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NENA Standard for Emergency Service Central Office (ESCO) Code Selection, Assignment and Display Management



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1 Executive Overview

1.1 Purpose and Scope of Document

This NENA Recommended Standard for Emergency Service Central Office (ESCO) Code Selection, Assignment and Display Management discusses the Emergency Service Central Office (ESCO) code specifications as it relates to the incoming trunk groups in the E9-1-1 Control Office. It is a guide for designers, manufacturers, 9-1-1 Service Providers, 9-1-1 Database Authorities and 9-1-1 Public Safety Answering Points (PSAPs). It identifies some of the issues involved with the selection, assignment, processing and management of the ESCO codes used for trunk group origination identification during an Automatic Number Identification (ANI) failure.

1.2 Reason to Implement

This document is published by NENA as a guide for the 9-1-1 community and related industries. It is not intended to provide complete design specifications or parameters related to E9-1-1 Control Office trunking translations or database specifications nor shall it serve as an exclusive procurement specification.

1.3 Benefits

Use of this NENA Recommended Standard for Emergency Service Central Office (ESCO) Code Selection, Assignment and Display Management as a guide will:

- provide consistent management of ESCO code resources;
- provide for consistent display of information; and
- permit the PSAP call taker to rapidly identify the “source” of the call in a situation where there was no ANI provided.

1.4 Operational Impacts Summary

An Enhanced 9-1-1 network is made up of several elements and features. This document describes the provisioning of central office trunking Emergency Service Central Office (ESCO) codes. It focuses on the purpose, selection and assignment processes, and the display management requirements in the 9-1-1 industry, as it relates to the relationship of 9-1-1 Service Providers, 9-1-1 database authorities and PSAPs.

It recommends that new standards be developed to address the need to handle the ESCO code in the E9-1-1 Control Office, the 9-1-1 database and ultimately the PSAP. Suggestions are offered for consideration by the 9-1-1 community.

1.5 Document Terminology

The terms "shall ", "must " and "required" are used throughout this document to indicate required parameters and to differentiate from those parameters that are recommendations. Recommendations are identified by the words "desirable" or "preferably".

1.6 Reason for Issue

This document is issued to serve as a document model for ESCO codes management. The purpose of this NENA Recommended Standard for Emergency Service Central Office (ESCO) Code Selection, Assignment and Display Management is to identify the minimum requirements as well as desirable elements for ESCO codes management.

1.7 Reason for Reissue

NENA reserves the right to modify this document. This document should only be used as one source of information to assist the reader in understanding and developing the 9-1-1 network. Whenever it is reissued, the reason(s) will be provided in this paragraph.

1.8 Date Compliance

All systems that are associated with the 9-1-1 process shall be designed and engineered to ensure that no detrimental, or other noticeable impact of any kind, will occur as a result of a date/time change up to 30 years subsequent to the manufacture of the system. This shall include embedded application, computer based or any other type application.

To ensure true compliance the manufacturer shall upon request provide verifiable test results to an industry acceptable test plan such as Telcordia GR-2945 or equivalent.

1.9 Anticipated Timeline

Processes and information depicted in this document are available immediately. Deployment or implementation shall take place as required.

1.10 Costs Factors

The techniques or information discussed herein may be covered by patents. No license expressed or implied is hereby granted. This document does not intend to bias or promote any product or service provider in particular, but rather intends to offer a fair and objective discussion of the techniques applied in the 9-1-1 network.

1.11 Cost Recovery Considerations

Normal business practices shall be assumed to be the cost recovery mechanism.

1.12 Acronyms/Abbreviations

Discussion of the E9-1-1 network entails the use of terms and jargon specific to the 9-1-1 industry. In many instances there are several phrases or terms that can refer to the same item or part of the network.

This is not a glossary! See NENA 01-002 - NENA Master Glossary of 9-1-1 Terminology located on the NENA web site for a complete listing of terms used in NENA documents.

Term	Definition
Alternative Local	See Local Exchange Carrier (LEC)

Term	Definition
Exchange Carrier (ALEC)	
Automatic Number Identification (ANI)	Telephone number associated with the access line from which a call originates.
Automatic Location Identification (ALI)	The automatic display at the PSAP of the caller's telephone number, the address/location of the telephone and supplementary emergency services information.
Call Detail Record (CDR)	The data information sent to the ALI computer by a remote identifying device (PBX, Call Position Identifier, ...)
Common Language Location Identification (CLLI)	An 11-character code assigned to a central office to designate the physical location and area served. Characters 1-4 designate the rate center location, characters 5-6 designate the state code, characters 7-8 identify the central office, and characters 9-11 specify the equipment type.
Emergency Service Central Office (ESCO) number	The information delivered to the PSAP when there is an ANI failure between the end office and the 9-1-1 Control Office. When ANI is not available, the 9-1-1 call is default routed and the ANI display at the PSAP will be "911-0TTT" (or 911-TTTT) with TTT or TTTT identifying the incoming trunk group.
Emergency Service Number (ESN) / Emergency Service Zone (ESZ)	An ESN is a three to five digit number representing a unique combination of emergency service agencies (Law Enforcement, Fire, and Emergency Medical Service) designated to serve a specific range of addresses within a particular geographical area, or Emergency Service Zone (ESZ). The ESN facilitates selective routing and selective transfer, if required, to the appropriate PSAP and the dispatching of the proper service agency(ies).
Feature Group D (FG-D)	An MF signaling protocol originally developed to support equal access to long distance services capable of carrying one or two ten-digit telephone numbers.
Integrated Services Digital Network User Part (ISUP)	A message protocol to support call set up and release for interoffice voice call connections over SS7 Signaling.
Local Exchange Carrier (LEC)	A Telecommunications Carrier (TC) under the state/local Public Utilities Act that provides local exchange telecommunications services. Also known as Incumbent Local Exchange Carriers (ILECs), Alternate Local Exchange Carriers (ALECs),

Term	Definition
	Competitive Local Exchange Carriers (CLECs), Competitive Access Providers (CAPs), Certified Local Exchange Carriers (CLECs), and Local Service Providers (LSPs).
Local Number Portability (LNP)	A process by which a telephone number may be reassigned from one Local Exchange Carrier to another.
Multi-Frequency (MF)	A type of in-band signaling used on analog interoffice and 9-1-1 trunks.
Number Plan Area (NPA)	An established three-digit area code for a particular calling area where the first position is any number 2 through 9 and the last two (2) positions are 0 through 9.
Number Plan Digit (NPD)	A component of the traditional 9-digit 9-1-1 signaling protocol between the Enhanced 9-1-1 Control Office and the PSAP CPE. Identifies 1 of 4 possible area codes.
Private Switch (PS/911)	A private telephone system which includes network, switching and database elements capable of providing ANI (ELIN) and ALI (ERL). Designed to use in emergency situations to notify Public Safety personnel of the specific location of a 9-1-1 caller utilizing a Telephone Station connected to a private telephone network.
Public Safety Answering Point (PSAP)	A facility equipped and staffed to receive 9-1-1 calls. (see also Primary and Secondary Public Safety Answering Point (PSAP))
Remote Service Unit (RSU)	A small switching system that is located at a remote point from a host switch. All or most of its call processing capability is obtained from an electronic type host office. The remote is connected to the host by umbilical circuits providing message and signal handling capabilities.
Virtual Facility Group (VFG)	One or more trunks terminated at the same two points and used internally within a switch. When referred to as E911VFG, it relates to the E9-1-1 Control Office switch.

2 Technical Description

This document discusses the Emergency Service Central Office (ESCO) code specifications as it relates to the incoming trunk groups at the E9-1-1 Control Office. It identifies some of the issues involved with the selection, the assignment, the processing and the management of the ESCO codes.

The ESCO concept works in the wireline, wireless and Local Number Portability (LNP) environments, as it is assigned to the incoming 9-1-1 trunk groups at the E9-1-1 Control Office end.

This document also intends to:

1. provide a background tutorial about the ESCO code in order to help establish a common perspective.
2. aid in the thought process and development of processes to meet cases where no valid Automatic Identification Number (ANI) spill occurs, and
3. suggest appropriate courses of action that meet PSAP, caller, service provider, and/or regulatory needs.

3 Definition

3.1 ESCO Number (i.e., Proxy ANI)

The Emergency Service Central Office (ESCO) number is used primarily to identify to the PSAP's call taker that the E9-1-1 Control Office switch did not receive a valid Telephone Number (TN) from the remote end office.

The ESCO number is a 10-digit number used as proxy ANI, in the format of NPA-911-0TTT or -TTTT. It is currently used solely for ANI/ALI display. This number does not carry any call routing specification.

Note that in a multiple E9-1-1 Control Office overflow design architecture, 9-1-1 calls carrying an ESCO number would be routed based on the receiving inter-tandem trunk group Emergency Service Number (ESN). The ESCO number is not populated in the Selective Routing Database nor would we want to use it as a routing key due to potential misrouting and switch translations contingency (i.e., 911 as NXX).

3.2 ESCO Code Definition

The ESCO code can be a 3-digit or 4-digit key that uniquely identifies the incoming trunk that delivered the 9-1-1 call to the E9-1-1 Control Office. Telcordia confirmed that Alliance for Telecommunications Industry Solutions (ATIS) Telecommunications (T1) Committee T1E1 and other standard corporations indicate that the ESCO code can be 4digits.

When required, the ESCO number is created using the 3-digit or 4-digit ESCO code assigned to the incoming 9-1-1 trunk group (e.g., NPA-911-0TTT) where :

NPA	=	trunk group's NPA,
911	=	911 used at NXX placeholder,
0	=	an inserted digit, and
TTT	=	3-digit trunk group's ESCO identifier.

or NPA-911-TTTT where:

NPA = trunk group's NPA,
911 = 911 used at NXX placeholder,
TTTT = 4-digit trunk group's ESCO identifier.

Telephone companies are encouraged to work with their switch manufacturers to ensure the NPA is supported. Previous Telcordia's Standards did not incorporate the NPA.

3.3 ESCO Code Selection

The ESCO codes are selected and assigned with the following considerations:

- 1) A unique 3-digit or 4-digit ESCO code is required for each :
 - Incoming "9-1-1 / Emergency Service" type trunk group to identify the originating end office (wireline and wireless), the Telephone Operator Services (for forwarded 0- dialed emergency calls) or E9-1-1 inter-tandem switch (where applicable);
 - E9-1-1 Virtual Facility Group (VFG) trunk group - internal to an E9-1-1 Control Office for access to "9-1-1" by its local subscribers; and
 - Private Switch (PS) trunking.

Note: For the purpose of this document, if not otherwise specified, "9-1-1 trunk group" designates all of the above mentioned trunk group types.

2. Various selection criteria may be used (e.g., the lowest NXX served from the originating office, random numbering, etc) for assignment purposes.
3. The same 3 or 4-digit ESCO code value may be assigned within the same E9-1-1 Control Office that serve multiple NPA's. It then creates distinct ESCO numbers per NPA code.

Note: No matter the criteria used, the ground rule is to end up with unique ESCO 10-digit number identifiers per ALI system.

4. The ESCO code is selected and assigned by the E9-1-1 network planning manager in consultation with the E9-1-1 Database Authority, with attention paid to the ESCO number uniqueness within the ALI database. This is particularly important if there is more than one "9-1-1" service operating from the same E9-1-1 Control Office.
5. In a Multi-Frequency (MF) protocol trunking environment, NPA Splits and NPA Overlays may require the creation of new ESCO codes. In addition, an NPA split could force a change of the assigned ESCO codes.
6. The 9-1-1 trunk groups associated with E9-1-1 service that are used solely for outgoing (e.g., to the PSAP) from the 9-1-1 Control Office do not need to be assigned an ESCO.

3.4 ESCO Number Processing Flow

In the event of an Automatic Number Identification (ANI) failure due to the nature of the voice network, the 9-1-1 routing translations can be affected. If a 9-1-1 caller's ANI is not available (e.g., no ANI, ANI-Fail, 4-Party, etc.), the receiving E9-1-1 Control Office creates a proxy ANI using the 9-1-1 trunk group serving NPA, 911 as the NXX, 0 as inserted digit and the 3-digit ESCO code assigned to the incoming 9-1-1 trunk group. The newly formed 10-digit ESCO number is conveyed

to the Automatic Location Identification (ALI) computer, the PSAP terminal equipment (in the case of Line to Digital Trunk equipment), or to the alternate E9-1-1 Control Office (for redundant E9-1-1 Control Offices).

In those cases, the E9-1-1 Control Office switches use the originating switch's 9-1-1 trunk group Emergency Service Number (ESN) to route the incoming call. This situation could result in a call mishandling due to default routing. Default routing may also cause improper routing if the default routed call originates from a peripheral Remote Service Unit (RSU) switch.

3.5 ESCO Number Processing - FG-D or ISUP Environment

In cases where an ANI failure occurs during a 9-1-1 call transmitted over a trunk type that provides a ten digit ANI, (FG-D or ISUP trunks for example) the E9-1-1 Control Office could use the default Number Plan Digit (NPD) associated with the trunk group that points to the NPA to send the ESCO number to the downstream system (ALI, PSAP, etc.) as the caller's proxy ANI.

3.6 ESCO Number(s) Associated to Wireless Calls Using ISUP Trunking

An ESCO number is created automatically by the 9-1-1 Control Office switch receives an invalid number from the serving mobile switch's incoming 9-1-1 ISUP trunk group. More specifically, where dual 10-digit numbers are forwarded using ISUP Initial Address Message (IAM), if the Generic Digit Parameter (GDP) field (*used for transmitting the wireless cell site/sector's Emergency Service Routing Digit (ESRD) number or destination PSAP's Emergency Service Routing Key (ESRK) number*) and/or the Calling Party Number (CgPN) field (*used for transmitting the wireless caller's Call Back Number*) is empty or corrupted an ESCO number will be created. The following table provides instances where an ESCO display will be provided.

GDP (ESRD/ESRK)	CgPN (CBN)	ESRD/ESRK Value	CBN Value
Valid	Valid	NPA-511-XXXX	NPA-XXX-XXXX
Valid	Not valid	NPA-511-XXXX	NPA-911-0XXX *
Not valid	Valid	NPA-911-0XXX	NPA-XXX-XXXX
Not valid	Not valid	NPA-911-0XXX	NPA-911-0XXX *

Note: The ESCO number used for wireless caller's CBN replacement could carry a "curious" or "unusual for the area where the 9-1-1 Control Office operates" NPA code like 060, 570 or another. The resulting 10-digit number may look like:

060-911-0XXX

570-911-0XXX

**0-911-0123

In all cases, the NXX is always "911" and the ESCO type CBN is a non dialable number. The PSAP call taker cannot dial that pseudo number

3.7 ESCO Code / Number Assignment Per NPA Form

In order to control the selection and assignment of the ESCO codes it is recommended to use an “ESCO Code / Number Assignment per NPA” form. Note that it could also be done using a tabular database.

Once an ESCO code has been assigned to an E911 trunk group and the related ESCO number created, the information is recorded on the “ESCO Code / Number Assignment per NPA” form by the 9-1-1 Network Planning manager for submission to the 9-1-1 Database Authority.

3.8 ALI Screen Display

The ESCO number’s location reference information should be provided by the trunk group’s Local Exchange Carrier (LEC) to the ALI provider.

Providing that it is required to proceed with a call trace and/or for trouble clearance it is critical that essential information that could point the PSAP to the most appropriate Network Services personnel be recorded on the ALI display.

It is recommended that the format includes :

" NO INFORMATION RECEIVED FROM (LEC NAME) CENTRAL OFFICE
(Originating Switch Name / Common Language Location Identification (CLLI) / City) "

or

" NO INFORMATION RECEIVED FROM INTER TANDEM TRUNK GROUP
(Originating Switch Name / Common Language Location Identification (CLLI) / City) "

or

" NO INFORMATION RECEIVED FROM (LEC NAME) OPERATOR SERVICES SWITCH
(Originating Switch Name / Common Language Location Identification (CLLI) / City) "

Note that a 24 hour / 7 day a week LEC network control contact phone number should be added to the ESCO’s ALI display in the “Remarks” field. The contact phone number would be required in order to quickly perform a call trace.

3.9 ALI Database Input

Once all the appropriate information has been submitted to the 9-1-1 Database Authority an ESCO number’s ALI display record can be created. The 9-1-1 Database Authority will proceed with the ESCO record input into the appropriate ALI computer(s) for future display.

It is recommended that the 911 Database Authority provide the PSAP Administrator with the ESCO numbers and code definitions.

3.10 PSAP Display

The ESCO code is used as part of the proxy (pseudo-ANI) sent to electronic business sets or other equipment designed for ANI reception at the PSAP when no ANI is available. It is also sent in the Call Detail Record (CDR) to the ALI request message to the ALI computer for calling number location display.

3.11 PSAP's Display Indication

When the PSAP's call taker receives this type of proxy ANI/ALI display information, (ESCO number) it is always an indication that the 9-1-1 call was default routed. Adequate validation and call trace actions may be required.

The PSAP may need to contact the 9-1-1 Service Provider to determine ownership of the trunk identified by the ESCO code unless the ALI display indicates the originating LEC.

4 VARIOUS

4.1 PSAP Training

It is essential that all PSAP personnel be trained on the content of the ESCO display screen and on how to manage this type of situation.

4.2 ESCO Display And/Or Trace Request

In the event that a PSAP refers an ESCO display condition or requests a call trace using an ESCO proxy ANI, the following procedures are recommended to be performed by the appropriate 9-1-1 Service Provider's 9-1-1 Control Center.

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Step	Activity	Prime
1	<p>ESCO ANI received by the PSAP with or without ALI display. Contact the designated LEC's 9-1-1 Control Center and provide related information.</p> <p><i>ONLY if the agency determines one of the following things;</i></p> <ul style="list-style-type: none"> <i>a) that they cannot obtain reliable location and call back information from the caller</i> <i>b) the ESCO is beginning to be received multiple times (indicates a potential trouble that might be able to be found and fixed), or</i> <i>c) if local policy dictates that ALL ANI failures are to be reported. Some agencies are beginning to accept that reporting ALL ANI failures is a time consuming process on their part and on the E9-1-1 Service Provider's part, and in most cases nothing can be found to "fix". If the PSAP or the E9-1-1 Service Provider have equipment that can track ESCO codes as they occur, a report can be developed on a timely basis that the E9-1-1 Service Provider can use to identify problem end office-to-9-1-1 Control Office trunk groups that are experiencing multiple non-continuous ANI failures. This is more effective than looking for a trouble that may not repeat itself.</i> 	PSAP prime
2	Receive ESCO identification/trace request from a PSAP prime.	9-1-1 Control Center
3	<p>Proceed with E9-1-1 Control Office analysis. Check appropriate E911 messages or logs related to that dedicated "9-1-1" trunk group.</p> <p>Inform the 9-1-1 Control Center (where applicable).</p> <p>The receiving LEC will expedite all emergency requests. If any delay in completing the trace is expected (such as when a dispatch to an unattended office is required or when personnel are not available) the receiving LEC will advise the requesting party of the reason for the delay and its expected duration.</p>	Network Services switch technician 9-1-1 Control Center
4	<p>Should the ESCO identification/trace request lead to another carrier (i.e., another LEC) the testing LEC will contact the other LEC and request that the ESCO identification/trace request be continued.</p> <p>Trace information concerning the end user's name, telephone number and address is confidential and can only be released to individuals covered by confidentiality agreement.</p>	9-1-1 Control Center
5	If a trace was requested, inform the PSAP prime of the request's	9-1-1 Control

	Center
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4.3 ESCO Record by NPA

The following is an excerpt of what the ESCO record ALI content could be.

	ESCO number	ALI screen display
Add	NPA-911-0TTTT or -TTTT	NO INFORMATION RECEIVED FROM (LEC NAME) CENTRAL OFFICE (Originating Switch Name / Common Language Location Identification (CLLI) / City) and remarks (where available)
Add	555-911-0111 or - 1111	NO INFORMATION RECEIVED FROM XYZ TELECOM - MAIN STREET CENTRAL OFFICE, MYTNTX02DS1, BORDERCITY, TEXAS XYZ TELECOM 9-1-1 Control Center 1-800-555-5555
Add	555-911-0456 or - 3456	NO INFORMATION RECEIVED FROM 9-1-1 TELCO - SECOND 9-1-1 INTER-TANDEM SWITCH, TELCTX99DS1, OTHERCITY, TEXAS 9-1-1 TELCO 9-1-1 Control Center 1-800-555-1234

4.4 Default routing identification where the ESCO code is not used

In those instances where at least one E9-1-1 Control Office does not currently support ESCO codes, it is recommended that when implementing a new “9-1-1” trunk group, the ESCO functionality be emulated by assigning a unique default ESN to each “9-1-1” trunk group.

As an example, default ESN codes in the 9XX range could be reserved for “9-1-1” trunk group default routing identification. It would uniquely identify the switch that originated the emergency call when there is no ANI or the ANI is not valid.

The default ESN is displayed to the call taker if there is no ANI.

Note that in that case the “9-1-1” trunk group default ESN details (Police, Fire and Ambulance) are the same as the PSAP’s default ESN.

4.5 Default Routing Testing with Proxy ANI (ESCO)

It is recommended that while implementing a new trunk group or changing an ESCO code value the LEC proceed with trunk group default routing testing and PSAP’s display validation as follows:

Test Procedure:	<ol style="list-style-type: none"> 1. Originate a 9-1-1 call from a test line with ANI information missing. (no ANI or garbled spill) 2. E9-1-1 Control Office switch routes via translations based on the default ESN for the dedicated “9-1-1” trunk group. 3. Verify that it routes to the proper PSAP based on trunk group’s default ESN.
Expected Results:	<p>9-1-1 call terminates at PSAP associated with trunk group’s default ESN, regardless of no ANI or garble ANI.</p> <p>ALI displayed at the PSAP = “No information available from ...”, LEC NAME or COMPANY ID of trunk group LEC owner, and ANI = “NPA-911-0TTT”, where</p> <p>NPA = trunk group’s NPA, 911 = 911 used at NXX placeholder, 0 = an inserted digit, and TTT = 3 digit trunk group’s Emergency Service Central Office (ESCO) identifier or</p> <p>“NPA-911-TTTT” where</p> <p>NPA = trunk group’s NPA, 911 = 911 used at NXX placeholder, and TTTT = 4 digit trunk group’s Emergency Service Central Office (ESCO) identifier</p>
Calling Number	Test line of local service provider network
Dialed Number	9-1-1
Test Outcome	E9-1-1 platform is able to process a 9-1-1 call from ported TN, without valid ANI spill, to a PSAP attendant using trunk group default ESN and displaying ESCO ANI/ALI.
Risk Factor	<p>If test trunk group default ESN points to 9-1-1 phone board’s PSAP</p> <p style="text-align: center;">or</p> <p>If test trunk group’s default ESN points to live PSAP, will route to live PSAP</p>

Note that the same test could be done using :

- a telephone number assigned within an NPA-NXX residing in the originating switch, or
- a ported telephone number from an NPA-NXX foreign to the originating switch (LNP environment)

5 Exhibits

5.1 ESCO Code Assignment in Network

Figure 1 shows examples of ESCO assignment to incoming 9-1-1 trunk groups.

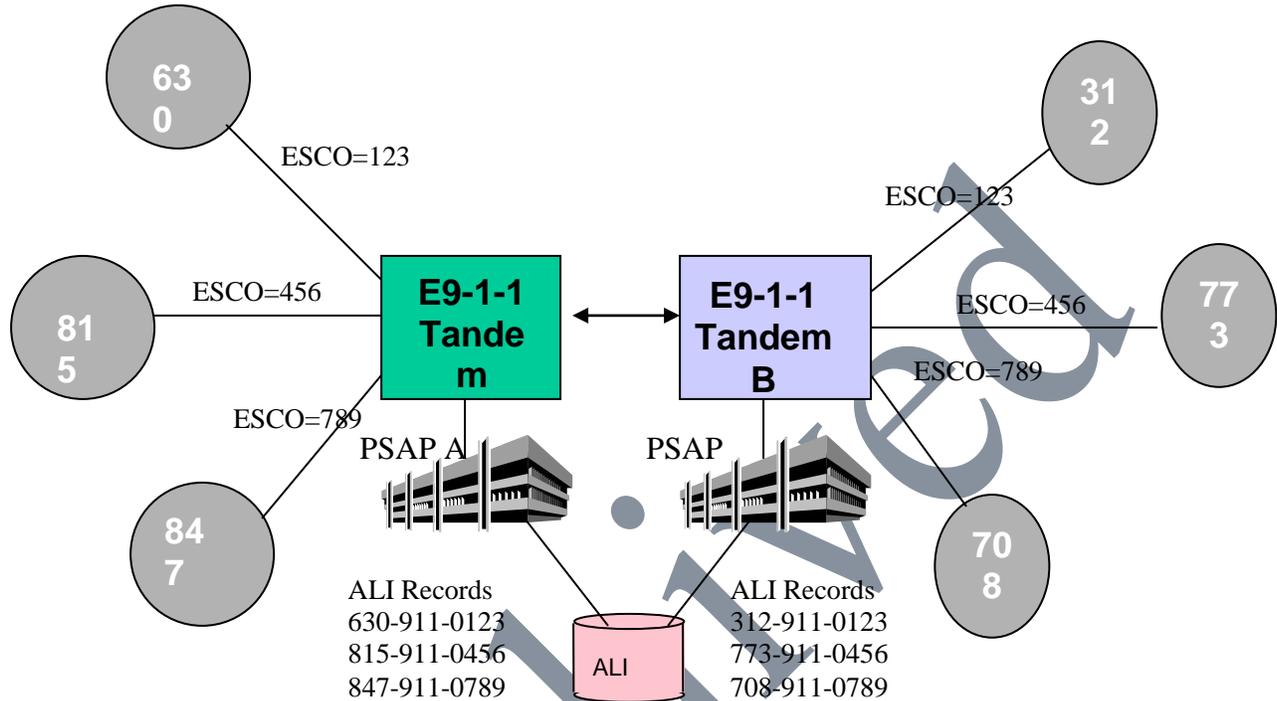


Figure 1 - ESCO assignment to incoming trunk groups

5.2 ESCO Number Display for Wireless Call Back Number

The next figure shows an example of an ALI display where a 10-digit ESCO number is used to replace the missing / invalid wireless caller's Call Back Number. You will note that the 10-digit ESRD/ESRK number is valid and the cell site/sector address is displayed.

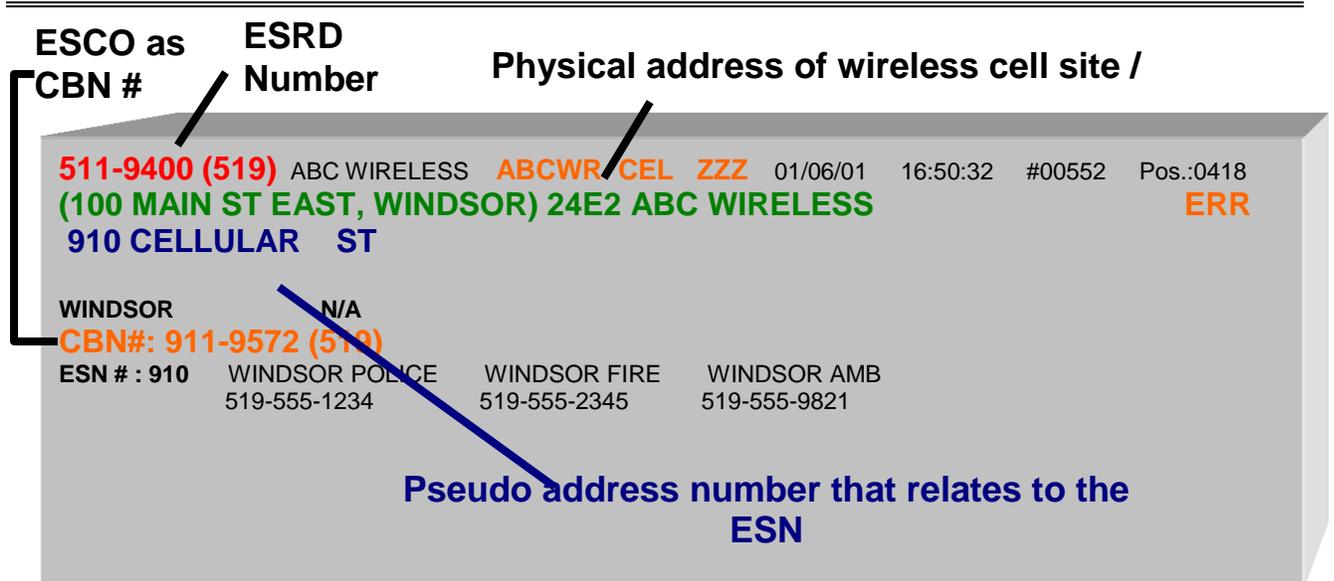


Figure 2 - ESCO replacement for wireless CBN

5.3 ESCO Number Display for Wireless ESRD and Wireless Call Back Number

The next figure shows an example of an ALI display where both a 10-digit ESCO number is used to replace the missing / invalid wireless cell site/sector ESRD/ESRK and wireless caller's Call Back Number.

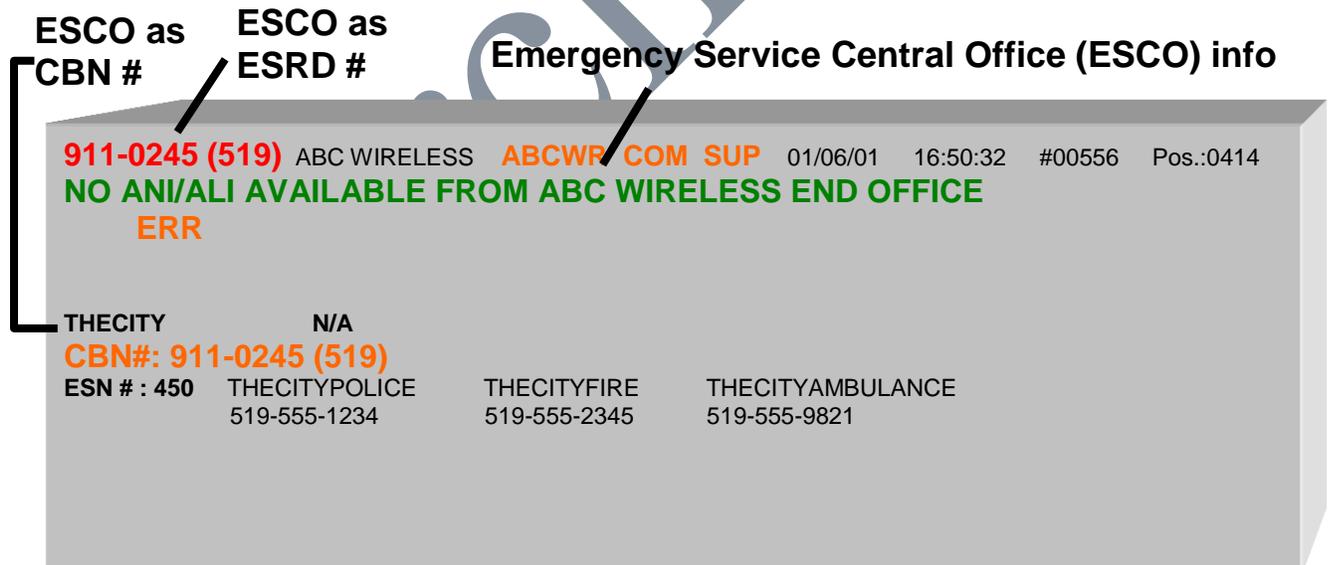


Figure 3 - ESCO replacement for wireless ESRD and CBN