



Telecommunications Service Provider (TSP) Interface Specification

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Document History

Version	Date	Author	Description of Change
1.0	2007		Original document.
2.1	December 2019	Carl Smith Liz Lett	Added Best Practices section. Rebranded to Intrado Life & Safety, Inc.
2.2	October 2021	Carl Smith Liz Lett	Updated section 7.3.1, PRI.2.1 to include PRI signaling types for Metaswitches. Updated section 7.3.1, PRI.2.10 to include additional acceptable dialed digits the PRI can send.
2.3	October 2022	Liz Lett	Updated section 1.3 References by changing “Telcordia” to “Ericsson” as the new owner. Updated section 2.3 to include additional ATIS information.
2.3.1	August 2023	Liz Lett	Updated Intrado Life & Safety, Inc. branding.

1.0 Introduction

The Intrado 9-1-1 Routing Network provides Selective Router functionality for Enhanced 9-1-1 (E9-1-1) emergency calls. In this role, the Intrado 9-1-1 Routing Network primarily accepts E9-1-1 calls from TSPs and routes them to the appropriate PSAP. This document discusses the PSTN interfaces supported by the Intrado 9-1-1 Routing Network that may be used by TSPs for these emergency calls. Intrado recommends that TSPs primarily use SS7 to signal emergency calls into the Intrado 9-1-1 Routing Network. SS7 signaling can reduce call setup times by typically 2-6 seconds at each stage of address signaling, as compared to CAMA signaling. In addition, compared to CAMA, SS7 can also reduce errors in transmitting Telephone Numbers (TNs).

Intrado recommends that each TSP consider connecting their network (see Figure 1) to the Intrado 9-1-1 Routing Network via at least two separate and independent trunking facilities (diverse routed). For each individual TSP End Office (see Figure 2), Intrado recommends two separate and independent emergency service (ES) trunk groups, each terminating on a different tandem switch or Intrado Point of Interfaces (POI) in the Intrado 9-1-1 Routing Network. (Business agreements may include other configurations as well.) If diverse connectivity is not used, the TSP is adding additional risk (with a single point of failure configuration). The TSP may choose to consolidate traffic from multiple EOs into these redundant and diverse trunk groups to the Intrado POIs. Intrado expects that the TSP will size the trunks appropriately to support a P.01 grade of service (or better) for all traffic. If the TSP encounters routing problems over any of these facilities, the call can be alternately routed by the TSP on another facility via a different POI into the Intrado 9-1-1 Routing Network. It is expected that any call rejection scenario encountered by the TSP when presenting the call to an Intrado POI would result in alternate route advancing to the other Intrado POI(s). SS7 in particular is expected to route advance on all call rejection cases, not just 'busy', or 'all trunks busy'

Only emergency E9-1-1 calls will be allowed into the Intrado 9-1-1 Routing Network. Any inbound direct-dial calls from TSPs will NOT be routed, but instead will be given final treatment (i.e., reorder tone then disconnected).

1.1 Scope

This document defines the specifications for the Public Switched Telephone Network (PSTN) interfaces available to a Telephone Service Provider (TSP) to send emergency calls into the Intrado 9-1-1 Routing Network. A Telephone Service Provider (TSP) may be a public carrier with wireline End Offices (EOs), wireline PBXs, wireless MSCs, etc. Because of the similarities, PSTN interfaces from Private Network PBX switches into the Intrado 9-1-1 Routing Network will also be included in this document. Within this document, the term TSP will also include these Private Network switches.

Refer to 'Intrado "Foreign Selective Router (FSR) Interface Specification – Intrado 9-1-1 Routing Network" [1]' for PSTN interfaces available to service providers with Foreign Selective Routers (FSRs) needing to connect with the Intrado 9-1-1 Routing Network.

Contact your Intrado representative for information on IP-based interfaces to the Intrado 9-1-1 Routing Network.

1.2 Terminology

In this document (Sections 6.0 and 7.0), the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT

RECOMMENDED”, “MAY”, and “OPTIONAL” are to be interpreted as described in BCP 14, RFC 2119 [2] and indicate “requirement levels” interface compliance.

1.3 References

- [1] Intrado, “Foreign Selective Router Interface Specification – Intrado 9-1-1 Routing Network” Revision 2.0, May 2012
- [2] Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels”, BCP 14, RFC 2119, March 1997
- [3] Ericsson, “Telcordia Technologies Specification of Signaling System Number 7”, GR-246-CORE, Issue 10, December 2005
- [4] Ericsson, “LSSGR: Switching System Generic Requirements for Call Control Using the Integrated Services Digital Network User Part (ISDNUP)”, GR-317-CORE, Issue 10, Nov 2007
- [5] Ericsson, “LSSGR: Switching System Generic Requirements for Interexchange Carrier Interconnection (ICI) Using the Integrated Services Digital Network User Part (ISDNUP)”, GR-394-CORE, Issue 8, Nov 2007
- [6] Ericsson, “LSSGR: Switching System Generic Requirements Supporting ISDN Access Using the Integrated Services Digital Network User Part (ISDNUP)”, TR-NWT-444, Issue 3, May 1993.
- [7] Ericsson, “CCS/SS7 Generic Requirements in Support of E9-1-1 Service”, GR-2956-CORE, Issue 5, December 2002
- [8] NENA, “SS7 Guidelines for MSC to Selective Router Connectivity”, NENA-05-501, October 16, 2002
- [9] Ericsson, “Signaling for Analog Interface”, GR-506-CORE, Issue 3, December 2011
- [10] ANSI, “Network-to-Customer Installation Interfaces – DS1 – Electrical Interfaces”, ATIS- 0600403.1999(R2012)
- [11] Ericsson, “ISDN Primary Rate Interface Call Control Switching and Signaling Generic Requirements for Class II Equipment”, TR-NWT-1268, Issue 1, December 1991, Rev 4, March 1998
- [12] Ericsson, “Notes on the Networks”, SR-2275, Issue 4, Oct 2000
- [13] Ericsson, “Switched Access Service: Transmission Parameter Limits and Interface Combinations”, GR-334-CORE, Issue 1, July, 1994
- [14] ATIS “Loss Plan for Digital Networks”, ATIS T1.0100508, Rev 03, 2008 (formerly ATIS T1.508)
- [15] Ericsson, “LSSGR: Transmission, Section 7”, GR-507, Issue 1, June 2000
- [16] ITU-T, “Talker echo and its control”, Recommendation G.131
- [17] ITU-T, “Transmission Planning for Voiceband Services over Hybrid Internet/PSTN Connections”, Recommendation G.177
- [18] ANSI “Telecommunications Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network” TIA-968, Rev B, Mar 12, 2010

1.4 Definitions

Table 1: Definitions

Term	Definition
E9-1-1 Selective Router	The E9-1-1 Selective Router (SR) is a preexisting network element that receives a 9-1-1 call from a caller or another switch (for example, the LEC terminating switch), locates the appropriate PSAP, and delivers the call to the PSAP. In order to determine the correct PSAP, the E9-1-1 SR queries a Selective Routing Database (SRDB). The SRDB may be within the E9-1-1 SR, an adjunct, or in the ALI system. It receives an ESN from the SRDB and correlates it to lines or trunks associated with the PSAP. The E9-1-1 SR delivers the call across these lines or trunks passing the ESQK.
PSAP (Public Safety Answering Point)	The PSAP is a preexisting network element that receives the Emergency Services call from the E9-1-1 Tandem. With the delivery of the call, the PSAP has voice contact with the calling party but does not have sufficient visual information to assist in handling the call. The PSAP queries the ALI database for this information.
PSTN (Public Switched Telephone Network)	The world's collection of interconnected voice-oriented public telephone networks, both commercial and government-owned. It is the aggregation of circuit-switching telephone networks that has evolved over time. Today, it is almost entirely digital technology except for the final link from the central (local) telephone office to the user.

1.5 Acronyms and Abbreviations

Table 2: Acronyms and Abbreviations

Term	Definition
ACM	Address Complete Message
ALI	Automatic Location Identification
ANI	Automatic Number Identification
ANM	Answer Message
ANSI	American National Standards Institute
ATIS	Alliance for Telecommunications Industry Solutions
CAMA	Centralized Automated Message Accounting
CAS	Channel Associated Signaling
CBN	Call Back Number
CdPN	Called party Number
CgPN	Calling Party Number
ChGN	Charge Number
COT	Continuity Test

Term	Definition
CpCAT	Calling Party Category
dB	Decibel
dBm	Power ratio in decibels of the measured power referenced to one milliwatt (mW)
DPO	Dial Pulse Only
DS0	Digital Signal 0
DS1	Digital Signal 1
E9-1-1	Enhanced 9-1-1
E9-1-1 SR	E9-1-1 Selective Router
EO	End Office
ERL	Echo Return Loss
ES	Emergency Services
ESF	Extended Super Frame
ESN	Emergency Services Number
ESQK	Emergency Services Query Key
ESRD	Emergency Services Routing Digits
ESRK	Emergency Services Routing Key
FCC	Federal Communications Commission
FSR	Foreign Selective Router
GDP	Generic Digits Parameter
HCAS	Hybrid Channel Associated Signaling
IAM	Initial Address Message
IETF	Internet Engineering Task Force
ICI	Interexchange Carrier Interconnection
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISDNUP	Integrated Services Digital Network User Part
ISUP	Integrated Services Digital Network User Part
kHz	Kilohertz
KP	Key Pulse
LEC	Local Exchange Carrier
LSSGR	LATA Switching System Generic Requirements
MF	Multi-Frequency
ms	Millisecond

Term	Definition
MSC	Mobile Switching Center
MTP	Message Transfer Part
NCAS	Non-Channel Associated Signaling
NENA	National Emergency Number Association
NOC	Network Operations Center
NPA	Number Plan Area
NXX	Office Code
OLI	Originating Line Information
OOS	Out-Of-Service
pANI	Pseudo Automatic Number Identification (ANI)
PBX	Private Branch Exchange
POI	Point Of Interface
PRI	Primary Rate Interconnection
PSAP	Public Safety Answering Point
PSTN	Public Switched Telephone Network
RCL	Release Complete Message
REL	Release Message
RFC	Request for Comments
SP	Service Provider
SR	Selective Router
SRDB	Selective Routing Database
SS7	Signaling System 7
ST	Start Signal
STP	Signaling Transfer Point
TN	Telephone Number
TSP	Telephone Service Provider
VoIP	Voice over Internet Protocol (IP)

2.0 Best Practices

In this section, Intrado outlines recommended best practices for TSPs to utilize to maximize the probability of call delivery. Some of the recommendations will be covered in more detail in subsequent sections. Intrado realizes that implementation of these practices will be TSP switching facility-dependent and ultimately the TSP's responsibility.

2.1 Redundant Trunk Facilities

TSPs shall use at least two (2) trunk facilities terminating to different Points of Interfaces (POIs). For clarification, if the TSP only has a need (based on traffic) for 1 DS0, Intrado's recommendation is that two trunk facilities each with a DS0 be provided by the TSP.

2.2 Trunk Selection

When a TSP needs to select a trunk to deliver the 9-1-1 call, the best practice is to alternate between the redundant trunk groups. For example, if the TSP has two 9-1-1 trunk groups, the first 9-1-1 call uses trunk group 1; the second 9-1-1 call uses trunk group 2; the third 9-1-1 call uses trunk group 1, etc. This is preferred over a primary/secondary arrangement because the secondary trunk group is only used when the first trunk group is busy. Depending on traffic conditions, it could be days or weeks before a call is ever presented to trunk group 2, thus highly recommended best practice is to exercise both trunks groups regularly.

For the individual trunks in each trunk group, the best practice is to round-robin amongst the DS0s. Again this will exercise all DS0s regularly. The goal is to identify trunks in need of maintenance during normal lower call load conditions as opposed to trying to use those trunks for the first time in a higher call volume condition.

2.3 Route Advancement

In the case of SS7-based trunks, the TSPs could get returned a non-success cause code indicating a failure on the Intrado side of the 9-1-1 Routing Network. Should that occur, the TSPs should route advance to the next trunk group (Note: do not route advance to the next DS0 in the same trunk group). Selecting another trunk group may allow the call to be delivered to a different Intrado 9-1-1 Routing Infrastructure that is not experiencing the issue that returned the cause code initially.

After utilizing route advancement, should the cause code persist, the TSPs should provide call treatment (reorder, busy, fast busy, etc). The desire is to not have the 9-1-1 call end up with dead air, but rather entice the caller to hang-up as soon as possible and try again. Please note that Intrado recognizes the implementation issue for some TSPs is that the cause code definitions and treatments on a particular switch infrastructure is for any call (i.e., POTS) and are not specific to a 9-1-1 call, thus tuning treatments for 9-1-1 calls impacts how a POTS call is treated.

Please find below references for TSPs to examine on cause codes and treatments.

ATIS - You may access this reference material if you are a current ATIS member at www.atis.com. If you are not a current ATIS member you may become one by contacting ATIS at admin@atis.access.org.

Reference [4] contains SS7 Cause Code information from an LSSGR. (Note: there is a cost to obtain this document.)

Again, this information is provided as recommended best practice, however TSPs should consult the technical manuals for their specific switching facility(s).

3.0 TSP Switch Homing to Intrado 9-1-1 Routing Network

The Intrado 9-1-1 Routing Network has been implemented with high availability and redundancy design goals. To complement the Intrado 9-1-1 Routing Network reliability and availability, Intrado recommends that TSPs connect to the Intrado 9-1-1 Routing Network via two separate and independent trunking facilities (diverse routed). Each TSP switch facility will then terminate on a separate and independent Intrado 9-1-1 Routing Network Point of Interface (POI). If the TSP encounters routing problems into one Intrado 9-1-1 Routing Network POI, the call can be alternately routed by the TSP on another facility into the Intrado 9-1-1 Routing Network via a different POI.

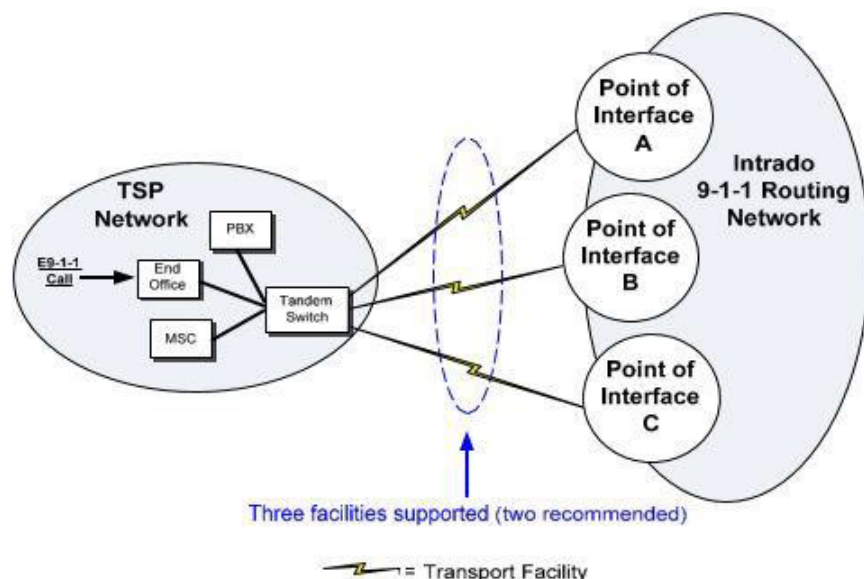


Figure 1: TSP Network Trunking Access to the Intrado 9-1-1 Routing Network

The transport used by the TSP to connect an individual switch to the Intrado Point of Interface (POI) will typically consist of two diverse routed DS1 based facilities.

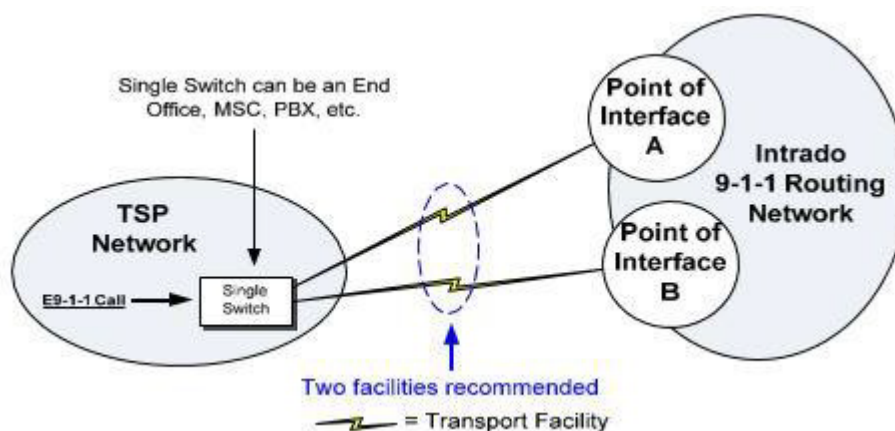


Figure 2: TSP Single Switch Trunking Access to the Intrado 9-1-1 Routing Network

3.1 Intrado POI at TSP Site

The previous section showed the TSP providing the facilities which connect with the Intrado POIs located on the Intrado network. Business agreements may include another configuration option, where Intrado provides the facilities to the TSP site. From the TSP's viewpoint, the Intrado POI is 'local' or co-located with the TSP switch. See the picture below.

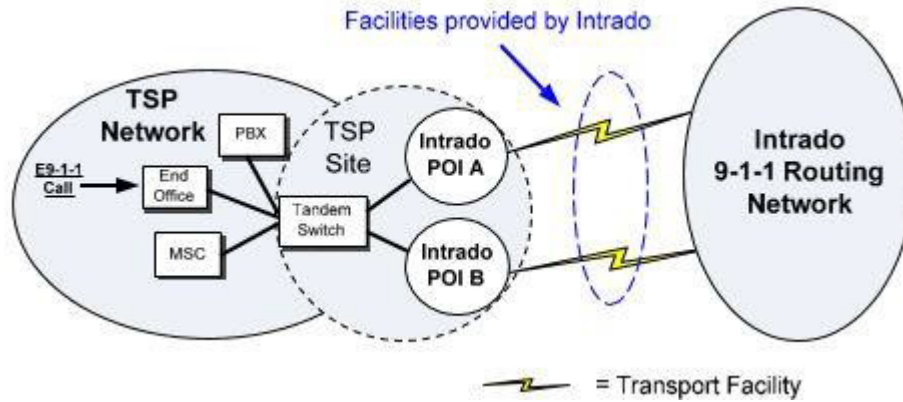


Figure 3: Intrado POIs at TSP Site

4.0 SS7 Signaling to Intrado 9-1-1 Routing Network

SS7 facilities are the preferred signaling option into the Intrado 9-1-1 Routing Network because of their signaling accuracy and call setup speed, as compared to CAMA facilities.

The TSP typically has two configuration options for obtaining SS7 access into Intrado¹:

- Option 1: Connect the TSP SS7 signaling links to the VeriSign SS7 signaling network, which is the SS7 network used by Intrado.
- Option 2: Connect the TSP SS7 signaling links to an alternative SS7 provider, which then has connectivity to the VeriSign SS7 network.

The following figure shows the configuration for a TSP using SS7 to send 9-1-1 calls to the Intrado 9-1-1 Routing Network.

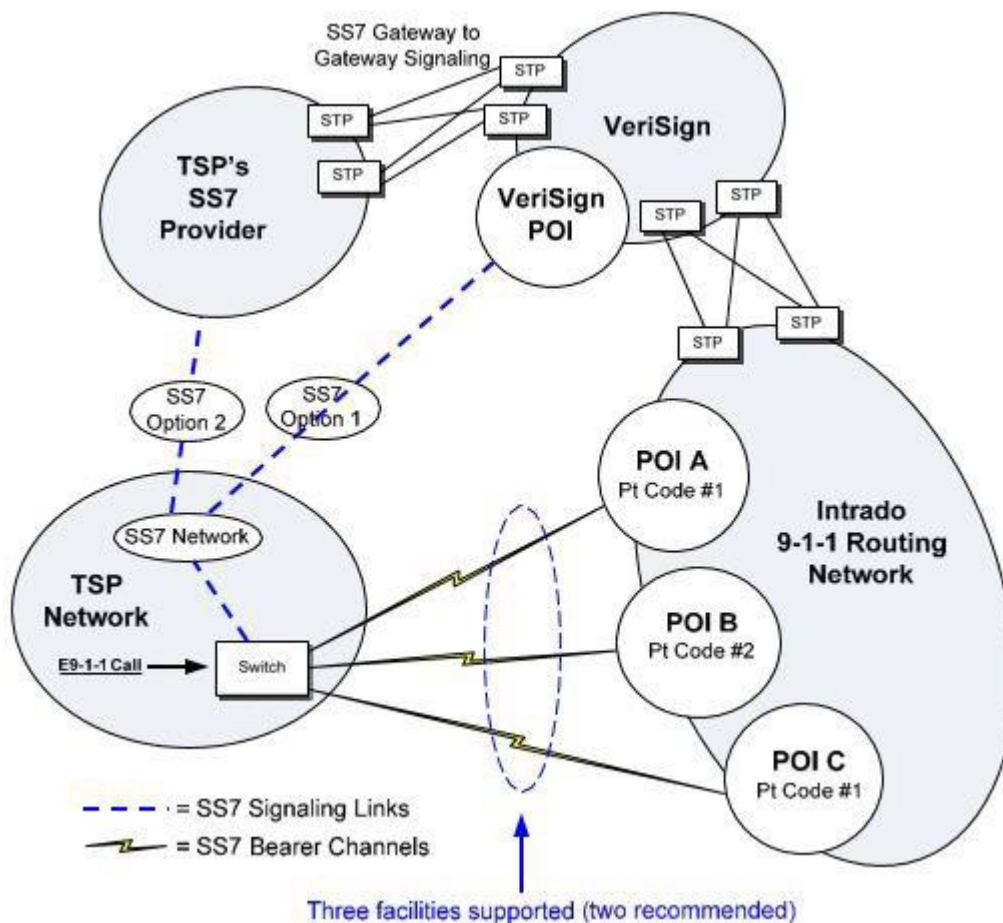


Figure 4: TSP Using SS7 Signaling to Access Intrado 9-1-1 Routing Network

¹ Other access configurations are available with appropriate business agreements. For example, the TSP STPs may be directly connected to the Intrado STPs.

Note: Each TSP switch will typically be signaling to two different SS7 point codes in the Intrado 9-1-1 Routing Network, no matter the number of interconnecting bearer facilities or the geographic location of the Intrado POIs.

SS7 facilities support wireline, NCAS, CAS, and HCAS wireless calls. SS7 signaling for NCAS wireless calls is very similar to wireline, and in fact, NCAS wireless is sometimes referred to as 'wireline compatible' or 'wireline equivalent'. For this reason, wireline and NCAS wireless are grouped together in the discussion and requirements of this document.

Likewise, CAS and HCAS wireless signaling types are grouped together in the discussion and requirements of this document, because the inter-network signaling and call flows are identical.

If a TSP attempts to route a call via an SS7 trunk group to the first Intrado 9-1-1 Routing Network POI and the call attempt fails for any reason, the TSP should attempt to route the call via a different SS7 trunk group(s) to a different POI of the Intrado 9-1-1 Routing Network.

4.1 Call Flow

The following describes the call flow for SS7 signaling.

1. A caller dials 9-1-1 and the call is routed to the TSP switch.
2. The TSP switch sends an Initial Address Message (IAM) containing an ANI for wireline calls, an ESRK pANI for NCAS wireless calls, and both a CBN and ESRD pANI for CAS/HCAS wireless calls. The formats are shown in Tables 6 and 8 below.
3. The TSP switch provides COT test tone in-band for the signaled trunk. Intrado loops the DS0 back to TSP.
4. The TSP switch sends COT message to indicate successful test.
- 5-7. Standard SS7 signaling occurs for the remainder of the call.
8. Either end of the call can initiate call tear down.
9. Release complete.

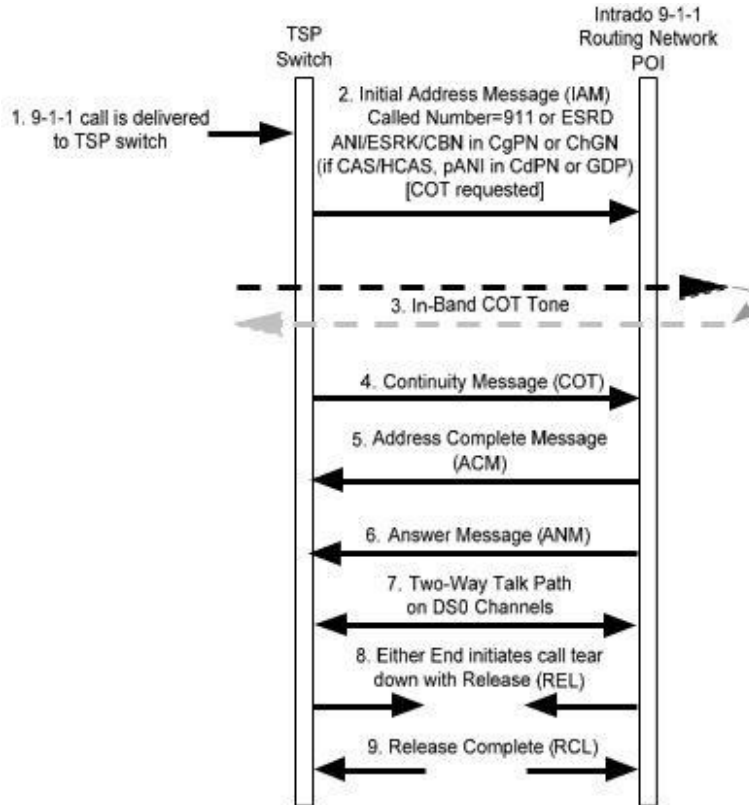


Figure 5: SS7 Signaling to Access Intrado 9-1-1 Routing Network

5.0 ISDN/PRI Signaling to Intrado 9-1-1 Routing

Along with SS7, ISDN/PRI facilities are preferred for their signaling accuracy and call setup speed, as compared to CAMA facilities.

It is expected that PBXs will be the most likely switch type sending 9-1-1 calls into the Intrado 9-1-1 Routing Network using ISDN/PRI facilities. However there is no technical reason that an EO or an NCAS MSC could not also connect to the Intrado 9-1-1 Routing Network using ISDN/PRI. The supported ISDN/PRI interface transports a single 10 digit number for each 9-1-1 call into the Intrado 9-1-1 Routing Network, so wireless CAS or HCAS calls are not supported.

If a TSP attempts to route a call via PRI to the first Intrado 9-1-1 Routing Network POI, and the call attempt fails, the TSP should attempt to route the call via the other PRI(s) to a different POI into the Intrado 9-1-1 Routing Network.

5.1 Call Flow

The following describes the call flow for ISDN/PRI signaling.

1. A caller dials 9-1-1 and the call is routed to the TSP switch.
2. The TSP switch originates a call into Intrado 9-1-1 Routing with an ISDN PRI (Q.931) SETUP message, with the following Q.931 call attributes set

Called Number = 911²

Calling Number = NPA-NXXYYYY (10 Digit ANI or ESRK)

- 3-10. The call setup continues using standard ISDN call processing. Either call end can initiate call tear-down.

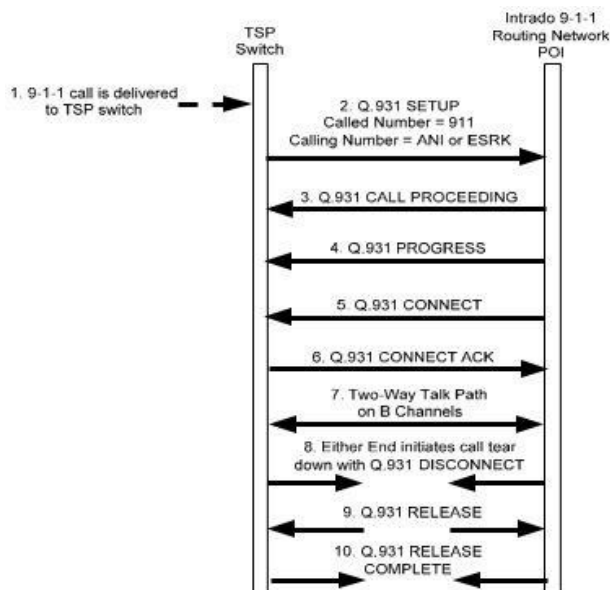


Figure 6: ISDN/PRI Signaling to Access Intrado 9-1-1 Routing

² The Called Number should be 911, but may alternatively be 11, 1, or no digits.

6.0 CAMA Signaling to Intrado 9-1-1 Routing Network

When the preferred signaling method of SS7 is not available, CAMA trunking is supported into the Intrado 9-1-1 Routing Network. Two CAMA options are supported:

1. CAMA on DS0 based facilities (i.e., DS1) using 7 digit ANI plus an Information Digit (I Digit)
2. CAMA on DS0 based facilities using 7 digit ANI without an I Digit

For CAMA trunk groups, the Called Number is typically 911 (or alternatively 11, 1, or no digits). The Calling Number will consist of the 7 digit ANI of the call originator and will be missing the NPA (which is implied by the trunk group).

6.1 Call Flow

The following describes the call flow for CAMA signaling.

1. A caller dials 9-1-1 and the call is routed to the TSP switch. The TSP switch could be a wireline End Office, a wireless MSC, or a PBX.
 2. The TSP switch seizes the CAMA trunk by going off-hook.
 3. The Intrado 9-1-1 Routing Network acknowledges the seizure and indicates readiness to accept MultiFrequency (MF) address digits by replying with a wink, which is a temporary off-hook.
 4. The TSP switch signals (using MF) the Called Number. The MF digit string sent is KP + 911 (or 11, 1, or no digits) + ST.
 5. The response is a steady off-hook, which indicates readiness to accept additional MF address digits.
 6. The TSP switch uses MF to signal the Calling Number in the form "KP + I + NXXXXXX + ST", where "NXXXXXX" is the last 7 digits of the ANI/pANI (ANI/ pANI with the NPA removed), and "I" equals either:
 - o Zero (0) if the ANI/ pANI is valid
 - o Two (2) if the ANI/ pANI is invalid
- Note: Intrado also supports an alternative configuration for DS0 based CAMA where the TSP sends no "I" digit and the TSP MF signals "KP + NXXXXXX + ST".
7. At this point, there is a two way talk path between the call originator and the destination. Note that there is no answer supervision signaled from the Intrado 9-1-1 Routing Network to the TSP switch.
 8. Either end can disconnect the call by going on-hook.

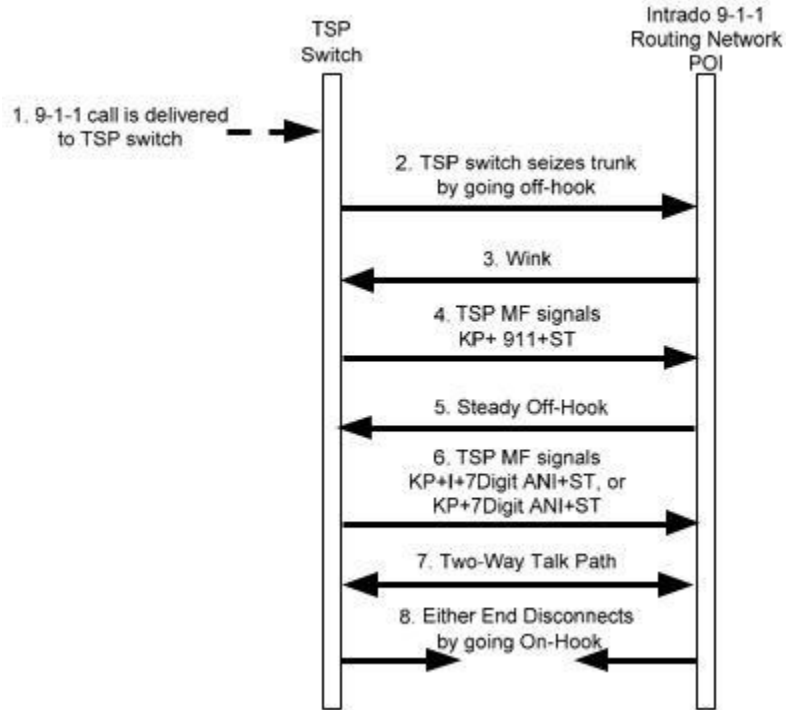


Figure 7: CAMA Signaling to Access Intrado 9-1-1 Routing Network

7.0 Intrado 9-1-1 Routing Network Interface Requirements

7.1 DS1 Physical Requirements

These physical requirements apply for all DS1 facilities.

Table 3: DS1 Physical Requirements

Number	Requirement	Comments
PHY.0.1	The TSP builds a dedicated facility (T1) for connection to each Intrado 9-1-1 Routing Network Point of Interface. (Unless negotiated otherwise by specific agreement.) It is acceptable to have multiple trunk groups over the same DS1 facility.	
PHY.0.2	The TSP builds the circuit tag for designation as an emergency services facility.	
PHY.0.3	The TSP sets the framing to Extended Super Frame (ESF) for DS1 facilities.	
PHY.0.4	The TSP sets the line encoding to B8ZS for DS1 facilities.	
PHY.0.5	The TSP allows Intrado Life & Safety to provide the timing source for these digital facilities. (Unless negotiated otherwise by carrier specific agreement.)	

7.2 Intrado 9-1-1 Routing Network SS7 Requirements– General

The following requirements apply to all SS7 call types.

Table 4: SS7 Requirements

Number	Requirement	Comments
SS7.1.1	The TSP ensures that their SS7 signaling is routed to Intrado's SS7 network.	
SS7.1.2	The TSP switch uses SS7 signaling for call setup and release, which is compliant with GR-246 [3], GR-317-CORE [4], GR-394-CORE [5], GR-444-CORE [6], and/or GR-2956-CORE [7]—as appropriate for the caller's origination call type and the TSP switch type.	
SS7.1.3	The TSP switch includes in the Initial Address Message (IAM) (for a percentage of calls to be agreed upon with Intrado) the mandatory Nature of Connection Indicator, set such that a continuity test (COT) is required. The determined percentage will be negotiated with Intrado.	

Number	Requirement	Comments
SS7.1.4	The TSP switch includes in every Initial Address Message (IAM) the mandatory Calling Party Category (CpCAT) parameter set to a value of 224, 225, or 226 decimal (E0, E1 or E2 hex). Typically E0 is used. All other CpCAT values will be treated as non-emergency by the Intrado 9-1-1 Routing Network.	
SS7.1.5	The TSP switch sets the MTP message priority = 1 (not 0) for all emergency calls. (Note: Because dedicated facilities are used, either MTP priority = 1 or 0 will be acceptable by the Intrado 9-1-1 Routing Network.)	
SS7.1.6	SUSPEND/RESUME messages will not be sent by the Intrado 9-1-1 Routing Network to the TSP switch.	
SS7.1.7	It is recommended that the TSP network use quad links for the SS7 interconnect with the Intrado SS7 network. At a minimum dual SS7 links should be used.	
SS7.1.8	It is required that the TSP network signal the Echo Control bit to the Intrado network. The 'Nature of Connection' indicator will be included within the IAM sent from the TSP to the the Intrado 9-1-1 Routing Network, with 'Echo Control' set to 1 (one) when an outgoing half echo control device is enabled in the TSP network, or 0 (zero) otherwise.	
SS7.1.9	It is strongly recommended that the TSP route advance across the available Intrado POIs for all rejected call attempts (i.e., for any ISUP error response code).	Route advance should occur for more than just busy.

7.2.1 Wireless NCAS and Wireline SS7 Variants

Because the SS7 signaling is identical for wireline and NCAS wireless calls, the requirements for both are listed together below.

Table 5: Wireline and Wireless NCAS SS7 Requirements

Number	Requirement	Comments
SS7N.1.1	The TSP switch can set the Originating Line Information (OLI) to any value other than 61, 62, or 63. Typically the OLI value used will be zero (or null). No OLI parameter being sent is also valid.	
SS7N.1.2	The TSP switch populates the ANI (for wireline calls) or pANI (for NCAS wireless calls) into either the Calling Party Number or the Charge Number. See the table below (taken from NENA 05-501 [8]) for NCAS A1-A3 definitions. The choice of NCAS A1, A2, or A3 for each of these trunk groups must be communicated to Intrado.	
SS7N.1.3	The TSP switch populates the Called Party Number with the digits 911.	

Table 6: Wireless NCAS and Wireline SS7 Requirements

ISUP Parameter Option	OLI Wireless	CpCAT Emergency	Called Party Number	Calling Party Number	Charge Number	Generic Digits Parameter
FNCAS A1	NO	YES	911	ESRK	ESRK	BLANK
NCAS A2	NO	YES	911	ESRK	-	BLANK
NCAS A3	NO	YES	911	-	ESRK	BLANK

Note: BLANK fields indicate that this parameter MUST NOT be populated.

7.2.2 Wireless HCAS and CAS SS7 Interfaces

Table 7: Wireless HCAS and CAS SS7 Interfaces

Number	Requirement	Comments
SS7C.1.1	The TSP switch sets the Originating Line Information (OLI) to 61, 62, or 63 decimal (3D, 3E, and 3F hex), indicating a wireless call.	
SS7C.1.2	The TSP switch populates the CBN into either the Calling Party Number or the Charge Number. See the table below (taken from NENA 05-501 [8]) for CAS A1-A3, E1-E2, and I1-I2 definitions. The choice of CAS A1, A2, A3, E1, E2, I1, or I2 for each of these trunk groups must be communicated to Intrado.	
SS7C.1.3	The TSP switch populates the ESRD pANI into either the Called Party Number or the Generic Digits Parameter Number. The choice of CAS A1, A2, A3, E1, E2, I1, or I2 for each of these trunk groups must be communicated to Intrado.	
SS7C.1.4	When the Generic Digits Parameter is used for the ESRD pANI, the TSP switch populates the Called Party Number with the digits 911.	
SS7C.1.5	When the Generic Digits Parameter is used for the ESRD pANI, the TSP switch populates one and only one 10 digit number in the Generic Digits Parameter.	
SS7C.1.6	When the Generic Digits Parameter (GDP) is used for the ESRD pANI, the TSP switch sets the GDP 'type of digits' = 13 decimal (0D hex).	

Table 8: Wireless HCAS and CAS SS7 Requirements

ISUP Parameter Option	OLI Wireless	CpCAT Emergency	Called Party Number	Calling Party Number	Charge Number	Generic Digits Parameter
CAS A1	YES	YES	911	CBN	CBN	ESRD
CAS A2	YES	YES	911	CBN	-	ESRD
CAS A3	YES	YES	911	-	CBN	ESRD
CAS E1	YES	YES	ESRD	CBN	CBN	BLANK
CAS E2	YES	YES	ESRD	CBN	-	BLANK
CAS I1	YES	YES	ESRD	CBN	CBN	ESRD
CAS I2	YES	YES	ESRD	CBN	-	ESRD

NOTE: BLANK fields indicate that this parameter MUST NOT be populated.

7.3 PRI Facility Requirements

See Section 7.1 for facility requirements for the PRI Interface. The following additional requirements apply to PRI connections to the Intrado 9-1-1 Routing Network.

7.3.1 PRI Requirements

Table 9: PRI Requirements

Number	Requirement	Comments
PRI.2.1	The TSP configures their ISDN PRI signaling to NI2. Additionally Metaswitches are capable of supporting the following PRI signaling types: 5ESS Custom, 5ESS National, DMS-100, DMS-200, ETS 300, and NI-2.	
PRI.2.2	The TSP configures their switch to User side. (Intrado will be the Network side - or as negotiated with the TSP.)	
PRI.2.3	TSP allows SERVICE messaging for individual B channels.	
PRI.2.4	The TSP sets the Two B Channel Transfer feature off.	
PRI.2.5	The TSP sets channels 1-23 as B channels.	
PRI.2.6	The TSP provisions any number of the 23 B channels as equipped/in-service. The remaining B channels will be considered out-of-service (OOS).	
PRI.2.7	The TSP sets channel 24 as the D channel on each PRI facility (i.e., Facility Associated Signaling).	
PRI.2.8	The TSP may not configure Backup D channels.	

Number	Requirement	Comments
PRI.2.9	TSP configures the PRI to be 1-way, with all calls coming from the TSP into the Intrado 9-1-1 Routing Network.	
PRI.2.10	TSP switch populates Q.931 Called Party Number with digits 911. It is also acceptable to send 1, 11, or I911.	
PRI.2.11	The TSP switch populates the Q.931 Calling Party Number with the caller's telephone number (i.e., ANI for wireline calls, and pANI for wireless NCAS calls).	
PRI.2.12	All other PRI signaling parameters populated by the TSP, which are not mentioned in these requirements, will be ignored by the Intrado 9-1-1 Routing Network.	
PRI.2.13	The TSP switch accommodates 'early cut-through' (i.e., pre-CONNECT) operation of the Intrado 9-1-1 Routing Network which will provide the TSP with audible ring tones.	
PRI.2.14	TSP calls to the Intrado 9-1-1 Routing Network specifying 'Speech and 3.1kHz Audio' as the Bearer Capability.	
PRI.2.15	The Intrado 9-1-1 Routing Network will not provide any screening on the Calling Party Number provided by the TSP.	
PRI.2.16	The TSP switch accepts STATUS ENQUIRY requests and provides STATUS responses.	
PRI.2.17	The TSP switch accepts RESTART requests and shall restart the requested channel(s) or interface.	

7.4 CAMA Requirements

7.4.1 Physical DS0 via DS1 Facility Requirements

See Section 6.0 for DS1 facility requirements.

7.4.2 DS0 Based CAMA Requirements

The following requirements apply to DS0-based CAMA trunk groups.

Table 10: DS0 Based CAMA Requirements

Number	Requirement	Comments
CAM.2.1	The TSP switch conforms to the seizure, hit, answer, and disconnect supervisory signaling requirements of GR-506-CORE [9].	
CAM.2.2	The TSP switch uses the A/B/C/D supervisory signaling of the Dial Pulse Only (DPO) signaling type of ANSI T1.403.2 [10] (e.g., Transmit A/B =0 for on-hook, and A/B=1 for off-hook. Receive interpret A=0 as on-hook, and A=1 as off-hook.	

7.4.3 CAMA Requirements

The following requirements apply to all CAMA interfaces.

Table 11: CAMA Requirements

Number	Requirement	Comments
CAM.4.1	The TSP switch conforms to the MultiFrequency (MF) digit signaling requirements of GR-506 [9].	
CAM.4.2	The TSP switch conforms to the wink start digit signaling control requirements of GR-506 [9] and ANSI T1.411-2001 (e.g., accept a wink of 100-350 msec from Intrado as the signal to send MF digits).	
CAM.4.3	The TSP configures the CAMA trunk as a 1 way trunk (i.e., the TSP switch will always originate the 9-1-1 call into the Intrado 9-1-1 Routing Network).	
CAM.4.4	The TSP switch, on an idle trunk, interprets an off-hook from Intrado as a 'trunk busy' or out-of-service condition.	
CAM.4.5	The TSP sends the digits '9 1 1' (or alternatively 11, or 1, or no digits) as the Called Number, which is the first set of MF digits sent (see step 4 of Section 6.1 "Call Flow"). The MF digit string sent is 'KP 911 ST'.	
CAM.4.6	The TSP provisions each CAMA trunk group to either use the I Information Digit as part of the ANI, or not. If no I Digit is to be sent, CAM.5.7 and CAM.5.8 below will not include the I Digit.	
CAM.4.7	The TSP switch sends the 7 digits 'NXXXXXX' as the Calling Party Number, or ANI, within the MF digit string 'KP I NXXXXXX ST' (see step 6 of Section 6.1 "Call Flow"). The NPA of the Calling Party Number, or ANI, is implied by the trunk group.	
CAM.4.8	The TSP switch sets the I Digit to zero, when a valid ANI is sent in the MF digit string 'KP I NXXXXXX ST'. If the TSP does not have a valid ANI, the TSP sets the I Digit = 2, and sends the MF digit string 'KP 2 ST' instead.	
CAM.4.9	The TSP configures a separate CAMA trunk group for each NPA for calls being routed into the Intrado 9-1-1 Routing Network.	
CAM.4.10	The TSP is able to accommodate a two-way talk path for a stable call at the conclusion of the ANI MF digit transmission (see step 7 of Section 6.1 "Call Flow"). No answer indication will be signaled from Intrado.	

8.0 Requirements for All Trunk Groups from TSP

Table 12: All Trunk Groups

Number	Requirement	Comments
TSP.7.1	The TSP will not send any non-emergency calls to the Intrado 9-1-1 Routing Network. Such calls will be given a reorder tone. A non-emergency call is defined as an SS7 call where CpCAT=non-emergency and the Called Number is not 911.	
TSP.7.2	It is recommended that the TSP configure trunking facilities into a minimum of two separate Intrado 9-1-1 Routing Network POIs. Intrado supports diverse facilities into three separate POIs.	
TSP.7.3	The TSP indicates call type (e.g., wireline, wireless, VoIP) for each trunk group.	
TSP.7.4	The TSP indicates routing logic (i.e., Selective Routing vs. Trunk Only Routing) for each trunk group.	
TSP.7.5	The TSP works with Intrado and the appropriate group(s) to determine a default PSAP for each trunk group.	
TSP.7.6	The TSP works with Intrado and the appropriate group(s) to determine ESNs for all calls handled by a trunk group.	
TSP.7.7	The TSP indicates a signaling type (e.g., SS7 [see Section 7.2.1 and 7.2] or CAMA [I Digit=Yes/No]) for each trunk group.	
TSP.7.8	The TSP provides Intrado with estimated call volumes (i.e., actual call volumes or number of TNs supported) for each trunk group.	
TSP.7.9	The TSP provides Intrado with trunking information for any Foreign Selective Routers to be supported.	
TSP.7.10	The TSP media loss plan is expected to conform to the applicable requirements of the 'Fixed Loss Plan' or the 'Evolving Digital Network' loss plan as documented in Telcordia SR-2275 [12], GR-507 [15], and GR-334-CORE [13], as well as ATIS T1.0100508 [14].	These plans typically insert 0, 3, or 6 dB of loss in the received media at the end of the connection.
TSP.7.11	In no case shall the average <u>speech</u> power level of media transmitted into the 9-1-1 Routing Network exceed -9 dBm for any interval of 3 seconds or greater. It is also expected that media will not have been previously clamped at a maximum level, regardless of the average power level when received [17] [18].	The act of clamping media produces additional speech distortion.

Number	Requirement	Comments
TSP.7.12	When the TSP origination leg contains a source of echo, the resulting echo coming into the Intrado 9-1-1 Routing Network should never have delay greater than 300 ms. Echo between 50 ms and 300 ms should be 55 dB lower (i.e., Echo Return Loss, ERL > 55 dB) than the original source signal sent to the TSP. For echoes fewer than 50 msec, the ERL should be at least 30 dB. (Derived from [15] and [16].)	Echo with delay greater than 50 msec should be eliminated within the TSP network. Minor echos fewer than 50 msec can be reduced by the 9-1-1 Routing Network.
TSP.7.13	It is expected that any call rejection scenario encountered when presenting the call to an Intrado POI would result in alternate route advancing to the other Intrado POIs.	For rejection reason list see Reference [3].