

Canadian Radio – television and
Telecommunications Commission
Interconnection Steering Committee

Report to the CRTC

by the

Emergency Services Working Group (ESWG)

**Wireless E9-1-1 Phase II Stage 2
Feature Analysis**

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1 Background

On February 2, 2009 the CRTC issued Telecom Policy Decision 2009-40 regarding the implementation of Wireless Phase II E9-1-1 Service in Canada. Within this Decision, the Emergency Services (9-1-1) Working Group (ESWG) received the following direction of Wireless Phase II E9-1-1 Stage 2 feature development:

22. The Commission considers that wireless Phase II Stage 2 E9-1-1 features would provide further significant benefits to PSAPs and consumers, and should be implemented as soon as technological solutions are available. To this end, the Commission requests that the ESWG file a report within six months of the date of this decision on its findings regarding the deployment of wireless Phase II Stage 2 E9-1-1 features. Upon review of this report, the Commission will specify the Stage 2 implementation requirements and time frames.

As described in ESRE0046 Technical and Operational Requirements of Wireless Phase II E9-1-1 Implementation, the ESWG recommended and the Commission approved that the current Phase I E9-1-1 capability must be preserved and should form a basis for all wireless Phase II E9-1-1 calls.

Phase I E9-1-1 service provides the subscribers telephone number, Wireless Service Provider (WSP), cell sector and the address of the cellular tower which routed the call to the PSAP.

Phase II Stage 1 is described as the “provision of X, Y [latitude, longitude] coordinate information and location system parameters that PSAPs [Public Safety Answering Points] use to determine a callers location.” Phase II Stage 1 has been described in ESRE0046.

Phase II Stage 2 is described as the “provision of mid-call location updates, plus provision of wireless Phase II E9-1-1 service for roamers and unsubscribed handsets, to be deployed as technology solutions become available.” This report (ESRE0049) does not include mid-call location updates, which has been addressed in ESRE0050.

2 Introduction

The purpose of this document is to identify the technological challenges and proposed solutions for the provisioning of wireless E9-1-1 Phase II Stage 2 features, with the exception of In-Call Location Update (ICLU), which is analyzed in TIF 59 and documented in report ESCO0050.

The report herein was developed through the combined efforts of Wireless Service Providers (WSPs), Incumbent Local Exchange Carrier (ILEC) 9-1-1 service

providers, and Public Safety Answering Point (PSAP) representatives (see Section 3 for details). Together they provided a detailed list of technological issues and definitions, identifying where location information can automatically be provided by Phase II infrastructure. Where location information cannot be delivered automatically to the PSAPs a manual work-around solution may be required.

3 ESWG Approach

After filing the October 31, 2008 Report (ESRE0046) – Technical and Operational Requirements of Wireless Phase II E9-1-1 Implementation, the ESWG continued regular monthly conference calls. This continued work resulted in the creation of three new Task Identification Forms (TIFs), one to address Phase II Stage 1 preparations (TIF57), and two more TIFs to focus on Stage II (TIF 58 and 59). These TIFs are detailed below:

TIF 57: Wireless Phase II Rollout – Criteria, Priority, Schedule

The purpose of this TIF is to prepare a Phase II Wireless schedule and to develop what criteria to be used in determining priority of the rollout.

ESRE0048 – Wireless E9-1-1 Phase II Stage 1: Rollout Schedule was submitted to the Commission May 1, 2009. The Commission approved it in Decision CRTC 2009-328.

TIF 58: Wireless Phase II E9-1-1 Support of Roamers

The October 31, 2008 ESWG report, “Technical and Operational Requirements of Wireless Phase II E9-1-1 Implementation” recommended, “that wireless roamer 9-1-1 calls should continue to be processed as they are today. The ESWG further recommends that wireless phase II E9-1-1 support of roamers should be investigated by the ESWG and as technology permits, for inclusion in a subsequent stage [of wireless phase II deployment] such as stage 2.” Telecom Regulatory Policy CRTC 2009-40, released on February 2, 2009, requests the CISC to file a report on its findings to the Commission by August 2, 2009.

This report is the culmination of the work on TIF 58.

TIF 59: Wireless Phase II E9-1-1 In-Call Location Update (ICLU)

The October 31, 2008 ESWG report, “Technical and Operational Requirements of Wireless Phase II E9-1-1 Implementation” recommended, “that the ESWG investigate the ability to provide mid-call location updates (Rebids) for inclusion in a future deployment such as stage 2.” Telecom Regulatory Policy CRTC 2009-40,

released on February 2, 2009, requests the CISC to file a report on its findings to the Commission by August 2, 2009.

The report ESRE0050 addressing In Call Location Update was submitted to the CRTC on August 2, 2009.

4 Common Elements to Wireless Phase II E9-1-1 Service

The ESWG first identified those wireless E9-1-1 call types that would require investigation within TIF 58 and determined that there were several. The provision of wireless Phase II Stage I for subscribers in their home networks has been made mandatory by CRTC Decision 2009-40. In-Call Location Update (ICLU) is not included in this report. ESWG consensus was gained on the nomenclature to be used to describe the call types examined in this report:

- Canadian Roamers
- North American Roamers
- International Roamers
- Uninitiated
- Unregistered
- Lapsed Subscription
- Unsubscribed

This report will examine each of the above call types, from the perspective of providing Phase II location information during initial 9-1-1 call set up. There are common elements of wireless handsets that must be understood and considered when examining these call types. They are explained below.

4.1 Handset Identification

A wireless handset is identified by two numbers: a public telephone number and a number used by the WSP for internal operational purposes. The identifiers are as follows. The telephone number is the dialable network identifier that other subscribers use to call the handset. The WSP identifier is a number sequence stored within the Code Division Multiple Access (CDMA) handset or Global System for Mobile communications (GSM) Subscriber Identity Module (SIM) card and is used by the WSP that provides service to the handset.

The numbers or identifiers are defined as follows:

Telephone Number: a public network address identifier that has the following format: (see E.164) The E.164 compliant telephone number has a maximum of 15 digits and is comprised of the following: Country Code (CC): 1 to 3 digits + National Destination Code (optional; in North American Numbering Plan (NANP) this is called the area code

or Numbering Plan Area (NPA)) + Subscriber Number. The country code for world zone 1 (North America or NANP) is 1. The format of NANP numbers is: NPA-NXX-XXXX, where NPA is the area code, N is a decimal digit ranging from 2 to 9, and X is a decimal digit ranging from 0 to 9.

	CDMA (ANSI-41)	GSM/iDEN/UMTS
Telephone Number:	MDN	MSISDN
WSP Identifier:	MIN	IMSI

MDN: Mobile Directory Number (the telephone number in an ANSI-41 standard -based handset, such as CDMA).

MIN: Mobile Identification Number. The MIN identifies the WSP that an ANSI-41 based handset (e.g. CDMA) is subscribed to.

Special note on MDN and MIN: Both of these numbers are recycled when subscribers churn or upgrade their handsets. In order to call the handset on the Public Switched Telephone Network (PSTN) the MDN has to be valid. In order to authorise handover, page, locate and other mobility functions the MIN has to be valid and unique. An active CDMA handset has a valid MDN/MIN pair. Similarly, an active GSM handset has a valid MSISDN/IMSI pair.

MSISDN: Mobile Station Integrated Services Digital Network. The telephone number (public network identifier) associated with a GSM/iDEN/UMTS phone.

IMSI: International Mobile Station Identifier. An identity number applicable to GSM and UMTS handsets. It is up to 15 digits long and includes the country code (3 digits) followed by the network code. The IMSI is stored inside the SIM card, which is inserted into the GSM handset. The SIM card may be removed and inserted into another GSM handset.

4.2 Handset Stages of Existence

A wireless handset has five stages of existence that reflect the handset’s subscription status. Initially, the handset is “**uninitiated**.” When CDMA handsets are manufactured they are preloaded with carrier information, such as Preferred Roaming List (PRL). GSM handsets with no subscriber identity module (SIM) card and as a result have no carrier identification. For GSM based carriers the IMSI is in the SIM card and not in the handset. The handset may dial 9-1-1, but has no callback number or it has a non-dialable callback number (e.g. 000-000-0000).

A handset will be in an “**unregistered**” state when it has not passed network registration. A handset with a valid subscription will appear as unregistered until successful network registration has occurred, which is typically in less than 10 seconds. Network registration occurs when a handset is powered up, periodically when the handset remains powered up,

and when the handset roams into another WSP's service area. Successful network registration occurs when the switching system that serves the handset receives confirmation of the subscriber's account from the WSP's Home Location Register (HLR).

When a handset is activated and has a valid subscription, it is referred to as "**active**" and is operating normally; it may place and receive calls and roam as is permitted by its subscription. Handsets in this stage that dial 9-1-1 in a geographic area that supports wireless Phase II E9-1-1 will normally provide wireless Phase II E9-1-1 location information to the PSAP.

When the handset is suspended due to a "**lapsed subscription**" (this case also applies to a prepaid phone with zero account balance), the handset's telephone number may be valid but the handset is prevented by the WSP from placing or receiving regular calls. The handset may originate a 9-1-1 call or may call WSP's customer service but cannot be called back by the PSAP. A lapsed subscription transitions to unsubscribed status typically within a one to six month interval.

The last stage of existence is "**unsubscribed**". An unsubscribed handset is one that had been activated in the past but currently does not have an active subscription with the WSP. When a handset subscription is cancelled the telephone number is recycled by the WSP (i.e. aging¹ then re-used) or is ported to another carrier.

The five stages of handset existence can be summarized as follows:

¹ Telephone numbers are recycled after the service has been disconnected by first aging the telephone number for a period of time then reassigning them to new subscribers. The period that a telephone number ages typically lasts for one to three months, but may vary per CRTC determinations.
http://www.cnac.ca/co_codes/co_code_guidelines.htm

Handset Life Stage	Characteristics	Wireless E9-1-1 Phase I Service	Dialable Call-Back Number (CBN)	Wireless E9-1-1 Phase II Location Service
Uninitiated	Handset has been manufactured and has some carrier information (such as PRL) but no telephone number. This includes GSM handsets without a SIM card.	Yes	No	No
Unregistered	A state where the handset has not passed registration. The subscriber may be valid or invalid. Calls other than 9-1-1 require the handset to first successfully pass registration.	Yes	No	No
Active	Normal operation. Handset can place and receive calls and roam but the handset is operating within its home network. Wireless Phase II Stage 1 E9-1-1 locates will normally be provided to handsets in this state.	Yes	Yes	Yes
Lapsed Subscription	Suspended by the carrier. This stage includes prepaid phones with zero account balance. The telephone number is still valid, but the handset cannot place or receive calls. The handset can call 9-1-1 or the WSP's customer service.	Yes	No. Telephone number is valid however due to suspension, the handset cannot be called.	Yes
Unsubscribed	Disconnected by the carrier. The telephone number has been recycled by the carrier (aged then reassigned to another handset) or the subscriber has ported the telephone number to another carrier.	Yes	No	Maybe (see analysis)

4.3 Analysis Common to Roamers and Unsubscribed Handsets

The analyses of these call types yielded the following analysis that are common to all of these call types:

- a) As wireless Phase I E9-1-1 is a prerequisite to Phase II, the Phase I location information (cell/sector ID) will always be provided to the PSAP within Phase II geographic areas. This default handling will provide the PSAP with Phase I location information in the event that the complete Longitude and Latitude Phase II information is not available.
- b) If necessary, PSAPs will have an alternative for locating a handset when Phase II location information is not available. The WSP's 24x7 support centre (established to support PSAPs) may be able to provide Phase II locate. The success of Phase II locates requested from these support lines will vary on a call by call basis and by WSP.
- c) Early in consideration of the wireless Phase II E9-1-1 service (in 2008), the ESWG reached consensus on preserving the Phase I service. As a result, Phase II service was built on the wireless Phase I E9-1-1 architecture, both in terms of signalling and call routing. As this approach differs from the implementation of Phase II in the US, some wireless Phase II E9-1-1 features that have been implemented in the US may not be applicable in Canada.
- d) Roaming agreements between wireless carriers are required to permit mobiles to roam between wireless networks. To enable wireless Phase II E9-1-1 capabilities of roamers onto Canadian WSPs, a number of prerequisites that must be met. First, the roamer's home wireless carrier must ensure that they use the same location technology as the serving wireless network. Second, the MDN/MSISDN is controlled by the home carrier in regards to the number of digits within the CBN and the type of phone number. When a subscriber roams onto the serving carriers' network, the registration process provides the MDN/MSISDN. The MDN/MSISDN is then used by the serving wireless carrier's switch as the call back number. The returned MDN/MSISDN from the home network may be 10 digits or more than 10 digits. Third, queries associated with location services must not be blocked by the home carrier and the interconnecting signalling network must permit such queries.
- e) Normal active handsets that are properly subscribed with WSPs should receive wireless Phase II E9-1-1 service in those geographical areas where Phase II is supported. This report deals with handsets that are of an irregular nature, as listed above.
- f) Call back number format is subject to the subscriber's home carrier restrictions.

5 Canadian Roamers

5.1 Description

Canadian roamers are handsets with a 10 digit telephone number (that must have a Canadian NPA or area code) assigned to them and a valid subscription. The subscriber is making a call outside of their WSP's home network and is roaming on another Canadian WSP's network. Handsets identify potential WSPs for roaming by its Preferred Roaming List (PRL) which is programmed into the handset.

5.2 Analysis

Phase II location coordinates will be delivered, except where there is a difference between the roamer handset's technology and the serving carrier's location technology (e.g.: a mismatch between network-based location technology and handset-based location technology). In this case only Phase I E9-1-1 location is provided. At this time not all carriers, and new WSPs, have disclosed which location technology they are implementing. Therefore, any mismatches cannot be identified at this point in time.

To enable wireless Phase II E9-1-1 capabilities of roamers onto Canadian networks, the roamer's home wireless carrier must ensure that they use the same location technology as the serving wireless network and the home network must not filter location service queries to its Home Location Register (HLR) by the serving network.

Roaming agreements between wireless carriers are required to permit mobiles to roam between wireless networks. To enable wireless Phase II E9-1-1 capabilities of roamers onto Canadian WSPs, a number of prerequisites that must be met. First, the roamer's home wireless carrier must ensure that they use the same location technology as the serving wireless network. Second, the MDN/MSISDN is controlled by the home carrier in regards to the number of digits within the CBN and the type of phone number. When a subscriber roams onto the serving carriers' network, the registration process provides the MDN/MSISDN. The MDN/MSISDN is then used by the serving wireless carrier's switch as the call back number. The returned MDN/MSISDN from the home network may be 10 digits or more than 10 digits. Third, queries associated with location services must not be blocked by the home carrier and the interconnecting signalling network must permit such queries.

5.3 Conclusion

Phase I location information will always be provided to the PSAP. The call back number (CBN) will be valid. PSAPs will receive Phase II location information for Canadian roamers, except where there is a difference between the roamer's and the serving carrier's location technology, or when location queries are blocked by the home carrier's HLR or by the inter-WSP signaling network.

To enable wireless Phase II E9-1-1 capabilities of roamers onto Canadian WSPs, the roamer's home wireless carrier must ensure that they use the same location technology as the serving wireless network. The home network must not filter location service queries to its Home Location Register (HLR) by the serving network.

5.4 Recommendations

Canadian WSPs must, for the purposes of supporting Phase II Wireless E9-1-1 on a roaming partner's network, provide a 10 digit MDN/MSISDN or make arrangements with their roaming partner to restrict the CBN to 10 digits. The home carrier must also ensure that their location technology matches that of the roaming partner, that queries associated with location services must not be blocked by the home carrier, and that the interconnecting signalling network must permit such queries.

6 North American Roamers

6.1 Description

A North American roamer is a subscriber from outside of Canada, but comes from a country that is under the NANP and is roaming on to a Canadian WSPs network. North American Roamers have a non-Canadian NPA with a 10 digit (NPA-NXX-XXXX) or 11 digit ((1+NPA-NXX-XXXX) NANP; World Zone 1) telephone number. The roaming mobiles are served by a Canadian WSP. The handsets identify potential WSPs for service by its Preferred Roaming List (PRL) which is programmed into the handset by its home carrier.

6.2 Analysis

NANP based carriers' handsets may provide 10 or 11 digit call back numbers, based on what is returned from the mobiles' registration process. Both 10 and 11 digit call back numbers are permitted from the standards perspective. Generally Canadian WSPs do not manipulate call back numbers and will deliver the digits in their original state (10 or 11 digits) to the 9-1-1 service provider.

Roaming agreements between wireless carriers are required to permit mobiles to roam between wireless networks. To enable wireless Phase II E9-1-1 capabilities of roamers onto Canadian WSPs, a number of prerequisites that must be met. First, the roamer's home wireless carrier must ensure that they use the same location technology as the serving wireless network. Second, the MDN/MSISDN is controlled by the home carrier in regards to the number of digits within the CBN and the type of phone number. When a subscriber roams onto the serving carriers' network, the registration process provides the MDN/MSISDN. The MDN/MSISDN is then used by the serving wireless carrier's switch as the call

back number. The returned MDN/MSISDN from the home network may be 10 digits or more than 10 digits. Third, queries associated with location services must not be blocked by the home carrier and the interconnecting signalling network must permit such queries.

The 9-1-1 service providers have identified that if more than 10 digits are transmitted, limitations may occur within the 9-1-1 tandem switch or within the ANI system. This gives rise to two cases: (a) the original 10 digit CBN is passed to the PSAP, and (b) the 11 digit CBN (1+NPA-NXX-XXXX) generates an ANI failure. The ANI for wireless 9-1-1 calls is the subscribers' call back number.

In case (a), the 10 digit CBN is valid and the 9-1-1 call is processed in a manner similar to Canadian Roamers, described above.

In case (b), the 11 digit CBN is no longer valid and generates an ANI failure. An **ANI failure** occurs when the 9-1-1 Service Provider receives more or less than 10 digits in the calling party address. This results in a PSAP receiving a non-dialable CBN consisting of a non standard 10 digit string or no digits at all. Examples are NPA-911-XXXX or 000-000-0000. When an ANI failure occurs the 9-1-1 Service Provider and the WSP do not have the ability to provide Phase II locate automatically.

No Canadian standards exist for the format of non-dialable CBNs; therefore PSAPs are unsure which life stage the handset is in and are unable to identify the information associated with that type call. Without a valid CBN phase II location cannot be generated. The 9-1-1 call will provide Phase I location information only.

To obtain the CBN in the event of an ANI failure, the PSAP may contact the 9-1-1 Service Provider Support Center. When the CBN has been obtained, the PSAP may contact the WSP 24x7 Support Centre and / or call to the subscriber. The ability of the WSP's 24x7 support centre to locate the subscriber will increase when a valid CBN is retrieved from the 9-1-1 Service Provider and is provided to the WSP 24x7 Support Centre, for the non-dialable CBN.

Three options for CBNs with other than 10 digits are as follows:

- 1) Maintain current configuration, and use a non-automated process;
- 2) Modify Infrastructure within the 9-1-1 call path to accommodate these digit strings; and
- 3) Deploy Emergency Service Routing Keys (ESRKs).

Option 1) Maintain Current Configuration

No technical modifications are required to the Wireless Phase II Stage 1 configuration. A non-automated process needs to be defined to allow the PSAP to request and receive CBN from the 9-1-1 Service Provider. The CBN can be used

by the PSAP to reconnect and to obtain a verbal location from the 9-1-1 caller. In the case where the customer is not reachable, or if they are not able to provide their location verbally, the PSAPs may then provide the information to the WSP to retrieve location if possible.

Option 2) 9-1-1 Call Path Infrastructure Modifications

The analysis for modification of the 9-1-1 Service Providers' infrastructure is listed in appendix B. It explains that standards must be analyzed and software development be undertaken for all 9-1-1 tandem switches. As a result, all current maintenance, surveillance, provisioning and 9-1-1 sub-systems must be analyzed and receive similar upgrades if applicable. Further, the PSAP interface must be closely examined and modified if required. This may drive PSAP infrastructure modifications.

Some WSPs may require development of their location platforms to support more than 10 digits in a telephone number. WSPs and ILECs will also require a modification to the Canadian MLP interface configuration (between WSPs and 9-1-1 Service Providers) to support more than 10 digits. The standard for the MLP interface supports up to 18 digits, which will support the E.164 Standard.

Option 3) ESRK Deployment

The requirement to modify the 911 network to use a non 10-D CBN is driven by the agreed to protocol of using the CBN to query the MPC for the 911 caller's location. An alternate solution would be to use something other than the CBN to query the MPC.

Emergency Services Routing Keys (ESRKs) have been deployed in the US to support wireless Phase II E9-1-1 calls. The ESRK is transmitted via the 10-digit CBN field to uniquely identify each wireless E9-1-1 call. The real CBN is transmitted from the WSP to the 9-1-1 Service Provider over the MLP link. The MLP interface supports the provisioning of more than 10 digits for CBN and as a result, the entire CBN may be presented to the PSAP without any ANI failures.

To deploy the ESRK method in Canada, the current wireless Phase I and Phase II Stage 1 configuration, which use ESRDs, requires a long term migration to ESRKs. Both methods must be sustained during the transition process or in perpetuity. ESRKs deployment would be disruptive to 9-1-1 and would in fact become a re-deployment of Phase I and Phase II in Canada. Introducing ESRK introduces a significant risk due to the redeployment of wireless Phase I and II and other unidentified risks. In the US, ESRK was deployed at phase I and was continued in Phase II for most carriers, and as a result they did not face the disruptive exercise of converting from ESRDs to ESRKs.

**Summary of Options to Accommodate Wireless Roamers with CBN
Other Than Ten Digits**

	Option 1: Maintain Current Configuration (Phase I and Phase II Stage 1)	Option 2: Modify Infrastructure to Accommodate other than 10 digits	Option 3: Develop and Deploy ESRK
Existing Phase I voice Routing	Supported	Supported	Not Supported. Replaced by ESRK routing (ESN ESZ mapping)
Call Setup time	Normal	Normal	Incrementally Longer (unknown and requires further analysis)
Existing Phase I Data (cell/sector location & CBN)	Supported	Supported	Supported with delay. An ALI MLP location query is required. If the accuracy specified is low (initial request), response is cell/sector ID in about 4 to 10 ² seconds. If the accuracy specified is high (first request with high accuracy or ICLU), response is X, Y location in up to 30 seconds.
Existing Phase II (mobiles with 10 digits)	Supported	Supported	Supported with delay. An ALI MLP location query is required. If the accuracy specified is low (initial request), response is cell/sector ID in about 4 to 10 ² seconds. If the accuracy specified is high (first request with high accuracy or

² The time delay is based preliminary information from Wireless Carriers and their vendors. As with the entire ESRK deployment consideration, further analysis is required.

			ICLU), response is X,Y location in up to 30 seconds.
Mobiles with other than 10 digits	Not Supported ³	Supported	Supported with delay. An ALI MLP location query is required. If the accuracy specified is low (initial request), response is cell/sector ID in about 4 to 10 ² seconds. If the accuracy specified is high (first request with high accuracy or ICLU), response is X,Y location in up to 30 seconds.
Level of Specifications Required	Phase I and Phase II Stage 1 Specifications already exist.	ILECs: Medium WSPs: Low PSAPs: Low (6 months)	ILECs: High WSPs: High PSAPs: Low Plus ESRK guideline development and provisioning (CSCN) (6 months)
Level of Incremental Procurement	Phase I and Phase II Stage 1 Specifications already exist.	ILECs: High WSPs: Low PSAPs: Low (12 months)	ILECs: Low WSPs: High PSAPs: Low (18 months)
Level of Deployment Effort	None	ILECs: High WSPs: Low PSAPs: Low (12 months)	ILECs: Medium WSPs: High PSAPs: High Total redeployment of wireless Phase I and II (2 years)
Total Project Time	0	2 - 3 years	4 years
Supports ICLU on calls with other than 10 digits	No	Yes	Yes

³ The numbers of mobile handsets with other than 10 digits that call 9-1-1 is small, but 9-1-1 calls from these handset owners often have language and location familiarity challenges. This delay in obtaining a location verbally increases the emergency service response time.

6.3 Conclusion

Where 10 digits are provided by the handset, the CBN will be valid and Phase II location will be provided as in the case of Canadian Roamers. Note that location technology must be compatible between the home and serving network and the home network must not filter location service queries.

Where an 11 digit call back number has been provided by the home wireless carrier, Phase II location information can only be generated by some WSPs, and the information remains confined within the WSP networks. There are three options to resolve the case where the CBN is other than 10 digits and there is an ANI failure.

Option 1 is a non-automated solution. It is supported by the existing Wireless Phase II configuration and requires process development to define the procedure to obtain the CBN from the 9-1-1 Service Provider. This is the most expeditious option of the three. As Wireless Phase II is in the early stages of deployment, usable statistics are not available. As more information becomes available and if it is determined that this solution is not adequate, the option exists to readdress it within the existing CISC process. Reference ESRE0046, Section H. 15.

In the long term, the evolution of WSP, ILEC, and PSAP infrastructure to all-IP technology will address wireless roamers with any network address format.

Options 2 & 3 are automated processes. Both options provide full CBN's and high accuracy of locate ability. The deployment of either option has various impacts on WSP's and 9-1-1 Service Providers, as described in the above table.

6.4 Recommendations

The TIF 58 members recommend that Option 1 be adopted for the following reasons:

- It is the most expeditious method within the existing Wireless Phase II Stage 1 infrastructure and processes
 - The CBN can be acquired by the PSAP from the 9-1-1 Wireless Service Provider
 - It does have the capability of providing manually acquired location information if technically available at the time of the call
- The existing CISC process allows for reassessing this issue
- The volume of these types of calls is unknown but expected to be very low

7 International Roamers

7.1 Description

International telephone numbers are typically more than 10 or 11 digits, and can be up to 15 digits. An International telephone number may also be less than 10 digits. Any digit stream other than 10 digits will cause an ANI failure.

International Roamers are handsets with telephone numbers outside of World Zone 1 (countries other than those in the North American Numbering Plan) that are served by a Canadian WSP. The handsets identify potential WSPs for roaming by its Preferred Roaming List (PRL) which is programmed into the handset by its home carrier.

7.2 Analysis

International carriers' handsets may provide call back numbers with up to 15 digits. Canadian WSPs do not manipulate call back numbers provided by the home WSP and will deliver the digits in their original state to the 9-1-1 Service Provider.

This case is similar to a NANP Roamer that has an 11 digit CBN (1+NPA-NXX-XXXX). The 9-1-1 Service Providers have identified that if other than 10 digits are transmitted, an ANI failure will occur. See section 6.2 for ANI failure description.

The analysis of 11 digit North American Roamers applies to non 10 digit International Roamers, see section 6.2.

7.3 Conclusion

Where other than a 10 digit call back number has been provided by the home wireless carrier, Phase II location information can only be generated by some WSPs, and the information remains confined within the WSP networks. There are three options to resolve the case where the CBN is other than 10 digits and there is an ANI failure.

Option 1 is a non-automated solution. It is supported by the existing Wireless Phase II configuration and requires process development to define the procedure to obtain the CBN from the 9-1-1 Service Provider. This is the most expeditious option of the three. As Wireless Phase II is in the early stages of deployment, usable statistics are not available. As more information becomes available and it is determined that this solution is not adequate, the option exists to readdress it within the existing CISC process. Reference ESRE0046, Section H. 15.

In the long term, the evolution of WSP, ILEC, and PSAP infrastructure to all-IP technology will address wireless roamers with any network address format.

Options 2 & 3 are automated processes. Both options provide full CBN's and high accuracy of locate ability. The deployment of either option has various impacts on WSP's and 9-1-1 Service Providers, as described in the above table.

7.4 Recommendations

The TIF 58 members recommend that Option 1 be adopted for the following reasons:

- It is the most expeditious method within the existing Wireless Phase II Stage 1 infrastructure and processes
 - The CBN can be acquired by the PSAP from the 9-1-1 Wireless Service Provider
 - It does have the capability of providing manually acquired location information if technically available at the time of the call
- The existing CISC process allows for reassessing this issue
- The volume of these types of calls is unknown but expected to be very low
- Adopting this option address both North American and International roamers

8 Uninitiated

8.1 Description

An uninitiated handset does not have the necessary telephone number / WSP internal number pair information to become an active handset, as listed in the following table:

	CDMA (ANSI-41)	GSM/iDEN/UMTS
Telephone Number:	MDN	MSISDN
WSP Identifier:	MIN	IMSI

A CDMA uninitiated handset has never been programmed with a MIN. The handset has basic WSP information installed by the manufacturer and will attempt a 9-1-1 call on the WSP's network referenced by the PRL. It does not have a valid telephone number. In its place is a non-dialable call back number, e.g. 000-000-0000 or 911 + last 7 digits of the Electronic Serial Number (ESN).

A GSM uninitiated handset does not have a SIM card and therefore does not have an IMSI or MSISDN. An uninitiated GSM handset will have only an International Mobile Equipment Identifier serial number (IMEI).

8.2 Analysis

There is no telephone number assigned to the handset and therefore the wireless 9-1-1 call has a non-dialable CBN. Generally, without a valid CBN, a Phase II

locate is not possible. North American 9-1-1 standards for wireless do not address the use of non-dialable CBNs to perform locates.

Generally, handsets must have a valid, unique MIN/IMSI in order for it to be located by the WSP. If the MIN is not available then the handset cannot communicate as specified by the standard. For some vendor's wireless switches the initial location may be available even though the handset has a non-dialable CBN and it lacks a MIN/IMSI.

8.3 Conclusion

Phase I location information will continue to be delivered for uninitialized handsets. A non-dialable CBN will be transmitted to the PSAP.

The J-STD-36 standard does not support this handset configuration. In some cases the vendor's wireless switches may provide initial location, even though the handset has a non-dialable CBN and it lacks a MIN/IMSI.

8.4 Recommendations

When the situation warrants it the PSAPs should contact the WSP's 24x7 support centres for assistance in locating the caller. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP.

9 Unregistered

9.1 Description

A handset will be in an unregistered state when it has not passed network registration. A handset with a valid subscription will appear as unregistered until successful network registration has occurred, which is typically in less than 10 seconds. Network registration occurs after a handset is powered up, periodically when the handset remains powered up, and when the handset roams into another WSP's service area. Successful network registration occurs when the switching system serving the handset receives confirmation of the subscriber's account from the WSP's Home Location Register (HLR). An unregistered handset may or may not have a valid subscription.

9.2 Analysis

An unregistered handset making a 9-1-1 call does not have all the credentials required to perform a Phase II locate, i.e. CBN and MIN/IMSI. During a 9-1-1 call set up when the handset was initially unregistered, after the eventual registration the handset will have a valid CBN and MIN/IMSI, but this information cannot be retransmitted via existing Phase I trunks to ILEC ALI.

Under these circumstances the WSP can manually query the handset at the request of the PSAP to provide the location information. If the CBN can be provided by the PSAP the Phase II locate will be obtained from the WSP's 24x7 support centre in a shorter time frame.

9.3 Conclusion

Network registration occurs typically in less than 10 seconds. The delay in registration that affects the ability to perform Phase II locate occurs after a handset is powered up or when the handset roams into another WSP's service area. Phase I location information will be provided to the PSAP.

Under these circumstances the WSP may be able to manually query the handset at the request of the PSAP to provide the location information. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP. If the CBN can be provided by the PSAP and if the handset can be queried by the WSP then the Phase II locate will be obtained from the WSP's 24x7 support centre in a shorter time frame.

9.4 Recommendations

When the situation warrants it the PSAPs should contact the WSP's 24x7 support centres for assistance in locating the caller. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP.

If the CBN can be provided by the PSAP the Phase II locate may be obtained from the WSP's 24x7 support centre in a shorter time frame.

10 Lapsed Subscription

10.1 Description

The handset had a subscription but the service has been suspended. The handset cannot make or receive calls, except for originating 9-1-1 calls and the WSP's customer service. This also includes prepaid telephones with an account balance of \$0 and where the handset's account has not entered the disconnected or unsubscribed state.

10.2 Analysis

The handset has a valid telephone number but the handset cannot place calls other than to 9-1-1 or receive calls. A Phase II locate on these call types can be supported. The PSAP cannot directly call the handset. If necessary the support centre may lift the suspension or top up the subscriber's account to enable the PSAP to call back the handset.

10.3 Conclusion

Phase II locate on these types of calls will be supported. If necessary the support centre may lift the suspension or top up the subscriber's account to enable the PSAP to call back the handset.

10.4 Recommendations

If necessary the WSP's 24x7 support centre may be able to lift the suspension or top up the subscriber's account to enable the PSAP to call back the handset. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP.

The PSAPs should contact the WSP's 24x7 support centre for assistance in contacting the caller. The ability to contact the handset by the WSP will vary on a case by case basis and by WSP.

11 Unsubscribed

11.1 Description

An unsubscribed handset is one that had been activated in the past but currently does not have an active subscription with the WSP. Handsets with cancelled subscriptions will not pass network registration. Its telephone number has been aged (typically 1-3 months) and reassigned or ported to another carrier. This handset state also applies to an ANSI-41 based CDMA handset that whose subscription has been moved to another handset.

11.2 Analysis

Registration fails for unsubscribed handsets and therefore there isn't a valid CBN. When a 9-1-1 call is made a non-dialable CBN is provided to the PSAP. A CDMA handset will still have the MIN initially assigned by the WSP after the subscriber has terminated services with the WSP or the same subscriber has acquired a new handset. When a subscription is cancelled the WSP will recycle the MIN and assign to another subscriber's handset. When a CDMA subscriber acquires a new CDMA handset the WSP will assign the same MIN to their new handset.

Therefore an unsubscribed CDMA handset may have a duplicate MIN when:

1. the original user terminated service and the MIN is recycled
2. the original user acquires a new handset and the old handset is retained for 9-1-1 services, or
3. the unsubscribed handset is tampered with and the MIN is changed

When a GSM subscriber cancels their service the SIM card becomes invalid. A GSM handset with an invalid SIM card becomes an unsubscribed handset. When

a GSM subscriber acquires a new GSM handset the SIM card is moved to the new handset. A GSM handset with the SIM card removed would become an uninitiated handset.

For an unsubscribed GSM handset initial locate is not possible because there is no CBN. The 9-1-1 service provider's ALI needs a CBN in order to query the location determining equipment (Gateway Mobile Location Centre (GMLC)) in order to acquire Phase II locate.

Any handset with a unique MIN will support Phase II locate. However, an unsubscribed CDMA handset which has the same MIN as another handset may result in the incorrect handset being located. In order for this to occur both handsets must be powered up and the active handset must have a valid registration.

If necessary, the 7x24 support centre may be able to provide Phase II locate depending on the information available.

11.3 Conclusion

Phase I location information will continue to be delivered. A non-dialable CBN is provided to the PSAP.

For CDMA Phase II compliant handsets may provide Phase II location. However, an unsubscribed CDMA handset which has the same MIN as another handset may result in the incorrect handset being located.

For an unsubscribed GSM handset initial locate is not possible because there is no CBN.

If necessary, the WSP's 7x24 support centre may be able to provide Phase II locate depending on the information available. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP.

Patches and fixes are not applied to the handset when they are not subscribed and as a result handset performance may become non-functional or suboptimal.

11.4 Recommendations

If necessary, the PSAP should contact the WSP's 7x24 support centre which may be able to provide Phase II locate depending on the information available.

WSPs must notify subscribers that unsubscribed handsets should not be relied on for 9-1-1 service and that Phase II locate may not be possible.

All 9-1-1 industry stakeholders should also inform the general public that unsubscribed handsets should not be relied on for 9-1-1 service and that Phase II locates may not be possible.

12 Standard Format for Non-Dialable Call Back Numbers

As indicated in the previous sections, in certain situations the ILEC may transmit a non-dialable CBN to the PSAP. Various ILECs and WSPs transmit non-dialable CBNs in different formats. As a result, PSAPs have difficulty in interpreting the non-dialable CBN, e.g. NPA-911-XXXX or 000-000-0000.

If the CBN was standardized the PSAP call taker would be able to identify the characteristics of the handset by the format of the non-dialable CBN. If the PSAP can quickly identify and describe to the WSP 7x24 support centre the characteristics of the 9-1-1 caller's handset, a locate may be obtained in an expedited manner.

12.1 Recommendation

The ESWG investigate options for creating a Canadian standard for the format of non-dialable CBNs to be delivered to the PSAP after deployment of Wireless Phase II Stage 1, i.e. February 2010.

13 Summary of Conclusions and Recommendations

The ESWG has determined that if a wireless handset has a valid post-paid or pre-paid subscription with a Canadian WSP and they dial 9-1-1, their wireless Phase II location will be provided to the PSAP where wireless Phase II E9-1-1 has been implemented.

The wireless Phase I E9-1-1 service (cell sector ID) will continue to apply to all wireless call types in areas where it has been deployed. If a handset is in an irregular state, e.g. is uninitiated or is unregistered, a valid Call-Back Number and the wireless Phase II E9-1-1 location may not always be provided. In these situations PSAPs may contact the Carriers' 7x24 PSAP Support Centers for assistance in locating the handset. The ability of the WSPs' 7x24 PSAP Support Centers to locate the 9-1-1 caller will vary on a call by call and WSP basis.

The following are the conclusions and recommendations from the ESWG:

1. Normal active non-roaming handsets that are properly subscribed with WSPs would receive wireless Phase II E9-1-1 service in those

geographical areas where Phase II is supported.

2. For Canadian Roamers that are properly subscribed with WSPs would receive wireless Phase II E9-1-1 service in those geographical areas where Phase II is supported and the prerequisites are met.
3. For North American and International Roamers that are properly subscribed with 10 digit CBNs would receive wireless Phase II E9-1-1 service in those geographical areas where Phase II is supported and the prerequisites are met. Currently, this category of roamers would be the largest group of likely roamers in Canada.
4. For North American and International Roamers that are properly subscribed with other than 10 digit CBNs would not receive wireless Phase II E9-1-1 service in those geographical areas where Phase II is supported. Adoption of Option 1 (Maintain Current Configuration (Phase I and Phase II Stage 1)) is recommended.
5. For uninitiated handsets Phase I location information will continue to be delivered for uninitialized handsets. A non-dialable CBN will be transmitted to the PSAP. When the situation warrants it the PSAPs should contact the WSP's 24x7 support centres for assistance in locating the caller. The ability to locate the handset by the WSP will vary on a case by case basis and by the WSP. Phase II locate will not be provided automatically to the PSAP for this category due to technology limits.
6. For unregistered handsets the delay in registration affects the ability to perform Phase II locate which occurs after a handset is powered up or when the handset roams into another WSP's service area. Network registration occurs typically in less than 10 seconds. Phase I location information will be provided to the PSAP.

When the situation warrants it the PSAPs should contact the WSP's 24x7 support centres for assistance in locating the caller. The WSP may be able to manually query the handset at the request of the PSAP to provide the location information and if the CBN can be provided by the PSAP the Phase II locate may be obtained from the WSP's 24x7 support centre in a shorter time frame.

7. For lapsed subscription handsets Phase II locate will be supported. If necessary the support centre may lift the suspension or top up the subscriber's account to enable the PSAP to call back the handset. The PSAPs should contact the WSP's 24x7 support centres for assistance in locating the caller. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP.

8. For unsubscribed handsets Phase I location information will continue to be delivered. A non-dialable CBN is provided to the PSAP. For CDMA Phase II compliant handsets may provide Phase II location. However, an unsubscribed CDMA handset which has the same MIN as another handset may result in the incorrect handset being located. For an unsubscribed GSM handset initial locate is not possible because there is no CBN.

If necessary, the WSP's 7x24 support centre may be able to provide Phase II locate depending on the information available. The ability to locate the handset by the WSP will vary on a case by case basis and by WSP.

WSPs must notify subscribers that unsubscribed handsets should not be relied on for 9-1-1 service and that Phase II locate may not be possible. All 9-1-1 industry stakeholders should also inform the general public that unsubscribed handsets should not be relied on for 9-1-1 service and that Phase II locate may not be possible.

9. PSAPs will have an alternative for locating a handset when Phase II location information is not available. The WSPs' 24x7 PSAP support line may be able to provide location information. In cases where the 9-1-1 Service Provider is able to provide the CBN, the time required to perform a manual locate by the WSP will be reduced and it will also allow the PSAP the ability to call back the wireless handset. The success of locates requested from these support lines will vary on a call by call basis and be dependent on the quality and reliability of information available.
10. In order for the WSPs to expeditiously assist the PSAPs in locating a handset where the Phase II locate has not been automatically delivered, it is recommended that the ESRD, the time stamp of the call, the name of the WSP and any other pertinent information be provided.

The following table shows a summary of capabilities for each type of wireless call:

Wireless E9-1-1 Call Type	Characteristics	Wireless E9-1-1 Phase I Service	Dialable Call-Back Number (CBN)	Wireless E9-1-1 Phase II Location Service	Solutions for Phase II Location
Uninitiated	Handset has been manufactured and has some carrier information (such as a PRL) but no telephone number. This state includes any GSM handset without a SIM card.	Yes	No	No	WSPs' 7x24 PSAP Support Centre
Unregistered	A state where the handset has not passed registration, such as immediately after power-up. The subscriber may be valid or invalid. Calls other than 9-1-1 require the handset to first successfully pass registration.	Yes	No	No	WSPs' 7x24 PSAP Support Centre
Active	Normal operation. Handset can place and receive calls and roam but handset is operating within its home network. Wireless Phase II Stage 1 E9-1-1 locates will normally be provided to handsets in this state.	Yes	Yes	Yes	Phase II location information is automatically provided to PSAPs
Canadian Roamer	A handset with a 10 digit Canadian telephone number and a valid subscription. Handset is roaming onto another Canadian WSP's network.	Yes	Yes	Yes	Phase II location information is automatically provided to PSAPs providing prerequisites in 5.2 are met.
North American Roamer	A handset with a 10 or 11 digit non-Canadian NANP telephone number and a valid subscription. Handset is roaming onto a Canadian WSP's network.	Yes	Yes, if 10 digits are transmitted to 9-1-1 Service Provider.	Yes, if 10 digits are transmitted to 9-1-1 Service Provider.	Phase II location information is automatically provided to PSAPs providing prerequisites in 6.2 are met.
		Yes	No, if 11 digits are transmitted to 9-1-1 Service Provider.	No, if 11 digits are transmitted to 9-1-1 Service Provider.	PSAP call to 9-1-1 Service Provider Support Centre (to obtain CBN) then call WSPs' 7x24 PSAP Support Centre (to obtain locations)

Wireless E9-1-1 Call Type	Characteristics	Wireless E9-1-1 Phase I Service	Dialable Call-Back Number (CBN)	Wireless E9-1-1 Phase II Location Service	Solutions for Phase II Location
International Roamer	A handset with a non- NANP telephone number and a valid subscription. Handset is roaming onto a Canadian WSP's network.	Yes	Yes, if 10 digits are transmitted to 9-1-1 Service Provider.	Yes, if 10 digits are transmitted to 9-1-1 Service Provider.	Phase II location information is automatically provided to PSAPs providing prerequisites in 7.2 are met
		Yes	No, if other than 10 digits are transmitted to 9-1-1 Service Provider.	No, if other than 10 digits are transmitted to 9-1-1 Service Provider.	PSAP call to 9-1-1 Service Provider Support Centre (to obtain CBN) then call WSPs' 7x24 PSAP Support Centre (to obtain locations)
Lapsed Subscription	Suspended by the carrier. This stage includes prepaid phones with an account balance of \$0.00. The telephone number is still valid, but the handset cannot place or receive calls. The handset can call 9-1-1 or the WSP's customer service.	Yes	No. Telephone number is valid however due to suspension, the handset cannot be called.	Yes	If PSAP needs to call back handset, contact WSP's 7x24 PSAP Support Centre for support
Unsubscribed	Disconnected by the carrier. The telephone number has been recycled by the carrier (aged then reassigned to another handset) or the subscriber has ported the telephone number to another carrier.	Yes	No	Maybe (see analysis in section 11.2)	WSPs' 7x24 PSAP Support Centre

Appendix A – Glossary & Definitions

Term	Definition
3GPP	3 rd Generation Partnership Project. A 3 rd generation wireless technology group whose discussions are technically based upon the evolution of GSM core networks. http://www.3gpp.org/
3GPP2	3 rd Generation Partnership Project – 2. A 3 rd generation wireless technology group whose discussions are based upon evolution of CDMA radio access technology or ANSI-41 inter-mobile system signaling technology. http://www.3gpp2.org/
ALI	Automatic Location Identification system for the 9-1-1 service.
ANI	Automatic Number Identification. ANI serves a function similar to the “Caller ID” feature but utilizes different underlying network technology. In the context of this report, it is the wireless subscriber’s telephone number, normally transmitted to the PSAP as Call Back Number (CBN).
ANSI-41	American National Standards Institute 41. A mobile cellular telecommunications standard that supports inter-switch (i.e. Mobile Switching Center; MSC) and database (i.e. Home Location Register; HLR and Visitor Location Register; VLR) messaging to support functionality such as handoff and roaming authentication. ANSI-41 supports AMPS (Analog Mobile Phone System), TDMA (Time Division Multiple Access), and CDMA (Code Division Multiple Access) technology. GSM (Global System for Mobile communications) access technology utilizes MAP (Mobile Application Part) for similar messaging.
ANSI J-STD-036	American National Standards Institute (ANSI) standard technical that describes the handling of wireless Phase II E9-1-1 calls. It was jointly developed by the Telecom Industry Association (TIA) and the Alliance for Telecommunications Industry Solutions (ATIS). https://www.atis.org/docstore/product.aspx?id=22688
Country Code-1 (CC-1)	Related: North American Numbering Plan (NANP). The geographical area within North America that includes Canada, the US, and the Caribbean that uses Country Code 1. Telephone numbering within CC-1 follows the format NPA-NXX-XXXX, where NPA is the area code, N is a decimal digit ranging from 2 to 9, and X is a decimal digit ranging from 0 to 9. http://www.nanpa.com/reports/reports_npa.html
CBN	Call-Back Number. The calling party’s telephone number that is provided to a

	PSAP. It may be valid or dialable (the PSAP can dial it and reach the caller) or invalid (the CBN has been truncated, is blank, is out of date, or contains digits not related to the caller's telephone number).
CDMA	Code Division Multiple Access. A wireless access technology that uses spread-spectrum technology and a special coding scheme over the same physical channel.
CPE	Customer Premises Equipment (usually refers to PSAP equipment)
CWTA	Canadian Wireless Telecommunications Association www.cwta.ca
E.164	An ITU-T standard which defines the international public telecommunication numbering plan that is used within the public switched telephone network (PSTN). The E.164 telephone number has a maximum of 15 digits and is comprised of the following: Country Code (CC): 1 to 3 digits; National Destination Code (optional; in NANP this is called the area code or NPA and it has 3 digits such as 613); Subscriber Number (7 digits in the case of a NANP number).
ESN	Electronic Serial Number (on CDMA handsets; similar to IMEI on GSM handsets) MINs are administered by the Telecommunications Industry Association. The ESN label on a handset is located under its battery. http://www.tiaonline.org/standards/resources/esn/documents/esn_guidelines_v2.0.pdf
ESRD	Emergency Services Routing Digits. ESRDs provide routing information for wireless Phase I and II E9-1-1 calls from WSPs to PSAPs and provide Phase I location information to the PSAP, i.e. cell/sector identification. They are in the format NPA-511-XXXX or NPA-211-XXXX. http://www.cnac.ca/esrd_codes/esrd_assignment_guidelines.htm
ESRK	Emergency Services Routing Key. A unique number assigned to a wireless 9-1-1 call.
ESZ	Emergency Service Zone. The ESZ describes the PSAP area.
GOC	Government of Canada
GSM	Global System for Mobile communications. A wireless access standard. iDEN and UMTS are related technologies. When GSM is mentioned in this report, the analysis also applies to iDEN and UMTS.
GMLC	Gateway Mobile Location Center. The GSM/iDEN/UMTS system platform that receives, stores, and forwards position data within the wireless network.
HLR	Home Location Register. A central database located within each WSP system that

	contains a list of mobiles that is subscribed to that system.
iDEN	Integrated Digital Enhanced Network. Wireless access technology that has been developed by Motorola that combines ingredients from trunked radio and cellular telephone systems. iDEN utilizes TDMA radio technology and its handsets have SIM cards.
IMEI	International Mobile Equipment Identifier (serial number of a GSM handset; similar to ESN on CDMA handsets). They are administered by the GSM Association. The IMEI label is located under the battery of a handset. It may be electronically read by entering *#06# on the keyboard. http://www.gsmworld.com/documents/DG06_3v7-Draft.pdf
IMSI	International Mobile Station Identity. An identity number applicable to GSM, iDEN, and UMTS SIM cards. It is up to 15 digits long and is comprised of the Mobile Country Code (MCC), Mobile Network Code (MNC), and the Mobile Station Identification Number (MSIN).
Lapsed Subscription (short-term lapsed)	The state of a handset where the subscription has lapsed and the handset will not pass registration. As a result, the handset cannot originate or receive calls (except for originating 9-1-1 calls). The WSP 24x7 support center may have information corresponding with the subscriber. This definition also applies to prepaid phones with an account balance of \$0, where the handset's account has not entered the disconnected or unsubscribed state. The WSP 24x7 support center may have information corresponding with the subscriber.
MDN	Mobile Directory Number (the telephone number in an ANSI-41 based handset, such as CDMA). A MDN and MIN identify an ANSI-41 based handset.
MIN	Mobile Identification Number. The MIN identifies the WSP that an ANSI-41 based handset (e.g. CDMA) is subscribed to. A ported handset's MIN will not match its MDN. Prior to the implementation of LNP / WNP, a handset's MIN matched its MDN. An active ANSI-41 based handset requires both a valid MIN and valid MDN.
MLP	Mobile Location Protocol (Specification: Open Mobile Alliance OMA-TS-MLP-V3_2-20051124-C) The protocol for obtaining the location of a handset, used between a 9-1-1 ALI platform and a WSP's location-determination platform.
MPC	Mobile Position Center. The CDMA system platform that receives, stores, and forwards position data within the wireless network.
MSC	Mobile Switching Center. A centralized mobile telephone switching system that supports numerous cell sites and interfaces with trunks to the public switched telephone network (PSTN).

MSISDN	Mobile Station Integrated Services Digital Network. The telephone number associated with a GSM / iDEN / UMTS handset.
NPA	NPA. Numbering Plan Area, or Area code. Canadian NPAs may be viewed at: http://www.cnac.ca/npa_codes/npa_map.htm
NANP	North American Numbering Plan. Also known as Country Code 1. The geographical area within North America that includes Canada, the US, and Caribbean countries that use Country Code 1. Telephone numbering within the NANP follows the 10-digit format NPA-NXX-XXXX, where NPA is the area code, N is a decimal digit ranging from 2 to 9, and X is a decimal digit ranging from 0 to 9. A listing of NANP area codes may be found at the following link: http://www.nanpa.com/reports/reports_npa.html
NENA	National Emergency Number Association www.nena.org
PRL	Preferred Roaming List. A list that resides in a wireless handset that contains information used during the handset's system selection and acquisition / registration. The PRL enables a handset to roam onto foreign wireless carriers for the purpose of making and receiving calls. PRLs are downloaded to handsets during handset programming or during an Over The Air (OTA) handset update session.
Registered	The state of a handset where the handset has passed registration and the handset's information is stored in the VLR. During registration, the serving mobile switching center (MSC), within the handset's home system (in the case of a home mobile) or a foreign system (in the case of a roamer mobile), consults the handset's Home Location Register (HLR; identified by the handset's IMSI or MIN number). The response to a positive registration request is stored in the MSC's VLR. In other words, successful registration enables the mobile's telephone number and service profile to be entered into the MSC's VLR.
Roamer	A handset that has come within the coverage area of a WSP other than its home WSP (the "ROAM" indicator becomes lit), and successfully passes registration. Handsets identify potential WSPs for roaming by its Preferred Roaming List (PRL), which is programmed into the handset. TIF 58 has identified three types of roamers: <u>Domestic:</u> A handset from a Canadian WSP has roamed into and is supported by another Canadian WSP's coverage area. <u>North American:</u> A handset from a wireless carrier within the NANP (Country Code 1; the handset has a 10- or 11-digit telephone number) has roamed onto and is serviced by a Canadian WSP. <u>Overseas:</u> A handset from outside of North America (Country Code 1) has roamed

	onto and is supported by a Canadian WSP. The handset's telephone number may not be ten digits.
SIM	Subscriber Identity Module. A card the size of a thumbnail that resides under the battery of GSM, iDEN, and UMTS-based handsets. The SIM card contains the identity of the home carrier (IMSI).
TDMA	Time Division Multiple Access. A wireless access multiplex technology.
Uninitiated	The state of a handset where the CDMA handset has never been programmed with a MIN at a retail outlet or by other means. The handset has basic WSP information installed by the manufacturer and therefore will attempt a 9-1-1 call on the WSP network programmed in by the manufacturer. Instead of a valid telephone number, the 10-digit field may have all zeros or parts of the handset's electronic serial number (ESN). An uninitiated GSM handset does not have a valid, active SIM (SIMless).
Unsubscribed (long term lapsed)	A handset that has an identity with a specific WSP (via its MIN), but has no valid telephone number. The handset was active at one point in time but subscription has lapsed to the extent where the WSP has no record of the subscriber, or the telephone number has been ported out. In the case of long-term lapsed subscription, the telephone number is in aging, or is in a queue for assignment by a retail store, or has been assigned to a new and different subscriber.
Unregistered	The state of a handset that has not passed registration, e.g. the handset is suddenly powered up and a 9-1-1 call is placed. The subscriber may be valid or invalid. For calls other than 9-1-1, a handset must successfully pass registration before it can place or receive phone calls.
VLR	Visitor Location Register. A database located within each Mobile Switching Center (MSC) that contains a list of validated and active mobiles served by that switching system.

Appendix B: Discussion of Roamer Option 2

The following paragraphs capture details and impacts associated with handling of non 10 digit CBN/ANI within the 9-1-1 Service Provider network.

To provision an automatic solution to accommodate 11 digits over the long term, 9-1-1 Service Providers advise that, according to their switch vendors, additional software development is required on the 9-1-1 tandem switch in order to support the E.164 digit string (i.e. more than 10 digits, to a maximum of 15).

This analysis examines modifying the 9-1-1 service provider's network to accommodate more than 10 digits. The analysis of roamers and handset state translates into two key concepts; the length of the Call Back Number (CBN) at its ability to be dialed. The CBN is interpreted by the 9-1-1 Network as the Automatic Number Identifier (ANI). As such, the CBN length must comply with requirement dictated by North American standards, systems and protocols which today require a 10 digit number. Through testing, the 9-1-1 SPs have concluded that in their existing 9-1-1 Networks:

- The CBN/ANI delivered to the 9-1-1 System from the WSP can be any 10-digit number be it dialable or non-dialable (XXX-XXX-XXXX)
- If the CBN/ANI is not 10 digits, be it more or less, the 9-1-1 Network will treat it as an ANI failure
- In most cases, an ANI failure will result in a CBN/ANI of NPA-911-XXXX⁴ to be transmitted to the PSAP and as part of the MLP/GMLC query for Phase II Stage I location queries.

As 10-digit ANI is a fundamental, standard-based requirement for 9-1-1 today in North America, many 9-1-1 systems, protocols and equipment are intrinsically reliant on and limited to 10-digit ANI. In the course of this proceeding, the following issues and challenges have been highlighted in regard to non 10-digit CBN/ANI.

NANP Standards

The North American PSTN network, including the 9-1-1 voice network, is by design NANP-based and as such, compliant with the North American standards for interoperability across the entire North American PSTN Network. Those standards define the calling party number to be 10 or 11 digits in length.

⁴ The ANI format is defined in NENA 03-007, Recommended Standard for Emergency Service Central Office (ESCO) Code Selection, Assignment and Display Management (http://www.nena.org/sites/default/files/03-007_20050607.pdf)

Accepting full length E.164 numbers in the ANI and ANI-related fields may go against those standards.

In addition, MF, E-MF and SS-7 signaling specifications (Telcordia GR-2953, GR-2956) will need to be assessed to confirm compatibility with non 10-digit ANI. To have the standards modified, it would take 1 to 2 years and it would require a significant sponsor, such as the GOC / CWTA /NENA, etc.

It is worth noting that the United States has had Wireless E9-1-1 Phase II functionality for at least 10 years. During that time, technical assessments and standards have been developed to overcome this limitation as opposed to undertaking the monumental task of modifying core architecture.

It is unclear at the present time whether the potential modification to the North American standards would require ubiquitous adoption for all North American 9-1-1 Service Providers to ensure interoperability and integrity of the North American 9-1-1 networks.

A full assessment of the standards impacts by the standards bodies would need to take place. This can only be done by bringing the subject to the standards bodies' attention through their normal standards development process. From experience, this process from initiation, issue acceptance, solution development and full standard release can take several years.

Vendor Support

Vendors supplying equipment and software products destined for the North American market generally conform to the NANP standards. As such, in order to accept and process non 10-digit CBN/ANI, those vendors' products would require modification that could make the solution non-standard. The technical viability of such a solution has yet to be confirmed. It is not clear if vendors would accept to undertake such an important development activity at this time or before the solution has been specified by standard bodies. In the eventuality that the technical viability would be validated and all the vendors would agree to proceed, the extent of the modifications would need to be assessed technically and fiscally by each vendor prior to establishing an implementation timeline. Confirmation has been received from one predominant vendor that none of their currently available software loads support non 10-digit CBN/ANI, and is not currently part of their Future Path Plan. It should be noted that vendor implementation of standards follows the release of the updated standard by approximately one year.

One specific change that was discussed in ESWG and was confirmed by one vendor will be to the protocol which synchronizes 9-1-1 messaging from the E9-1-1 Tandem switch to the ALI. This protocol is currently only configured to process 10-digit ANI. As noted above, other aspects of the 9-1-1 infrastructure may be impacted and the technical viability of the solution needs to be confirmed.

Operational & service impacts

The Canadian 9-1-1 Service Providers are cognizant of their responsibilities in regard to providing a best-in-class 9-1-1 service to Canadian citizens. The introduction of a new software load onto the E9-1-1 Tandem switches is a delicate operation that requires a series of testing sessions and a well structured implementation plan to ensure service continuity. Switches are never upgraded in parallel within one's 9-1-1 Service Provider's network. Considering that all 9-1-1 switches would be required to upgrade to support this non-standard ANI, the switch implementation alone could take up to 12 months.

ILEC 9-1-1 Systems (effort required and impacts may vary per 9-1-1 service provider)

All of the current maintenance, surveillance, provisioning and 9-1-1 sub-systems rely on 10 digit ANI as a subset of the core 9-1-1 requirements. A complete analysis and software development would be required for most of these systems. Any change by the Vendor to core 9-1-1 software will result in subsequent development to the 9-1-1 service provider's systems.

Another 9-1-1 SP consideration is the impact on network signaling. Changes to the 9-1-1 SP's Voice Network may be required to accommodate non 10-digit CBN/ANI within the backbone of their E9-1-1 Voice network.

Considering the current CRTC 9-1-1 mandates, 9-1-1 service provider's would require 6 months to properly and fully assess changes with respect to non 10 digit CBN/ANI within its various systems provided the requirements are finalized and only once the vendor has provided details of software changes impacting 9-1-1 SP's systems. To be clear, the 6 months is required once vendor discussions have concluded, not in parallel with vendor discussions.

PSAP Interfaces

For PSAPs using Centrex 9-1-1 lines in certain configurations (Automatic Call Distribution, Electronic Business Systems) changes will need to be made to accommodate non 10-digit numbers within the E911 Centrex software package. LDT (Line-to-Digital Trunk) PSAPs will also have special configuration requirements and development with respect to 9-1-1 interconnection and non 10-digit CBN/ANI support.

The WSP interface/Interconnection documents and specifications provided by the 9-1-1 SP will need to be modified in order to support non 10 digit CBN/ANI. Rules, guidelines and parameters will need to be established to ensure common signaling/delivery.

9-1-1 service provider to PSAP interface specification changes will also be required. Specifically the 9-1-1 protocol for all wireless messages will need to be modified both for CAD (Computer Aided Dispatch) terminals as well as “dumb” terminals as well as most of the other interface specification. This will also require PSAP software development based on the revised interface documents.

The 9-1-1 service provider to PSAP router/PAD (Packet Assembler / Disassembler) interface will require assessment and may require configuration changes to support non 10-digit CBN/ANI.

PSAP Telephone switches and the CDR (Call Detail Records) transmitted for 9-1-1 messaging would need to be modified in order to process this new CBN/ANI format. SL1, Meridian and other commonly used switches may require modifications or software upgrades.

Considering the current CRTC 9-1-1 mandates, 9-1-1 Service Providers would require 6 months to properly assess changes with respect to non 10 digit CBN/ANI within its various interfaces provided the requirements are finalized and only once the vendor has provided details of software changes impacting 9-1-1 SP's systems. To be clear, the 6 months is required once Vendor discussions have concluded, not in parallel with Vendor discussions. Vendor confirmation is required since all specifications and interface changes will depend on 9-1-1 core changes and requirements.

The North American Network was designed for NANP. Trying to modify it to support strings of digits other than 10 digits is a significant undertaking that has ramifications deep into the core architecture. This would necessitate a meticulous assessment from the PSTN equipment vendors like Nortel, Lucent, Avaya, Mitel et al to nail down all the possible impacts. Since this might impact the core PSTN architecture, Telcordia's specifications may need to be changed. With that said, the 9-1-1 SPs are committed to continue this assessment, vendor discussions and exploration of alternatives in support of this report's recommendations.

Appendix C: Discussion of Roamer Option 3

The following paragraphs capture details and impacts associated with handling of non 10 digit CBN/ANI with the introduction of the ESRK method for implementing Wireless E9-1-1 Phase II. This is an alternative method to Option 2.

Emergency Services Routing Keys (ESRKs) have been deployed in the US to support wireless Phase II E9-1-1 calls. The ESRK is transmitted via the 10-digit CBN field to uniquely identify each wireless E9-1-1 call. The real CBN is transmitted from the WSP to the 9-1-1 Service Provider over the MLP link, including the initial Phase I data (ESRD / cell site information). The MLP interface supports the provisioning of more than 10 digits for CBN and as a result, the entire CBN may be presented to the PSAP without any ANI failures.

This solution would be to use the Network Call Associated Signalling (NCAS ESRK) method first introduced at NENA, also known as “Wireline Compatibility mode”.

This Wireless Phase II NCAS ESRK proposal is the standard-based (J-STD-36) and the solution would require minimum changes to the 9-1-1 infrastructure. The PSAPs would receive Phase II location automatically with the 2nd display with a valid and dialable CBN.

The PSAP display or CAD packet formats could be updated to 15-digit ANI on a per request basis.

However, this requires complete overhaul of the WSP location system inclusive of integrating the coordinated routing database (CRDB), which must include support for both ESRD and ESRK. ESRK management is a new process requiring more resources and procedures to manage the pool of numbers. A guideline would have to be developed by the CSCN. The ESRK pools would have to be managed by the CNA. WSP support systems must be modified to accommodate ESRKs.

Phase I routing is impacted and will increase call setup time and is dependent on WSPs location system. Initially a low level locate will have to be performed to obtain the ESRD and then again for the high level locate to obtain the location. There may be a 4 to 10 second delay in the delivery of Phase I data to the 9-1-1 Service Provider, as indicated by one infrastructure vendor. In options 1 and 2, the civic address is provided with the voice call.

Development time for the ESWG will include 6 months for industry analysis and technical specification recommendation, and switch vendors would require 18 months to deliver. Total redeployment of Phase I and Phase II role out would be required, including cell site by cell site validation.

Note: It is important that the industry must maintain the current Phase II Stage 1 service throughout this deployment.