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SS7 Guidelines for MSC to Selective Router Connectivity

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1 Executive Overview

1.1 Purpose and Scope of Document

This document is a guide to orient the SS7 translation engineer/technician on the nature of 9-1-1 Mobile Switching Center (MSC) to SR translations. It is not in the scope of this document to explain exact details of any particular 9-1-1 SR, but to act as a way to understand the dynamics of these types of translations. As stated earlier, this document is secondary to any network disclosure or other translation policy guides from any 9-1-1 Service System Provider. The reader of this document is encouraged to contact the 9-1-1 Service System Provider for any detailed questions on SS7 translations or policy details.

The purpose of this Technical Information Document (TID) is to identify and reflect current trends, not to catalog every SS7 translation requirement for every 9-1-1 Service System Provider. The SS7 Implementation Improvement Working Group seeks to give the reader the knowledge required to better understand and implement service, using supported interconnection methods that exist in the field today.

1.2 Reason to Implement

Implementation of this TID will provide a consistent set of guidelines for the Wireless Service Providers (WSPs) and the E9-1-1 Service System Providers (SSPs) in the SS7 interconnection between a Mobile Switching Center (MSC) and E9-1-1 Selective Router (SR).

1.3 Benefits

The benefit attained through the use and application of this TID are uniform SS7 interconnections between a MSC and an E9-1-1 SR for Phase I and Phase II Wireless E9-1-1 call delivery for each of the solutions defined.

1.4 Acronyms/Abbreviations

The terms used within this document are specific for this TID. A full glossary can be viewed in the NENA Master Glossary of 9-1-1 Terminology (NENA 01-002).

The following Acronyms are used in this document:	
ALI	Automatic Location Identification
ANI	Automatic Number Identification
ATM	Asynchronous Transfer Mode
ATIS	Alliance for Telecommunications Industry Solutions
CAMA	Centralized Automatic Message Accounting
CAS	Call path Associated Signaling
CBN	Call Back Number
CdPN	Called Party Number
CGL	Calling Geodetic Location parameter

The following Acronyms are used in this document:	
CHGN	Charge Number parameter
CpCAT	Calling party CATegory
CPE	Customer Premises Equipment
CPN	Calling Party Number parameter
E9-1-1	Enhanced 9-1-1
ESN	Emergency Service Number
ESP	Emergency Service Protocol
ESRD	Emergency Service Routing Digits
ESRK	Emergency Service Routing Key
FCC	Federal Communications Commission
FG-D	Feature Group D
GDP	Generic Digit Parameter
IAM	Initial Address Message
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
LEC	Local Exchange Carrier
MF	Multi-Frequency
MSC	Mobile Switching Center
MTP	Message Transfer Part
NCAS	Non-Callpath Associated Signaling
NPA	Numbering Plan Area
OLI	Originating Line Identification parameter
PAM	PSAP to ALI Message specification
PSAP	Public Safety Answering Point
PSTN	Public Switched Telephone Network
SIF	Signaling Information Field
SIO	Service Information Octet
SS7	Signaling System Number 7
TIA	Telecommunications Industry Association
TID	Technical Information Document
WSP	Wireless Service Provider

1.5 Effective Date

This Technical Information Document is effective as of August 7, 2002

1.6 Document Terminology

The terminology used in this document has been aligned to designate definitions used within the American National Standard for Telecommunications technical standard T1.628 Emergency Calling Service, issued by the Alliance for Telecommunications Industry Solutions (ATIS).

1.7 Reason for Issue

This document is issued to serve as a NENA Technical Information Document to address the need for guidance on SS7 translations between the MSC and the SR. This document presents a broad view of the SS7 translations that exist today, and any possible future translations.

1.8 Reason for Reissue

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

1.9 Date Compliance

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

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

2 General Description

This NENA Technical Information Document (TID) provides a reference for Wireless Service Providers (WSP) on the basics of 9-1-1 SS7 translations to the Selective Router (SR). This document is subject to any network disclosure or configuration documents published by any company that provides interconnection to a SR. This document is intended as a reference to orient the translations resources of a WSP on the nature of 9-1-1 Signaling System Number 7 (SS7) translations.

3 Wireless E9-1-1 Solutions Defined

3.1 Phase I

Phase I Wireless requires delivery to the Public Safety Answering Point (PSAP) of the 9-1-1 voice call, the Call Back Number (CBN) associated with the handset, and identification of the cell site and/or sector from which the call originated.

3.1.1 Phase I Call path Associated Signaling (CAS):

In Phase I CAS, the 9-1-1 call, Emergency Service Routing Digits (ESRD), and CBN are transmitted from the MSC to the E9-1-1 SR via SS7/ Integrated Services Digital Network User Part (ISUP) or FG-D (Feature Group D) trunks. The ESRD and CBN are transmitted to the PSAP via Enhanced MF (EMF) or Integrated Services Digital Network (ISDN) (VoIP in the future). The ESRD is used to retrieve the cell site information from the Automatic Location Identification (ALI) database.

3.1.2 Phase I Non Call path Associated Signaling (NCAS):

In Phase I NCAS, the 9-1-1 call and Emergency Service Routing Key (ESRK) are sent to the E9-1-1 SR. The other Phase I data is sent via a separate data link to the ALI database. The PSAP uses the ESRK to query the ALI database for an ALI record that contains the CBN and originating cell site information.

3.1.3 Phase I Hybrid:

In Phase I, a Hybrid architecture combines elements of both CAS & NCAS to provide a Phase I compliant call to the PSAP. The connection between the MSC and the E9-1-1 SR is the same as it is for CAS (i.e., the MSC sends both CBN and ESRD to the E9-1-1 SR.) The E9-1-1 SR sends the CBN and ESRD to the ALI database, where an ALI record is created for the call. ALI may either return a “retrieval key” to the SR, or a “retrieval key” may be created by the SR depending upon methods used. The E9-1-1 SR delivers the 9-1-1 call, along with the CBN or ESRD or “retrieval key” to the PSAP. The information sent to a PSAP depends on the Hybrid implementation and the options selected by the PSAP and the ALI-DB in use. The PSAP will use either the CBN or ESRD or "retrieval key" to query the ALI database for the caller's ALI record. The ALI record contains the CBN and originating cell site information.

3.1.4 CBN (Call Back Number):

CBN here is used as the telephone number that a PSAP can use to call back a caller (e.g., in the event the call is prematurely disconnected).

3.2 Phase II

Phase II Wireless requires, in addition to the information (CBN and originating cell site) provided in Phase I, that the Wireless Carrier provide the coordinates (longitude and latitude, aka: x, y) of the caller at the time the call was placed.

3.2.1 Phase II CAS: (call set-up with CBN+ESRD+CGL)

In Phase II CAS, all pertinent data, including the initial position of the mobile caller, travels from the MSC to the PSAP in the call path. All of the Phase II data, (CBN+ESRD+CGL), is sent directly from the SR to the PSAP with the call. (NOTE: if ISDN is used as the PSAP interface, the CGL parameter data is sent to the PSAP in the ISDN Generic Information element.)

This definition has been included here for completeness, but as of 3Q2002 the pure form of CAS (delivery all the way to the PSAP) is not generally supported in E9-1-1 Network Switch software.

3.2.2 Phase II WCM: (call set-up with ESRK)

In Phase II WCM, as in Phase I NCAS, only the ESRK is sent to the SR. The other Phase II data is delivered, via a separate data link, to the ALI database. The SR uses the ESRK to query the SRDB (which may be an ALI-SRDB) for PSAP routing information then sends the ESRK on to the PSAP with the call. The PSAP uses the ESRK to query the ALI database for the Phase I and Phase II data. The ALI database will obtain the location information from the wireless network to transmit back to the PSAP.

3.2.3 Phase II NCAS: (call set-up with CBN+ESRD)

In a Phase II NCAS architecture, the connection between the MSC and the E9-1-1 SR is the same as it is for Phase I CAS, (the MSC sends both CBN and ESRD to the E9-1-1 SR.) The E9-1-1 SR sends the CBN and ESRD to the PSAP using Enhanced-MF signaling or ISDN. The PSAP will use either the CBN or the ESRD to query the ALI database for the caller's x,y location information. The ALI database will obtain the location information from the wireless network to transmit back to the PSAP.

3.2.4 Phase II Hybrid: (call set-up with CBN+ESRD)

In a Phase II Hybrid architecture, the connection between the MSC and the E9-1-1 SR is the same as it is for Phase I CAS, (the MSC sends both CBN and ESRD to the E9-1-1 SR.) The E9-1-1 SR sends the CBN and ESRD to the ALI database, where an ALI record is created for the call. ALI may either return a “retrieval key” to the SR, or a “retrieval key” may be created by the SR depending upon methods used. The E9-1-1 SR delivers the 9-1-1 call along with a CBN, CBN plus ESRD or a "retrieval key" to the PSAP. The information sent to a PSAP depends on the Hybrid implementation and the options selected by the PSAP and the ALI-DB in use. The PSAP will use either the CBN or the "retrieval key" to query the ALI database for the caller's location information. The ALI database will obtain the location information from the wireless network to transmit back to the PSAP.

4 Interconnection Matrix

The interconnection matrix is a standard mechanism for wireless carriers and E9-1-1 service providers to communicate the technical attributes of their wireless E9-1-1 solutions. The matrix consists of the call signaling scenarios and database steering options used to support wireless E9-1-1 calls. E9-1-1 service providers can use the matrix to identify the call signaling scenarios and database steering options supported in their service areas. Wireless carriers can then use that information to order suitable capabilities from the E9-1-1 service provider.

Call signaling scenarios are used to describe the information sent by a MSC to an E9-1-1 selective router. Separate call signaling scenarios are defined for a MSC to send: an ESRK; CBN and ESRD; or CBN, ESRD, and CGL to an E9-1-1 selective router. The later is in an Appendix A, because it is generally not available in the United States at this time, but it is viable where it can be supported.

The database steering options define the interfaces that can be used by wireless carriers or their agents to convey information to the ALI database serving the PSAP. There are two steering options identified in this TID; the Telecommunications Industry Association (TIA) Emergency Services Protocol (ESP) provided over the E2 interface and the PSAP to ALI Message (PAM) protocol. Although not directly associated with the interconnection of the MSC to the E9-1-1 SR, these steering options may impact which interconnection scenarios can be supported in any given situation.

4.1 Call Signaling Scenarios

The call signaling scenarios for successful Wireless E9-1-1 calls are listed below:

- A successful 9-1-1, Phase I wireless call, is a call to a PSAP designated to serve the cell site or cell sector of call origination and which receives the CBN and cell site location information.
- A successful 9-1-1, Phase II wireless call, is a call that is routed to the PSAP designated to serve the location of the caller and the PSAP receives the caller's CBN and location in terms of X,Y coordinates and in some cases confidence/uncertainty.

4.2 Call Scenario 1: ESRK Delivery

Call Scenario 1 describes the mode where a MSC uses ISDN User Part (ISUP) protocol to send an ESRK to an E9-1-1 selective router. Call Scenario 1 supports the Wireline Compatibility Mode[1] described in J-STD-036, Section D.1.1. Wireless carriers can use Call Scenario 1 to support Phase I and/or Phase II wireless E9-1-1 calls. Table 4-1 shows the possible alternatives for populating the parameters in the Initial Address Message (IAM).

Table 4-1 (ESRK Delivery)

ISUP Parameter Option	OLI Wireless	CpCAT Emergency	CdPN	CPN	CHGN	GDP	Note(s)
A1	No	Yes	911	ESRK	ESRK	Blank	1, 2
A2	No	Yes	911	ESRK	-	Blank	1, 2
A3	No	Yes	911	-	ESRK	Blank	1, 2
B1	No	No	911	ESRK	ESRK	Blank	1, 2
B2	No	No	911	ESRK	-	Blank	1, 2
B3	No	No	911	-	ESRK	Blank	1, 2

Notes:

1. This ISUP parameter option is widely supported in the U.S. It is estimated that 95% of the E9-1-1 selective routers deployed in the U.S. support this option when the selective router has been equipped with wireless E9-1-1 features.
2. "Blank"-- this parameter MUST NOT be populated.

4.3 Call Scenario 2: CBN and ESRD Delivery

Call Scenario 2 describes the mode where a MSC uses ISUP protocol to send the caller's CBN and ESRD to an E9-1-1 selective router. Call Scenario 2 supports the NCAS[2] mode described in J-STD-036, Section D.1.2. Wireless carriers can use Call Scenario 2 to support Phase I and/or Phase II wireless E9-1-1 calls. Table 4-2 shows the possible alternatives for populating the parameters in the Initial Address Message (IAM).

[1] J-STD-036 uses the term "Wireline Compatibility Mode" to describe scenarios where MSCs use the ISUP parameter mappings normally used by landline switches to signal E9-1-1 calls to E9-1-1 selective routers.

[2] J-STD-036 uses the term NCAS to describe scenarios where an MSC uses ISUP protocol to send CBN and ESRD to an E9-1-1 selective router.

Table 4-2 (CBN and ESRD Delivery)

ISUP Parameter Option	OLI Wireless	CpCAT Emergency	CdPN	CPN	CHGN	GDP	Note(s)
A1	Yes	Yes	911	CBN	CBN	ESRD	1
A2	Yes	Yes	911	CBN	-	ESRD	1
A3	Yes	Yes	911	-	CBN	ESRD	1
B1	Yes	No	911	CBN	CBN	ESRD	3
B2	Yes	No	911	CBN	-	ESRD	3
B3	Yes	No	911	-	CBN	ESRD	3
C1	No	Yes	911	CBN	CBN	ESRD	3
C2	No	Yes	911	CBN	-	ESRD	3
C3	No	Yes	911	-	CBN	ESRD	3
D1	No	No	911	CBN	CBN	ESRD	3
D2	No	No	911	CBN	-	ESRD	3
D3	No	No	911	-	CBN	ESRD	3
E1	Yes	Yes	ESRD	CBN	CBN	Blank	1, 2
E2	Yes	Yes	ESRD	CBN	-	Blank	1, 2
F1	Yes	No	ESRD	CBN	CBN	Blank	2, 3
F2	Yes	No	ESRD	CBN	-	Blank	2, 3
G1	No	Yes	ESRD	CBN	CBN	Blank	2, 3
G2	No	Yes	ESRD	CBN	-	Blank	2, 3
H1	No	No	ESRD	CBN	CBN	Blank	2, 3
H2	No	No	ESRD	CBN	-	Blank	2, 3
I1	Yes	Yes	ESRD	CBN	CBN	ESRD	1
I2	Yes	Yes	ESRD	CBN	-	ESRD	1
I3	Yes	Yes	ESRD	-	CBN	ESRD	3
J1	Yes	No	ESRD	CBN	CBN	ESRD	3
J2	Yes	No	ESRD	CBN	-	ESRD	3
K1	No	Yes	ESRD	CBN	CBN	ESRD	3
K2	No	Yes	ESRD	CBN	-	ESRD	3
L1	No	No	ESRD	CBN	CBN	ESRD	3
L2	No	No	ESRD	CBN	-	ESRD	3

Notes:

1. This ISUP parameter option is widely supported in the U.S. It is estimated that 95% of the E9-1-1 selective routers deployed in the U.S. support this option when the selective router has been equipped with wireless E9-1-1 features.
2. "Blank"-- this parameter MUST NOT be populated.
3. This ISUP parameter option is available in some areas. It is estimated that 50% of the E9-1-1 selective routers deployed in the U.S. support this option when the selective router has been equipped with wireless E9-1-1 features.

4.4 Call Scenario 3: CBN, ESRD, and CGL Delivery

Call Scenario 3 describes the mode where a MSC uses ISUP protocol to send the caller's CBN, ESRD, and CGL to an E9-1-1 selective router. Call Scenario 3 supports the CAS[3] mode described in J-STD-036, Section D.1.3. Wireless carriers can use Call Scenario 3 to support Phase II wireless E9-1-1 calls. The table to support this scenario is provided in Appendix A because it is not generally available in the United States at this time (3Q2002), but can be viable when it is supported. The table shows the possible alternatives for populating the parameters in the Initial Address Message. See Appendix A for details.

4.5 GDP Type

In all cases where GDP is used, "type of digits must equal "13". Delivery of a pANI in a GDP that isn't type 13 will not work as intended.

4.6 Using the Interconnection Matrix

The interconnection matrices provide a standard mechanism for wireless carriers and E9-1-1 service providers to communicate the technical attributes of their wireless E9-1-1 solutions. The following example illustrates how carriers can use the interconnection matrices to communicate. Consider a hypothetical E9-1-1 service provider called ACME Telco Company. ACME Telco Company offers wireless carriers several capabilities to support both Phase I and Phase II wireless E9-1-1. The capabilities supported by ACME Telco Company are identified in Tables 3-3 and 3-4. **NOTE: Individual companies may have region or city specific translation requirements.**

Table 4-3 Example of ACME Telco Company Phase I Capabilities

Call Scenarios	ISUP Parameter Options	Database Steering Options
CS1 (ESRK Delivery)	A1, A2, B1, B2	Option 2 (PAM Protocol)
CS2 (CBN and ESRD Delivery)	A1, A2, E1, E2, I1, I2	Not Applicable

Table 4-4 Example of ACME Telco Company Phase II Capabilities

Call Scenarios	ISUP Parameter Options	Database Steering Options
CS1 (ESRK Delivery)	A1, A2, B1, B2	Option 2 (PAM Protocol)
CS2 (CBN and ESRD Delivery)	A1, A2, E1, E2, I1, I2	Option 1 (E2 Interface)

[3] J-STD-036 uses the term CAS to describe scenarios where an MSC uses ISUP protocol to send CBN, ESRD, and CGL to an E9-1-1 selective router.

5 Database Steering Options

5.1 Database Steering Option 1: TIA ESP (E2 Interface)

See NENA document on the E2 Interface. (Expected to be published in 2002)

5.2 Database Steering Option 2: PAM Protocol

PAM Protocol is an existing interface method. Contact the 9-1-1 Service System Provider for any detailed questions.

6 MSC Constraints and SS7 Capability Defined

SS7 is an out-of-band signaling system used to provide basic routing information. Today, the majority of 9-1-1 selective routing tandems are digital, and SS7 is the transmission path of choice with the implementation of an Enhanced 9-1-1 network architecture.

Depending on what type of switch the wireless carriers use, there will be three kinds of communication protocol, or outgoing trunks that can be used between the MSC and the selective routing tandem:

- ? FG-D/MF signaling which supports call setup and release with in-band signaling.
- ? SS7/ISUP signaling which supports call setup and release with out-of-band signaling.
- ? CAMA/MF signaling which supports call setup and release with in-band signaling.

For some MSC switch types, the ISUP signaling is not available and MF signaling must be implemented. Both ISUP and FG-D/MF will transmit the call back number (CBN) and the routing number (ESRD/ESRK) to the PSAP. CAMA/MF will only transmit the ESRK with the call and utilizes the NCAS interface to transmit the CBN to the PSAP via ALI. However, there are also limitations to FG-D/MF signaling that make the SS7/ISUP signaling the recommended choice for information to be transmitted between the MSC and the 9-1-1 selective routing tandem.

In addition, some E9-1-1 Tandem switch types do not support FG-D/MF signaling. For this reason, the serving 9-1-1 Service System Provider may not support this type of interconnection. As stated earlier, this document is secondary to any network disclosure or other policy guides from any 9-1-1 Service Provider. The reader of this document is encouraged to contact the serving 9-1-1 Service Provider for any detailed questions on SS7 or FG-D type trunks and policy details.

7 Future Considerations

When a switch generates an IAM associated with a 9-1-1 call, it is also expected to populate certain Message Transfer Part (MTP) parameters. (See ANSI T1.111.4 for details related to the encoding of MTP parameters.) Specifically, the switch will be responsible for generating information that will be populated in the Signaling Information Field (SIF) and the Service Information Octet (SIO).

The SIO contains a service indicator that identifies the MTP-user part involved in the message. In the case of an IAM, the service indicator will identify the ISDN User Part as the MTP-user. The sub-service field will indicate that the message is a national network message and will identify the MTP message priority. In the case of IAMs related to 9-1-1 calls, the message priority will be higher than for "normal" calls (i.e., message priority value of "1", where normal calls have a message priority of "0"). Note that message priority does not determine which messages are processed first when received at a node, but is used instead to determine which messages should be discarded if a SS7 network experiences congestion.

The switch is expected to populate the SIF with the Originating and Destination Point Codes, the Signaling Link Selection value for the message, a Circuit Identification Code associated with the outgoing trunk selected for the call, a Message Type Code identifying the message as an IAM, and the content of the IAM itself.

In addition to the SIO and SIF, a switch generating an IAM related to an Emergency Call is expected to populate the following information in the MTP portion of the message: the Flag, Forward and Backward Sequence Numbers and Indicator Bits, Length Indicator, and Check Bits.

A switch that is responsible for generating an IAM related to an Emergency Call is expected to provide the MTP information described above, along with the ISUP information described in Section 3, to an E9-1-1 tandem in an SS7-based Emergency Services Network.

In the future, SS7-based Emergency Services Networks may interconnect with networks that utilize other signaling arrangements to transport call control information over different bearer technologies (e.g., Asynchronous Transfer Mode (ATM), IP). In fact, at some future time, such signaling schemes may be incorporated into Emergency Service Networks themselves. Regardless of the technology used, a network that is interconnecting with an Emergency Services Network must, at a minimum, support the transport of critical call setup information in a format that is expected by the receiving E9-1-1 tandem/Selective Router node. It is also important that call setup signaling related to Emergency Calls continue to be given higher priority than that related to normal calls, to give Emergency Calls a better chance of completing in cases of network congestion. While some of the protocol stacks being investigated to support call setup and narrow band services over different bearers already support these capabilities, it is critical that any network interconnecting with an SS7-based Emergency Services Network be able to generate an IAM that contains the expected ISUP and MTP information.

8 References

TR-45 J-STD-034 Wireless Enhanced Emergency Service

TR-45 J-STD-036 Enhanced Wireless 9-1-1 Phase 2

ANSI T1.111.4 Signaling System No.7 Message Transfer Part

ANSI T1.628 Emergency Calling Center

Appendix A: CBN, ESRD, and CGL

Table A-8-1 CBN, ESRD, and CGL

ISUP Parameter Option	OLI Wireless	CpCAT Emergency	CdPN	CPN	CHGN	GDP	CGL
A1	Yes	Yes	911	CBN	CBN	ESRD	Yes
A2	Yes	Yes	911	CBN	-	ESRD	Yes
A3	Yes	Yes	911	-	CBN	ESRD	Yes
B1	Yes	No	911	CBN	CBN	ESRD	Yes
B2	Yes	No	911	CBN	-	ESRD	Yes
B3	Yes	No	911	-	CBN	ESRD	Yes
C1	No	Yes	911	CBN	CBN	ESRD	Yes
C2	No	Yes	911	CBN	-	ESRD	Yes
C3	No	Yes	911	-	CBN	ESRD	Yes
D1	No	No	911	CBN	CBN	ESRD	Yes
D2	No	No	911	CBN	-	ESRD	Yes
D3	No	No	911	-	CBN	ESRD	Yes
E1	Yes	Yes	ESRD	CBN	CBN	Blank	Yes
E2	Yes	Yes	ESRD	CBN	-	Blank	Yes
F1	Yes	No	ESRD	CBN	CBN	Blank	Yes
F2	Yes	No	ESRD	CBN	-	Blank	Yes
G1	No	Yes	ESRD	CBN	CBN	Blank	Yes
G2	No	Yes	ESRD	CBN	-	Blank	Yes
H1	No	No	ESRD	CBN	CBN	Blank	Yes
H2	No	No	ESRD	CBN	-	Blank	Yes
I1	Yes	Yes	ESRD	CBN	CBN	ESRD	Yes
I2	Yes	Yes	ESRD	CBN	-	ESRD	Yes
I3	Yes	Yes	ESRD	-	CBN	ESRD	Yes
J1	Yes	No	ESRD	CBN	CBN	ESRD	Yes
J2	Yes	No	ESRD	CBN	-	ESRD	Yes
J3	Yes	No	ESRD	-	CBN	ESRD	Yes
K1	No	Yes	ESRD	CBN	CBN	ESRD	Yes
K2	No	Yes	ESRD	CBN	-	ESRD	Yes
K3	No	Yes	ESRD	-	CBN	ESRD	Yes
L1	No	No	ESRD	CBN	CBN	ESRD	Yes
L2	No	No	ESRD	CBN	-	ESRD	Yes
L3	No	No	ESRD	-	CBN	ESRD	Yes

Notes: The parameter mappings shown in Table A-8-1 require further study.