

Making Use of the Emergency Services Access Enhancements in IP Office Release 9.0/9.1



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1 Introduction

With the move to larger installations, Avaya has modified IP Office Release 9.0/9.1 to support calls to Emergency Services. Although 9-1-1 is commonly used in the document, it represents any emergency number defined in the dialling plan (911/112/999/000 etc.)

The following information is based on USA Emergency Services requirements as they are the most demanding of the major territories. It offers some basic guidelines on best practices in supporting Emergency Services requirements and how specific IP Office features can be used to support those requirements. It is important to understand that Emergency Call handling can be very unique to a specific environment. Customers are advised to review plans with their risk management teams and local public safety authorities to ensure compliance with any legislation or employee safety regulations.

2 Definitions

ESA	Emergency Services Access Calls to 911, 112, 999, 000, etc. depending on your country.
NTE	Network Terminating Equipment The interface between the carrier network in the customers PBX, typically converting Fibre to Copper for example.
ELIN	Emergency Location Identification Number Number sent to the PSAP used to identify a specific response location during an emergency call. Each ELIN has an entry in the PSTN Automatic Location Identification (ALI) database, which is used to display information to the emergency call taker. An ELIN number can be dialed and routed in the PSTN.
ERL	Emergency Response Location A location to which a 9-1-1 emergency response team may be dispatched during an emergency. The location should be specific enough to provide a reasonable opportunity for the emergency response team to quickly locate a caller anywhere within it.
OSN	On-Site Notification Mechanism used to alert local on-site personnel about an emergency condition. Typically this alert can be via a flashing button on a telephone, and audible sound, and a display of location information. Common OSN delivery mechanisms are email.
PSAP	Public Safety Answer Point A designated agency that answers emergency calls from the public and dispatches emergency responders.
VPC	Voice Positioning Carrier/Center An 'umbrella' network provider cable of terminating emergency calls to remote emergency networks that are not reachable via the normal PSTN. Access to these networks can be via SIP or direct using a PSTN access number. An 'umbrella' network provider cable of terminating emergency calls to remote emergency networks that are not reachable via the normal PSTN. Access to these networks can be via SIP or direct using a PSTN access number.

3 Description of operation

When a call is made to Emergency Services, the 9-1-1 call taking systems in the PSAP use the ANI or Caller ID received to identify the address of the location the call originated from – when ANI or Caller ID is used in this mode of operation it is commonly referred to as the Emergency Location Identification Number or ELIN. When analog or digital trunks are provisioned from your provider, the provider will normally provide address details to the ANI/ALI database servicing that area. This enables the 9-1-1 lookup functionality mentioned earlier. The same mechanism will operate for all calls, including SIP, but you must ensure that your ITSP will send the relevant changes and any updates in a timely manner to the ANI/ALI database so that the PSAP has access to them.

Inside the IP Office there is a special shortcode “Dial Emergency” which is like the more usual “Dial” shortcode except that calls through this shortcode are not subject to call barring, can be dialed from locked or logged off phones, and will immediately go to alternate routes at the highest priority if ARS is used. In summary, normal operations that can block a call are eliminated for “Dial Emergency”; it also triggers an alert, which is discussed later in this document.

The default u-Law config for USA includes Dial Emergency shortcodes to handle 911 and 9911 (usual line access digit 9 plus 911).

For the A-Law non-USA default config the default routing will route Emergency calls as normal calls. It is the responsibility of the installer to add the required codes. As a reminder, Manager will provide warnings that no Dial Emergency numbers have been defined.

For simple small sites there is nothing more to do.

For larger or more complex sites there may be a need to provide more detailed location identification due to multiple floors or multiple buildings on a campus.

4 Larger, or More Complex Sites - E911

Where an installation is more complex - for example, a car dealership with an office and showroom at the front, and a workshop and body shop in separate buildings elsewhere on the site - it may be desirable, or required by law, to be able to indicate from which building the call is made. Another example of a more complex installation is a company with several floors in an office building. Since laws regarding E911 vary by state, research must be done to help ensure system compliancy and minimize liability.

The emergency services dispatcher / call taker will want to know the general area of the site, or the floor of the building from which the call originated. In most cases, a desk/cube reference in an open plan office is meaningless, because first responders won't have the detailed information needed to understand how to decode the numbering scheme - "2C-231", for example, is not meaningful to outsiders, but very meaningful to internal first responders. Where local regulations specify the size of a response zone, those regulations must be followed, or an exception waiver obtained in writing. If there are no specific specifications, the National Emergency Number Association (NENA) MLTS E9-1-1 Caller Location Discovery and Reporting Technical Information Document 06-502 recommends fire alarm zones as good starting points.¹

IP Office has the ability to indicate the Location of Extension on the configuration record, and each location can be associated to a dedicated ARS; therefore, the emergency call from an extension configured with that location can have a specific CallerID/ELIN assigned or a specific trunk group selected, or both. All standard IP Office ARS functions operate on the call so if the main routing is not possible - congested or trunk down - an alternate route can be followed, so that the call is placed.

For IP extensions the location assignment can be automatically done based on IP address range - so if each floor/building has a dedicated DHCP range then this is a simple setup to manage and maintain. This is easily accomplished using Layer 3 PoE switches and DHCP forwarding/helpers. That way IP Office can still operate as the DHCP provider for the phones for easy installation/maintenance - up to 64 DHCP address pools can be configured.

The location for digital and analog extensions must be configured explicitly as these devices are not automatically able to be located.

The details for each location and its related CallerID/ELIN must also be provided to the ANI/ALI database provider servicing the PSAP; the provider will not need details of every single extension in the locations. This is especially true if there is local On-Site Notification configured on the premises, and a central response point is established for public safety.

It is important to note that it is the location of the extension that matters - not the user. Users can hot-desk around the IP Office. Therefore, it is the location of the extension that is used to determine the trunk/ELIN used.

5 On-Site Alert

IP Office will generate an alarm for any call attempt through a defined Dial Emergency number, even if it fails due to no free trunks. Unlike SMDR, which is output at the end of a call, the alarm is generated immediately at the time the call is made. The importance of this over SMDR is that the PSAP/Emergency Operator will often stay on the line until the first responders arrive. Since SMDR is generated upon call completion, notification will not occur before the first responders arrive on-site.

The alert from IP Office is a standard alarm and can be sent to SNMP/syslog/e-mail - the alarm message is not intended for direct use or readability by humans but intended for consumption by On-Site Notification applications, which typically offer a variety of features, for example:

- E-Mail/IM/SMS/Pager alerts with escalation and acknowledgments
- Interfaces to discovery tools to locate IP phones based on data switch ports, as well as DECT/WiFi phones, including that information within the application's alerts
- Location maps with additional information – hazardous material warnings, for example
- Emergency call alert displays for operators/reception/security desks
- Printing of alerts for physical archiving

The IP Office provides the following information in the alarm:

- Location name
- Number dialed by caller
- Calling number and CallerID/ELIN presented on call or reason for failure
- Current user for phone, "NoUser", or Trunk ID for tandem calls - may not actually be the person making the call
- Extension details, IP Office ID, port details, phone number (telecommuter), or MAC & IP addresses

6 Considerations

6.1 Moves and Changes

If a system has been setup with locations for ESA, special care must be taken to maintain these records throughout moves and changes. For example, no re-patching of IP phone cabling in the IDF closet should be done without notifying the person responsible for maintaining the locations data (data switch port to jack location). For simple office swaps, cabling changes are not needed. Changing the user associated to the physical extensions as detailed in the IP Office Install Manual "Swapping Extension Users" will leave the location for the extension/port the same.

NOTE: If IP extensions have had their locations manually configured, users must not be permitted to move the phones on the network since they may inadvertently move the phone to a different location. Best practices include MAC address tables on switches, or physical low cost cable management locks that prevent users from unplugging cables.

6.2 UPS/Standby Power

Situations such as fire or flood are exactly when calls to the Emergency Services will occur. It is critical that all parts of the system are on UPS protected power. This includes: PoE switches for IP extension, intermediate switches routers, the IP Office and any lineplant for the trunks (fibre to copper converters, NTE, or routers/firewalls/SBCs if SIP trunks are being used).

As an added failsafe, analog trunks are sometimes provisioned so that they can be used when there is total failure of on-site power. These analog trunks can be connected to the PBX but must be on ports supporting power-fail to suitable analog extensions. In the event a 911 call is placed on these trunks, the ANI/Caller ID of the trunk itself is used for the ELIN, and no manipulation of that data is possible.

6.3 Trunk Types

Emergency calls can be placed on all trunks supported on IP Office, including inter-PBX trunks for SCN/Tandem operation. Depending on the local requirements and the needs of the customer there may be a preference for certain types - see previous section about UPS/Standby Power.

6.4 Remote Workers/Cordless Phones

There are an increasing number of ways of operating on PABXs outside the traditional physical extension on a desk, which can present challenges to location reporting.

6.4.1 Remote Extension; NAT Traversal and VPN

Using various IP techniques these users have an IP phone at a remote location that appears as if it is at the main site. It is usually best to advise users of these phones to use a local landline or mobile/cellular phone to call the emergency services, if required.

IP Office will route any emergency call and VPCs can be used to route calls to a specialized service where the correct PSAP will be identified and the call routed. As mentioned in the section on moves and changes, it is vital that remote workers do not move their VPN/remote phone without updating the person responsible for updating the VPC service, or via an online Location Management Dashboard provided by the VPC.

6.4.2 Telecommuter

IP Office Telecommuter functionality relies on Avaya one-X® Portal and a local phone to allow users to operate as if they have an extension on the PBX. They should be advised to use the local phone to directly call emergency services. Additionally, a VPC provider and Location Dashboard may be used to provide the proper call routing and termination.

Any emergency call made through telecommuter will be routed by the IP Office, but any location identification will have to be a manual operation by a VPC or the PSAP/Emergency Operator and any response could be significantly delayed if not provisioned properly.

6.4.3 Softphones/Soft Clients

If the soft client is on a smart phone, the user should use the smart phone to make an emergency call directly via the PSTN. For a soft client on a PC, it is recommended this be used only if there is no local phone or mobile/cell phone available. As stated earlier, a VPC provider and location dashboard may be used to provide the proper call routing and termination.

Any emergency call made through a soft client will be routed by the IP Office, but any location identification will have to be a manual operation by a VPC or the PSAP/Emergency Operator and any response could be significantly delayed if not provisioned properly.

6.4.4 Cordless

On-Site cordless systems will report the correct general location based on the base station/access point providing coverage. Despite this, it is recommended when configuring the IP Office to consider grouping all cordless devices into a general cordless location. This could avoid providing incorrect location information due to the nature of radio coverage operating between floors or buildings and BS/AP supporting users who are physically in a different location. For example, if a user is in Building A with poor coverage from their 'local' base station/access point yet with a clear line of sight to a BS/AP in Building B, their handset will appear to be in Building B and the emergency services may go to the wrong building. The ELIN used for cordless devices could be tagged in the descriptor field of the ANI/ALI database as "WIRELESS USER - GET LOCATION" prompting the 9-1-1 call taker to ascertain the exact location information first.

6.5 Testing

Any installation of a PBX should check the correct operation of ESA. This must be planned in advance and with cooperation of the PSAP/Emergency Operators. Installers must not make calls to the emergency number without prior arrangement as this may cause a diversion of vital resources. It is inappropriate to simply call the number, hear the PSAP answer and quickly hang-up. That will likely cause an unnecessary call back and possibly a visit from the Police/Emergency Services to find out what is happening.

Special care should be taken to monitor the CALLING NUMBER sent on PRI circuits to confirm that what is being sent matches what is being received. In many cases the carrier may modify the ANI or caller ID on 9-1-1 calls, but pass this information on normal calls. You should never assume the caller ID displayed on a normal call is the same caller ID that will be seen on a 9-1-1 call. Not checking this simple fact may cause 'false positives' that will later become troublesome should the carrier change the configuration and stop modifying the ANI caller ID.

6.6 Routing for Incoming Calls to ELIN numbers

All callerID/ELIN numbers presented on emergency calls must have incoming routing. If an emergency call is dropped, the PSAP/Emergency Operator will typically call back. This must be configured in the IP Office Incoming Call Routes.

The routing for incoming calls on these numbers should be to a group, which includes: Reception, Security, Building Manager, On-Site response teams, and other appropriate internal parties ([See Section: On-site Alerts](#)). There may be limited value in attempting to return the call to the location where the call originated and certainly this is insufficient. If callers are able, they will re-dial. Otherwise, there may be any number of reasons that this call would go unanswered. It is best to route to parties who are most likely able to answer, and these parties should have On-Site Notification ([See Section: On-site Alerts](#)) so they are aware of the emergency before the call back.

6.7 Foreign Numbers

In sites where there are lots of visitors from other countries it might be desirable to add Dial Emergency shortcodes for the usual emergency numbers for their home countries. For example, an American company with a lot of visiting staff from Europe should add 112.

NOTE: If configuring this, be sure to translate the digits sent to the PSTN to 911 as carriers typically do not recognize foreign emergency numbers.

6.8 Server Edition/SCN

IP Office Small Community Networks and Server Edition support ESA and the locations are shared across the SCN/Server edition. It is recommended that call routing for such setups take into account the resilience/reliability of various links. In some cases, it may be appropriate to have a local trunk service a building as a primary or secondary route, as opposed to communications over a link that is known to have reliability issues. Also remember that on an analog trunk, the caller ID or ANI that is sent is that of the trunk and not the desired ELIN. For this reason alone, it may be desirable to use a digital PRI facility.

7 High Level Configuration Examples

For this example, we will use a small company that occupies a two story building and has WiFi cordless phones. Other extensions are digital. WiFi Subnet is 192.0.2.0/255.255.255.0

The following DID numbers have been assigned as ELINs and Caller IDs are registered:

650-555-0199 - (default) Ground Floor, 650-555-198 (Top Floor), 650-555-197 (Cordless)

7.1 Create ARS entries/check that 911 is in the system settings

Setup is using US default config with Line Access digit of '9' & Secondary Dialtone. Check that there is already a shortcode;

9N: Dial

Short Code

Code: 9N

Feature: Dial

Telephone Number: N

Line Group ID: 50: Main

Locale:

Force Account Code: ☐

Which points to ARS 50 “Main” where the default config has processing for 911 and 9-911.

Main

ARS

ARS Route Id: 50

Route Name: Main

Dial Delay Time: System Default (4)

In Service: ☒

Time Profile: <None>

Secondary Dial tone: ☒ SystemTone

Check User Call Barring: ☒

Out of Service Route: <None>

Out of Hours Route: <None>

Code	Telephone Number	Feature	Line Group ID
11	911	Dial Emergency	0
911	911	Dial Emergency	0
0N;	0N	Dial 3K1	0
1N;	1N	Dial 3K1	0
XN;	N	Dial 3K1	0
XXXXXXXXXXN	N	Dial 3K1	0

Add

Remove

Edit

The linegroup ID of the Dial Emergency shortcodes must be valid as this is used as a fall-back if the location matching is invalid and the default location is not available. For this site 0 has an analog trunk - which power-fails to a red POTS phone on the receptionist’s desk.

We create an ARS for the fall-back as well, which we will use on the location specific ARS entries.

Fallback 911

ARS

ARS Route Id: 54

Route Name: Fallback 911

Dial Delay Time: System Default (4)

In Service: ☒ Out of Service Route

Time Profile: <None> Out of Hours Route

Code	Telephone Number	Feature	Line Group ID
11	911	Dial Emergency	0
911	911	Dial Emergency	0

No attempt to set the ELIN/ANI/CallerID as this is an analog trunk.

Then we create 3 more ARS tables for the ELINs, standard IP Office shortcode character "S" is used to set the CallerID, and the fall-back ARS is set as the alternate route so that if the PRI is down or congested the call will still route.

Ground Floor911

ARS

ARS Route Id: 51

Route Name: Ground Floor911

Dial Delay Time: System Default (4)

In Service: ☒ Out of Service Route: <None>

Time Profile: <None> Out of Hours Route: <None>

Code	Telephone Number	Feature	Line Group ID
11	911S6505550199	Dial Emergency	1
911	911S6505550199	Dial Emergency	1

Alternate Route Priority Level: 1

Alternate Route Wait Time: 30

Alternate Route: 54: Fallback 911

Line Group 1 is the PRI.

Similar records for:

Route Name	Top Floor 911	Code	Telephone Number	Feature	Lin
		11	9115650555198	Dial Emergency	1
		911	9115650555198	Dial Emergency	1
Route Name	Cordless 911	Code	Telephone Number	Feature	Line G
		11	9115650555197	Dial Emergency	1
		911	9115650555197	Dial Emergency	1

These do not have to be dedicated ARS tables but it is neater, easier to maintain, and less likely to be accidentally changed if they are.

7.2 Create Locations

Location

Location Name

Location ID

Subnet Address

Subnet Mask

Emergency ARS

Parent Location for CAC

Call Admission Control

Total Maximum Calls

External Maximum Calls

Internal Maximum Calls

Ground Floor

Ground Floor

2

0 . 0 . 0 . 0

0 . 0 . 0 . 0

51: Ground Floor911

<None>

Unlimited

Unlimited

Unlimited

Location

Location Name

Location ID

Subnet Address

Subnet Mask

Emergency ARS

Top Floor

3

0 . 0 . 0 . 0

0 . 0 . 0 . 0

52: Top Floor 911

Location

Location Name

Location ID

Subnet Address

Subnet Mask

Emergency ARS

Cordless

4

192 . 0 . 2 . 0

255 . 255 . 255 . 0

53: Cordless 911

Set the System default location.

System

LAN1

LAN2

DNS

Voicemail

Telephony

Directory Services

System Events

SMTP

SMDR

Twinning

ESA Demo

Locale

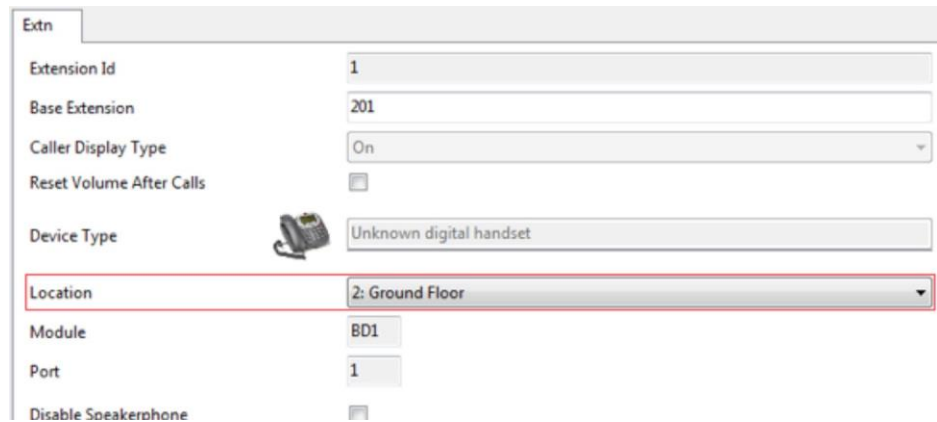
United States (US English)

Location

2: Ground Floor

Set to ground floor - as this is where the main entrance and reception desk is - with the on-site notification system so the receptionist can meet and direct the first responders if there are any extensions with no location set.

7.3 Assign Locations to Extensions

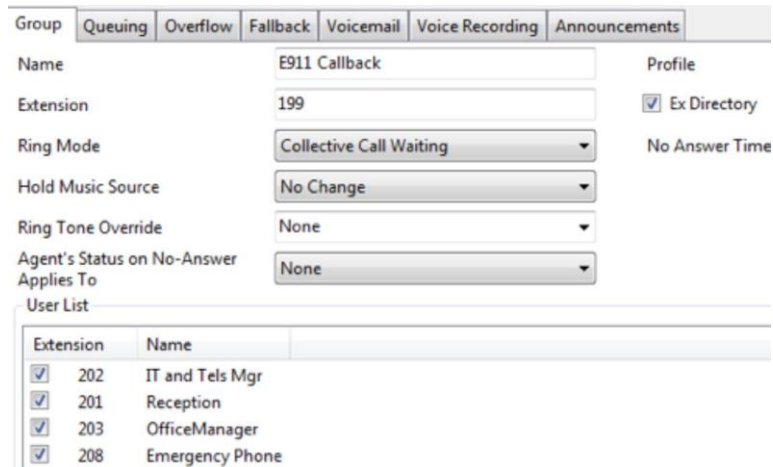


The screenshot shows the 'Extn' configuration page. The 'Location' dropdown menu is highlighted with a red border and shows '2: Ground Floor' selected. Other fields include Extension Id (1), Base Extension (201), Caller Display Type (On), Reset Volume After Calls (checkbox), Device Type (Unknown digital handset), Module (BD1), Port (1), and Disable Speakerphone (checkbox).

This should be done for all extensions, even the ones in the default location (Ground Floor). Automatic can be used for IP extensions and the location will be identified based on the IP address (Automatic is not available on digital or analog extensions).

7.4 Create Hunt Group for call back

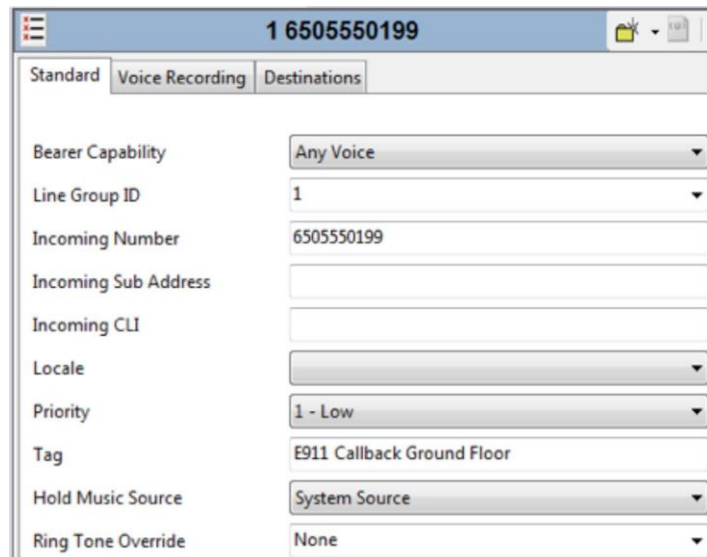
A single HuntGroup, Collective with Call Waiting with some managers, the receptionist, and the red emergency phone that is on reception.



The screenshot shows the 'Group' configuration page. The 'Name' field is 'E911 Callback', 'Extension' is '199', 'Ring Mode' is 'Collective Call Waiting', 'Hold Music Source' is 'No Change', 'Ring Tone Override' is 'None', and 'Agent's Status on No-Answer Applies To' is 'None'. The 'User List' table is as follows:

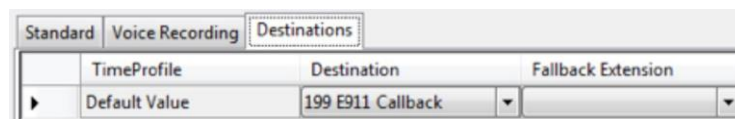
Extension	Name
☒ 202	IT and Tels Mgr
☒ 201	Reception
☒ 203	OfficeManager
☒ 208	Emergency Phone

7.5 Create Incoming Call Routes



1 6505550199	
Standard	Voice Recording Destinations
Bearer Capability	Any Voice
Line Group ID	1
Incoming Number	6505550199
Incoming Sub Address	
Incoming CLI	
Locale	
Priority	1 - Low
Tag	E911 Callback Ground Floor
Hold Music Source	System Source
Ring Tone Override	None

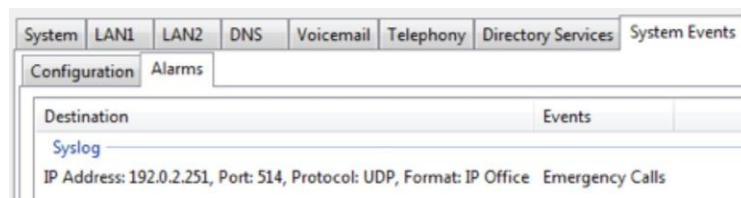
Use the tag to indicate which location this is a callback for.



TimeProfile	Destination	Fallback Extension
▶	Default Value	199 E911 Callback

Two more for the other ELINs and one for the analog trunk.

7.6 Enable alarms



System	LAN1	LAN2	DNS	Voicemail	Telephony	Directory Services	System Events
Configuration Alarms							
Destination							Events
Syslog							
IP Address: 192.0.2.251, Port: 514, Protocol: UDP, Format: IP Office Emergency Calls							

8 Call Flow for example setup

The processing for an emergency call in the example setup in section 7 is as follows:

- User dials 9
- Matches the 9N system shortcode - processed through the "Main" ARS, secondary dialtone applied, number is unresolved
- User dials 1
- Secondary dialtone removed, Number is unresolved to no further action
- User dials 1

- Matches the “11” shortcode in ARS Main and dial emergency action is processed
 - System checks the originating extension (not user) location
 - Location is “Top Floor” - call is processed through ARS “Top Floor 911”
Caller ID is changed to 6505550198 and 911 is dialed on the first free trunk in outgoing group 1

Alternate location processing is:

- Call cannot be placed on the PRI because it is congested/out of service, the “Fallback 911” ARS is followed and the call is made on the analog trunk.
- Location is Automatic - system iterates through the locations to find a location where the IP subnet includes the IP address of the extension, then the call is processed through the matching ARS.
- Location is blank or there is no match for automatic - use the system location.
- System location is blank - route the call to the Process the Dial Emergency shortcode in the “Main” ARS and use the configured outgoing trunk group 0.

¹ NENA 06-502 MLTS E9-1-1 Caller Location Discovery and Reporting TID V1
http://c.ymcdn.com/sites/www.nena.org/resource/collection/C9292FAF-6B47-4CEB-83D1-3982DBE77186/NENA_06-502_v1_MLTS_9-1-1_Caller_Location_____Discovery.pdf

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