 19, 2005.**
- 4.2 Title 47 CFR Part 9, Interconnected Voice over Internet Protocol Services**
- 4.3 NENA 08-001, Interim VoIP Architecture for Enhanced 9-1-1 Services**

5 Exhibits

5.1 VoIP Implementation Checklist

5.1.1 Planning and Preparation

- Appoint a project manager to act as single point of contact for providers
- Organize an implementation team
- Provision Alternate Emergency Access Number(s)
- Designate ESN(s) to be used for call routing

5.1.2 Initial Contact

- Establish contact with VoIP Service Provider (or designee)
- Identify points of contact with VoIP Positioning Center and Emergency Services Gateway provider
- Provide VSP or designee with access to the MSAG
- (Option) Provide VSP or designee with geospatial data, including PSAP boundaries and ESZs with sufficient address detail for routing determination. (If agreeing to geospatial routing.)

5.1.3 Deployment Planning

- Obtain telephone numbers, pager numbers and email addresses for the VSP Testing Coordinator, VoIP Positioning Center and Emergency Services Gateway provider.
- Identify the NENA Company ID and 24 x 7 emergency contact numbers for each VSP.
- Identify the NENA Company ID and 24 x 7 emergency contact numbers for each VPC.
- Identify the NENA Company ID and 24 x 7 emergency contact numbers for each ESGW provider to facilitate emergency trouble isolation.
- Provide the MSAG and other appropriate data necessary to establish a shell record for each ESQK range used for routing VoIP calls and clearly identify them as shell records.
- Identify administrative contact numbers and processes for reporting ANI/ALI discrepancies and other purposes.
- Identify 24 x 7 emergency contact numbers and processes for obtaining in-progress call support.
- Provide training to PSAP telecommunicators on the handling of VoIP calls.

5.1.4 Testing

- ❑ Work with VSP Testing Coordinator to schedule testing at a mutually convenient time.
- ❑ Determine who will need to participate in the testing (VSP, VPC, ESGW provider E9-1-1 Provider)
- ❑ Determine how many test calls will be made and over what period of time
- ❑ Determine if a conference bridge will be used during the testing, and if so obtain the access numbers.
- ❑ Determine the data elements that require verification by the telecommunicator receiving the test call. These should include the ESQK(s) (p-ANI), address, call back number, class of service, ESN, NENA Company ID, English Language Translation.
- ❑ Establish default, overflow and alternate routing instructions (see Section 3.7.3).
- ❑ For newly established trunks (prior to E9-1-1 service activation), test overflow processing by placing trunks between the ESGW and SR in all trunks busy status.
- ❑ If trunks have been provisioned to the PSAP that are not shared with wireline or wireless call traffic, test alternate routing by placing all trunks in busy status. If trunks are shared, do not busy trunks between SR and PSAP as a live emergency call may be blocked.
- ❑ Conduct test calls and document results.
- ❑ Verify ability to call back number.
- ❑ Compare expected display data provided with actual data received.
- ❑ Ensure data is complete and correct prior to acceptance of test results and authorizing service activation.

5.2 Sample Shell Record

While the design of each shell record display will vary, largely depending upon the 9-1-1 service provider (typically a local exchange carrier), the data elements of the record should include the following:

- ESQK (p-ANI)
- Date and Time
- Subscriber name field (“test record” or “shell record”)
- Street name field (“VoIP Caller” or similar)
- ESN
- Class of service
- Community name (“PSAP/Community Name”)
- NENA Company ID of the VSP or its designee (may be the ESGW or the VPC)
- English Language Translation of ESN

The following sample record layout contains the above data elements:

321-234-5678 0911 09/11/2001

TEST RECORD

VOIP CALLER ESN: 123 COS: VOIP

COMMUNITY NAME LEC: VNGE

ANYWHERE COUNTY SHERIFF

ANYWHERE COUNTY FIRE RESCUE

ANYWHERE COUNTY AMBULANCE