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DPNSS [189-I]

**Interworking Between DPNSS 1 and ISDN
Signalling Systems**

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INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 1 - GENERAL

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HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]
- Glossary referred to DPNSS[188]

1 GENERAL

1.1 This specification details the additional requirements, including procedural changes, to those given in DPNSS[188] that are necessary for PBXs to support interworking between DPNSS 1 and ISDN signalling systems.

1.2 This issue of the specification details only interworking between the DPNSS 1 Simple Call (Telephony or Data) and the ISDN Basic Call. The fact that interworking between DPNSS 1 and ISDN supplementary services is not described in this issue of this specification, however, does not mean that interworking between supplementary services is not possible.

The references in Subsection 4 of this Section list the documents which detail Basic Call requirements for the ISDN signalling systems relevant to this specification.

1.3 Two levels of interworking between DPNSS 1 and the ISDN signalling systems are specified in this specification; these are, Basic Interworking and Enhanced Interworking and are defined as follows:

1.3.1 Basic Interworking defines mapping between DPNSS 1 and ISDN at a Gateway PBX, based on the minimum requirements of each signalling system, as detailed in DPNSS[188], DPNSS[189] and the relevant ISDN signalling standards.

1.3.2 Enhanced Interworking provides maximum integration of DPNSS 1 and ISDN by defining more complex DPNSS 1 signalling procedures than those detailed for Basic Interworking. This is achieved by specifying a comprehensive mapping between DPNSS 1 and ISDN at a Gateway PBX, utilising additional DPNSS 1 Supplementary Information Strings.

NOTE: The fact that interworking is specified in this specification in the terms of paragraphs 1.3.1 and 1.3.2 does not preclude an implementation from achieving a level of interworking between these two extremes, by supporting a subset of the procedures specified for Enhanced Interworking.

1.4 Reference is made in this specification to the terms "Basic Gateway" and "Enhanced Gateway"; these are defined as follows:

1.4.1 A Basic Gateway is a Gateway PBX that supports Basic Interworking as defined in paragraph 1.3.1.

1.4.2 An Enhanced Gateway is a Gateway PBX that supports Enhanced Interworking as defined in paragraph 1.3.2.

1.5 Two Enhanced Gateways linked by DPNSS 1, will be able to provide full transparency on all ISDN Basic Calls that can be supported on 64 kbit/s bearers between two ISDN interfaces. (Transparency of Supplementary Services is outside the scope of this issue of the specification.)

Where two ISDN Gateway PBXs are linked by DPNSS 1, and they are not both Enhanced Gateways, the level of transparency that can be achieved on a call between ISDN interfaces on these PBXs will be dependent on the precise level of functionality offered by each of the PBXs.

The level of functionality offered between the two Gateway PBXs can be determined by reference to the Compliance Tables of SECTION 6, completed for each PBX.

1.6 Where a Supplementary Information String that is defined explicitly for Enhanced Interworking is received by a PBX that does not support that String (for example a Basic Gateway) it shall be processed in accordance with the general procedures for handling unrecognised Strings, as defined in DPNSS[188], SECTION 5.

1.7 The Physical Characteristics (Layer 1) and the Link Access Protocol (Layer 2) are referenced in SECTION 2 and SECTION 3, respectively of this specification and are unchanged for the purposes of interworking.

1.8 The Layer 3 coding and definition of DPNSS 1 Supplementary Information Strings and Parameters and the rules for commonly used mappings between DPNSS 1 message contents and ISDN Information Elements are contained in SECTION 4 of this specification. References in SECTION 4 to DPNSS[188] and ISDN source documents are given for all other coding.

1.9 An outline of the structure of SECTION 6; a guide to the text and MSD conventions; a list of ISDN Progress Descriptions, and an overview of the signalling procedures used in this specification, are contained in SECTION 5.

1.10 Use of the signalling procedures defined in this specification explicitly for interworking between DPNSS 1 and ETS 300 172 (Private ISDN) and ETS 300 102 (Public ISDN) may be appropriate in other contexts, for example:

- when interworking DPNSS 1 with other signalling systems that have similar characteristics to those of ISDN, or
- in conjunction with the signalling procedures defined in DPNSS[188], SECTION 6 to support the interworking of DPNSS 1 with ISDN terminals (or ISDN-like terminals) directly connected to DPNSS 1 End PBXs, or

- by PBXs on behalf of non-ISDN interfaces to utilise the functionality of remote ISDN Gateway PBXs.

1.11 Throughout this specification, the term "PBX" is used to indicate a "switching node" on a network. Generally, this term is used to mean a Private Branch Exchange, but can mean Centrex, Virtual Private Network, or other types of switching nodes, or other types of equipment, including those which have no telephone terminations (eg a transit exchange, a data switch or a multiplexer).

2 COMPLIANCE TABLE FOR DPNSS 1 PBXS INTERWORKING WITH ISDN SIGNALLING SYSTEMS FOR THE BASIC CALL

TABLE 1 indicates for which types of ISDN interface Gateway Working, as defined in this specification, is supported.

For a PBX to be compliant to this specification a "YES" must be entered in at least one of the boxes in TABLE 1 below.

TABLE 1

PBX FUNCTION (ISDN BASIC CALL REFERENCE DOCUMENT)	YES /NO	DETAILED COMPLIANCE
Gateway with a Private ISDN (ETS 300 172)		SECTION 6 Subsection 3.1
Gateway with a Public ISDN (ETS 300 102-1) (Point to Point Mode of Operation)		SECTION 6 Subsection 3.2

3 HISTORY OF DPNSS[189-I]

NOTE: At Issue 1 this specification was known as BTNR 189-I.

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]
- Specific changes made to the following SECTIONS:
SECTION 1
SECTION 4
SECTION 4, ANNEX 1
SECTION 6

4 REFERENCES

DPNSS[188] Global Issue 7

DPNSS[189] Global Issue 4

ETS 300 102-1 (1990)

ETS 300 172 (1992)

5 GLOSSARY OF TERMS

The glossary for DPNSS 1 appears in SECTION 1 of DPNSS[188].

INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 2 - PHYSICAL CHARACTERISTICS (LAYER 1)

REQUIREMENTS

There is no interworking at Layer 1; the DPNSS 1 and ISDN ports on a Gateway PBX shall each conform to their respective Layer 1 standards.

HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]

INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 3 - DATA LINK LAYER (LAYER 2)

REQUIREMENTS

There is no interworking at Layer 2; the DPNSS 1 and ISDN ports on a Gateway PBX shall each conform to their respective Layer 2 standards.

HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]

INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 4 - MESSAGE CONTENTS CODING AND MAPPING

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ANNEX 1: MAPPING BETWEEN DPNSS 1 MESSAGE CONTENTS AND ISDN
INFORMATION ELEMENTS

HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]
- Annex 1 removed to DPNSS[188]
- Annex 2 renumbered as Annex 1

1 GENERAL

1.1 All requirements relating to the coding of DPNSS 1 Messages and Message Contents are specified in DPNSS[188], SECTION 4.

1.2 Reference should be made to the relevant ISDN Standards (see SECTION 1 Subsection 4) for all requirements relating to ISDN messages and message contents.

1.3 The rules for commonly used mappings between DPNSS 1 message contents and ISDN Information Elements, are contained in ANNEX 1 of this Section. Other mappings are detailed within the text of SECTION 6.

INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 4

**ANNEX 1 : MAPPING BETWEEN DPNSS 1 MESSAGE CONTENTS AND ISDN
INFORMATION ELEMENTS**

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HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]
- Annex renumbered
- Data SICs for DASS 2 and DPNSS 1 aligned

1. GENERAL

The signalling procedures described in this specification for interworking between DPNSS 1 and ISDN signalling systems include specification of the messages and message contents of each signalling system that have to be generated as a result of the information received from the other.

This Annex details some general mappings between ISDN message contents and DPNSS 1 message contents. In most cases, these mappings are independent of the context in which they occur in that receipt of a particular component in one system always requires the generation of a particular component in the other, whether it be during signalling for the Simple/Basic Call or a Supplementary Service. Where a mapping specific to a particular case is required, this is defined within the appropriate Section of this specification.

The mapping details given assume that the DPNSS 1 Strings received are valid in accordance with SECTION 4 of this specification and that the ISDN information elements received are valid in accordance with the relevant ISDN standard. It is assumed that any invalid information received from a signalling system has been handled in accordance with the appropriate error handling procedures for that system and can therefore be ignored for mapping purposes.

In general, for each mapping that exists, two directions are specified; these are ISDN to DPNSS 1 and DPNSS 1 to ISDN. In some cases, the mappings may be applicable only to one type of Gateway (i.e. public ISDN or private ISDN). Any limitations of applicability are identified within the relevant mapping descriptions.

2 MAPPING DETAILS

2.1 ISDN Bearer Capability and Low Layer Compatibility information elements <--> DPNSS 1 SIC

2.1.1 ISDN to DPNSS 1

It is assumed that the Bearer Capability and any Low Layer Compatibility information elements received are compatible with routing of a call via DPNSS 1 and that CCITT standard coding is used both for the information elements themselves and for the contents of the fields within the information elements. In particular, it is assumed that:

- The Bearer Capability contains octets 3 and 4.
- Octet 3, bits 7 and 6 indicate a coding standard of "CCITT".

- Octet 4, bits 7 and 6 indicate a transfer mode of "circuit".
- Octet 4, bits 5 to 1 indicate a transfer rate of "64 kbit/s".

Use of non-CCITT codings, for example octet 3 indicating a coding standard of "national", or octet 5 indicating a coding standard of "non-CCITT rate adaptation" is covered below in the paragraph headed, "Non-CCITT Coding".

The DPNSS 1 SIC is generated from the contents of Bearer Capability and, if present, Low Layer Compatibility as described below.

There are some instances where the information in Bearer Capability or Low Layer Compatibility cannot be represented adequately in the SIC. In these circumstances a PBX may still route a call via DPNSS 1, however, under the following conditions:

- If it is known that it is not necessary to pass end-to-end compatibility information in order for the call to be correctly established, then a default SIC that forces the selection of a 64 kbit/s bearer shall be used. If Enhanced Gateway procedures are used and hence I-BC and possibly I-LLC are included in the ISRM (as defined in SECTION 6) then in this case, the String Identifier Codes of I-BC and I-LLC shall be allocated no suffix.
- If it is necessary to pass end-to-end compatibility information which must be understood at the called party's PBX, then a default SIC that forces the selection of a 64 kbit/s bearer shall be used and the Enhanced Gateway procedures which make use of the I-BC and I-LLC Strings in an ISRM (as defined in SECTION 6) shall be utilised. In this case a "B" suffix shall be added to the String Identifier Code of I-BC (if Bearer Capability was inadequately represented in the SIC) and/or to the String Identifier Code of I-LLC (if Low Layer Compatibility was inadequately represented in the SIC).

Where the information in Bearer Capability and Low Layer Compatibility can be adequately represented in the SIC, I-BC and I-LLC shall be allocated no String Identifier Code suffix when included in the ISRM.

The mapping of Bearer Capability and Low Layer Compatibility into the DPNSS 1 SIC is covered by three basic cases, according to what is represented by the "information transfer capability" and "user information layer 1" fields.

Case 1: The information transfer capability field indicates either "speech" or "3.1 kHz audio".

In this case, a single octet SIC shall be constructed with bits 7 to 5 set to indicate "speech" and bits 4 to 1 assigned according to the coding of the user information layer 1 protocol field in bits 5 to 1 of octet 5 of Bearer Capability/Low Layer Compatibility.

Case 2: The information transfer capability field indicates either "unrestricted digital" or "restricted digital", and in addition the user information layer 1 field is either not present or it indicates "V.110/X.30 rate adaptation".

In this case, unless octet 5a indicates a user rate that cannot be represented by a valid DPNSS 1 SIC, a two octet SIC shall be constructed where bits 7 to 1 of the first octet shall be assigned according to the user rate indicated by bits 5 to 1 of octet 5a. Bits 7 to 1 of the second octet shall be assigned according to the remainder of octet group 5 and octets 6 and 7 of Bearer Capability/Low Layer Compatibility as follows:

- If bit 7 of octet 5a indicates "asynchronous", bits 3 to 1 of the second octet of the SIC shall be set to one of the asynchronous indications according to the number of stop bits indicated by bits 7 and 6 of octet 5c. Otherwise bits 3 to 1 of the second octet of the SIC shall be set to indicate synchronous data with a value "100" or "011". It is recommended that the value "100" is used to avoid interworking problems with DASS 2.
- If bit 7 of octet 5d indicates "half duplex", bit 4 of the second octet of the SIC shall indicate "half duplex". Otherwise it shall indicate "full duplex".
- In the synchronous case, bit 5 of the second octet of the SIC shall be set to indicate byte timing not provided, bit 6 shall be set to "anonymous or unformatted" unless octets 6 and 7 of Bearer Capability/Low Layer Compatibility indicate that it should be set to "X.25 packet mode", and bit 7 shall be set according to the Network Independent Clock indications in octet 5b.

- In the asynchronous case, bit 7 of the second octet of the SIC shall be set according to the Flow Control indications in octet 5b, and bits 6 and 5 shall be set according to the number of data bits indicated by bits 5 and 4 (Number Of Data Bits) and bits 3 to 1 (Parity) of octet 5c. Where there is no parity bit, the coding of bits 5 and 4 of octet 5c can be directly mapped onto bits 6 and 5 of the second octet of the SIC. Where a parity bit is indicated, the number of data bits in the SIC can only be explicitly indicated (as 8) if the number of data bits indicated by octet 5c is 7. In all other cases where a parity bit is indicated, the number of data bits indicated by the SIC shall be set to "unspecified".

Where the relevant octets of Bearer Capability/Low Layer Compatibility are not present (e.g. octet 5a), values for the SIC coding shall be assigned according to the default meanings associated with missing Bearer Capability/Low Layer Compatibility octets.

In the case where octet 5a indicates a user rate that cannot be represented by a valid DPNSS 1 SIC, and the call is still to be routed via DPNSS 1, a default SIC forcing selection of a 64 kbit/s bearer shall be used. Where the enforcement of end-to-end compatibility checking is required, I-BC and, if appropriate, I-LLC shall be included in the ISRM in accordance with the procedures defined for an Enhanced Gateway (see SECTION 6) with one or both of the Strings being allocated a "B" suffix, as appropriate.

Case 3: The information transfer capability field indicates anything other than "speech", "3.1 kHz audio", "unrestricted digital" or "restricted digital", or in the case of unrestricted digital or restricted digital, the user information layer 1 field indicates something other than "V.110/X.30 rate adaptation".

In this case, if the call is still to be routed via DPNSS 1, a default SIC forcing selection of a 64 kbit/s bearer shall be used. Where the enforcement of end-to-end compatibility checking is required, I-BC and, if appropriate, I-LLC shall be included in the ISRM in accordance with the procedures defined for an Enhanced Gateway (see SECTION 6) with one or both of the Strings being allocated a "B" suffix, as appropriate.

Where a default SIC is to be used, the recommended coding is 64kbit/s synchronous data, full duplex, no byte timing, anonymous format, clock linked to transmission. For this default case, the SIC has the value: Octet 1 = "10100000", Octet 2 = "00000100".

Non-CCITT Coding

Where Bearer Capability or Low Layer Compatibility information elements employing non-CCITT codings are received, it will depend on the meaning of these codings, as defined for the incoming ISDN interface, whether it is possible to map them to a suitable SIC.

If it is possible to construct a SIC, then the call may be routed via DPNSS 1 using that SIC. In such a case, it may be inappropriate to convey also the received information element(s) as I-BC and/or I-LLC, unless they are first converted into a CCITT coded equivalent, as the Terminating PBX might not have sufficient information available to understand the non-CCITT codings. If it would be inappropriate to send I-BC or I-LLC, then these Strings should be omitted from the ISRM, even at an Enhanced Gateway PBX.

If a SIC cannot be generated, then either the call shall not be routed via DPNSS 1, or the default SIC (see above) may be used and I-BC and/or I-LLC sent with a "B" suffix as appropriate. In choosing the latter course of action, however, consideration will need to be given regarding the ability of a Terminating PBX to be able to process satisfactorily, I-BC and/or I-LLC Strings containing non-CCITT codings.

2.1.2 DPNSS 1 to ISDN

The following mapping description assumes that the outgoing ISDN interface expects Bearer Capability and Low Layer Compatibility information elements to be coded without recourse to non-CCITT coding. Where this is not the case, coding appropriate to the outgoing interface shall be used. The derivation of this coding from the SIC is outside the scope of this specification.

If Bearer Capability and Low Layer Compatibility have not been derived from the receipt of I-BC and I-LLC, a Bearer Capability information element and, optionally, a Low Layer Compatibility element shall be constructed from the SIC as follows:

The coding standard in octet 3, bits 7 and 6 shall be set to indicate "CCITT", the transfer mode in octet 4, bits 7 and 6 shall be set to indicate "circuit", and the transfer rate in octet 4, bits 5 to 1 shall be set to indicate "64 kbit/s". The remainder of the coding of the information element(s) shall depend on which of the following cases applies.

Case 1: Single octet SIC, with bits 7 to 5 indicating "speech".

The information transfer capability field in bits 5 to 1 of octet 3 of Bearer Capability and/or Low Layer Compatibility shall be set to indicate "3.1 kHz audio" or "speech" and the user information layer 1 field in bits 5 to 1 of octet 5 of Bearer Capability and/or Low Layer Compatibility shall be assigned according to the coding of bits 4 to 1 of the SIC.

Note: The choice between Speech and 3.1 kHz Audio is an implementation option which may be applied to all calls or on a call by call basis. In addition, where 3.1 kHz Audio is used, it may be beneficial to include CCITT Progress Indicator 1 in the SETUP message ("call is not end to end ISDN"). This would be the case, for example, if it were possible for the call to be routed to an ISDN destination where the absence of progress indicator 1 would cause rigorous enforcement of checks such that if "Speech" was expected but 3.1 kHz Audio was received the call would fail, whereas progress indicator 1 might cause the destination to accept a 3.1 kHz Audio call in case it represented a speech call.

Case 2: Two octet SIC, with bits 7 to 5 of the first octet indicating "data".

In this case the information transfer capability field in bits 5 to 1 of octet 3 of Bearer Capability and/or Low Layer Compatibility shall be set to indicate "unrestricted digital". Octets 5 onwards of Bearer Capability and/or Low Layer Compatibility shall be generated in accordance with the requirements for coding Bearer Capability and/or Low Layer Compatibility in the ISDN into which the call is being routed. In particular:

- If octet 5 is to be included, the user information layer 1 field in bits 5 to 1 shall be set to indicate "V.110/X.30 rate adaptation".
- Octet 5a shall be included if the user rate indicated by the SIC is less than 64 kbit/s.
- Where octet 5a is included, the user rate field in bits 5 to 1 of octet 5a shall be assigned according to the coding of bits 7 to 1 of the first octet of the SIC, the Synch/Asynch bit (bit 7) shall be assigned according to whether bits 3 to 1 of the second octet of the SIC indicate synchronous or asynchronous data, and the Negotiation bit (bit 6) shall be set to zero.

- Octets 5b and 5c shall be included if bits 3 to 1 of the SIC indicate "asynchronous".
- If octet 5b is included, the intermediate rate field shall be coded on the basis that V.110/X.30 rate adaptation is in use. In the case of synchronous data, the Network Independent Clock indications shall be assigned according to bit 7 of the second octet of the SIC. In the case of asynchronous data, the Flow Control indications shall be set according to bit 7 of the second octet of the SIC.
- If asynchronous data is indicated, the number of stop bits field in octet 5c shall be coded according to bits 3 to 1 of the second octet of the SIC, the number of data bits field in octet 5c shall be coded according to bits 6 and 5 of the second octet of the SIC, and the parity field in octet 5c shall be set to indicate "none".
- Octet 5d shall be included to indicate half duplex operation if bit 4 of the second octet of the SIC indicates "half duplex".
- Octets 6 and 7 may be included in the case of synchronous data to indicate X.25 layer 2 and layer 3 if bit 6 of the second octet of the SIC indicates "X.25 packet mode".

2.2 ISDN Party Category and Progress Indicator information elements <--> DPNSS 1 CLC

This mapping is only applicable at a Gateway between DPNSS 1 and ETS 300 172 (private ISDN).

2.2.1 ISDN to DPNSS 1

This mapping can only be performed if at least one of the following has been received:

- A Party Category information element, other than one indicating "unknown".
- A Progress Indicator information element indicating progress description 16, with a location field indicating the local private network.
- A Progress Indicator information element indicating progress description 1, with a location field indicating the local private network, that has not subsequently been negated by receipt of a progress description 4 with a corresponding location field value.

Progress descriptions received other than as described above, e.g. with a location field indicating the public network, or a progress description 1 that has been followed by a progress description 4 with the same location field value, shall be ignored for the purpose of this mapping.

The mapping shall take account of all relevant progress descriptions received up to the point where CLC is to be generated.

If no Party Category information element has been received, other than one indicating "unknown", but either or both of progress descriptions 16 or 1 has been received as described above, CLC-DEC, CLC-PSTN or CLC-ISDN shall be generated as follows:

- CLC-DEC shall be generated if progress description 1, but not 16, has been received.
- CLC-PSTN shall be generated if both progress descriptions 16 and 1 have been received.
- CLC-ISDN shall be generated if progress description 16, but not 1, has been received.
- In addition, if progress description 17 or 19 has been received, the Parameter to the CLC shall indicate "unable to supply a release signal", and if progress description 18 has been received, the Parameter to the CLC shall indicate "unable to supply a release signal before answer".

If a Party Category information element indicating "extension" has been received CLC-ORD shall be generated.

If a Party Category information element indicating "emergency extension" has been received, CLC-ORD with a Service Marking Parameter indicating "emergency telephone" shall be generated.

If a Party Category information element indicating "operator" has been received, CLC-OP shall be generated.

2.2.2 DPNSS 1 to ISDN

If CLC-ORD without a Service Marking Parameter indicating "emergency telephone" has been received, a Party Category information element indicating "extension" shall be generated.

If CLC-ORD with a Service Marking Parameter indicating "emergency telephone" has been received, a Party Category information element indicating "emergency extension" shall be generated.

If CLC-OP has been received, a Party Category information element indicating "operator" shall be generated.

If CLC-ISDN has been received, a Progress Indicator information element containing progress description 16 shall be generated. A Party Category information element indicating "unknown" may also be generated.

If CLC-PSTN has been received, a Progress Indicator information element containing progress description 16 and a Progress Indicator information element containing progress description 1 shall be generated. A Party Category information element indicating "unknown" may also be generated.

If CLC-DEC has been received, a Progress Indicator information element containing progress description 1 shall be generated. A Party Category information element indicating "unknown" may be generated.

If the CLC Status Parameter indicates that release capability is limited, then additional progress descriptions shall be generated as follows:

- If the Parameter indicates "unable to supply a release signal" then a Progress Indicator information element containing progress description 17 shall be generated.
- If the Parameter indicates "unable to supply a release signal before answer" then a Progress Indicator information element containing progress description 18 shall be generated.

2.3 ISDN Cause information element <--> DPNSS 1 Clearing Cause

2.3.1 ISDN to DPNSS 1

Since there is limited correspondence between ISDN Causes and DPNSS 1 Clearing Causes, a mandatory mapping is not given. TABLE 1, however, shows recommended mappings between Causes and Clearing Causes which may normally be expected during a Simple Call. Alternative mappings are permissible. In particular, the Cause information element may contain Location and Diagnostic information which the Gateway PBX may use to derive a more appropriate Clearing Cause. Mappings that are not shown are an implementation option, however, an implementation should avoid the use of mappings which could give rise to undesirable actions, e.g. inappropriate mapping of a Cause information element to Clearing Cause: Busy (BY) may result in the unwanted invocation of DPNSS 1 Supplementary Services such as Call Back When Free, Intrusion, etc.

If a Cause is received which suggests that a protocol error has occurred within the ISDN network, it is recommended that this is mapped to the DPNSS 1 Clearing Cause, Network Termination (NT).

Under certain circumstances at a public ISDN Gateway, more than one Cause information element may be received in an ISDN message. In this case the Gateway PBX shall choose one of these for mapping to a DPNSS 1 Clearing Cause. The choice of which Cause information element to map is an implementation option.

TABLE 1

RECOMMENDED MAPPINGS FROM ISDN CAUSE TO DPNSS 1 CLEARING/REJECTION CAUSE			
ISDN CAUSE		DPNSS 1 CAUSE	
Number	Meaning	Mnemonic	Meaning
1	Unallocated (Unassigned) Number	NU	Number Unobtainable
16	Normal Call Clearing	CT	Call Termination
17	User Busy	BY	Busy
22	Number Changed	NU	Number Unobtainable
27	Destination Out of Order	SOS	Subscriber Out of Service
28	Invalid Number Format	AI	Address Incomplete
31	Normal, Unspecified	CT	Call Termination
34	No Circuit/Channel Available	CON	Congestion
38	Network Out of Order	ROS	Route Out of Service
41	Temporary Failure	CON	Congestion
42	Switching Equipment Congestion	CON	Congestion
44	Requested Circuit/Channel Not Available	CON	Congestion
65	Bearer Capability Not Implemented	INC	Service Incompatible
70	Only Restricted Digital Information Bearer Capability Implemented	INC	Service Incompatible
88	Incompatible Destination	SI	Subscriber Incompatible
102	Recovery on Timer Expiry	NT	Network Termination

2.3.2 DPNSS 1 to ISDN

Since there is limited correspondence between DPNSS 1 Clearing Causes and ISDN Causes, a mandatory mapping is not given. TABLE 2, however, shows recommended mappings between Clearing Causes and Causes which may normally be expected during a Simple Call. Alternative mappings are permissible.

Mappings that are not shown are an implementation option, however, an implementation should avoid the use of inappropriate mappings which could give rise to undesirable actions in the ISDN network.

If a Clearing Cause is received indicating a protocol error has occurred within the DPNSS 1 network, it is recommended that this is mapped to the ISDN Cause number 31 (Normal, Unspecified).

TABLE 2

RECOMMENDED MAPPINGS FROM DPNSS 1 CLEARING/REJECTION CAUSE TO ISDN CAUSE			
DPNSS 1 CAUSE		ISDN CAUSE	
Mnemonic	Meaning	Number	Meaning
AI	Address Incomplete	28	Invalid Number Format (Address Incomplete)
BY	Busy	17	User Busy
CON	Congestion	34	No Circuit/Channel Available
CT	Call Termination	16	Normal Call Termination
ICB	Incoming Calls Barred	21	Call Rejected
INC	Service Incompatible	65	Bearer Capability Not Implemented
NT	Network Termination	31	Normal, Unspecified
ROS	Route Out of Service	38	Network Out of Order
SI	Subscriber Incompatible	88	Incompatible Destination
SOS	Subscriber Out of Service	27	Destination Out of Order

2.4 ISDN Transit Counter information element <--> DPNSS 1 String LA

This mapping is only applicable at a DPNSS 1 to ETS 300 172 (private ISDN) Gateway.

The generation of a Transit Counter information element is not dependent on receipt of a Loop Avoidance (LA) String from DPNSS 1, nor is generation of a Loop Avoidance String in DPNSS 1 dependent on receipt of a Transit Counter information element from ISDN.

If there are mechanisms in place to prevent indefinite looping between the ISDN and DPNSS 1 parts of a private network, the looping control mechanisms available can be independently applied in the DPNSS 1 and ISDN parts of a private network to prevent looping in the private network as a whole.

The mapping between Loop Avoidance and Transit Counter described below provides a mechanism for controlling looping in a combined network where there is no restriction imposed on the number of times a call can cross between the DPNSS 1 and ISDN parts of a private network. Implicit in this is the notion of a "global transit limit" for the combined ISDN/DPNSS 1 network which represents the maximum number of transit PBXs which a call may pass through during call setup.

2.4.1 ISDN to DPNSS 1

When a Transit Counter information element is received and the call is to be routed into the DPNSS 1 part of the network, the Parameter value shall be subtracted from the global transit limit. If the value resulting is less than 1, then the call shall be deemed to have encountered congestion. If the value resulting is greater than or equal to 1, then it shall be decremented by 1 and the decremented value shall be encoded as the parameter to a Loop Avoidance String passed forward in ISRM/SSRM message sequence.

For example, with a global transit limit of 6, a received Parameter of 3 would be mapped onto "C" (representing 2 further transits allowed).

The Number Of Further Alternative Routes Parameter may be added as required by the Gateway PBX.

2.4.2 DPNSS 1 to ISDN

When a Loop Avoidance String is received and the call is to be routed to the ISDN part of the network, the Number Of Further Transits Parameter shall be decoded to ascertain the number of further transit PBXs which the call can pass through. If this indicates zero, the call shall be deemed to have encountered congestion. If a non-zero value results, this shall be decremented by 1 and subtracted from the global transit limit. The resulting value shall be passed forward in the Transit Counter information element included in the SETUP message.

For example, with a global transit limit of 4, a received Parameter of "D" (representing 3 further transits allowed) would be mapped onto a transit count of 2.

The Number Of Further Alternative Routes Parameter (if present) shall be discarded when routing from DPNSS 1 to ISDN although it may be used by the gateway PBX to decide whether or not to allow alternative routing into the ISDN.

2.5 ISDN Progress Indicator information elements <--> DPNSS 1 String RTI

This mapping is only applicable at a Gateway between DPNSS 1 and ETS 300 172 (private ISDN) during the routing phase of the call (i.e. before a NAM has been sent or received).

2.5.1 ISDN to DPNSS 1

This mapping can only be performed if at least one of the following has been received:

- A Progress Indicator information element indicating progress description 16, with a location field indicating the local private network.
- A Progress Indicator information element indicating progress description 1, with a location field indicating the local private network, that has not been subsequently negated by receipt of a progress description 4 with a corresponding location field value.

Progress descriptions received other than as described above, e.g. with a location field indicating the public network, or a progress description 1 that has been followed by a progress description 4 with the same location field value, shall be ignored for the purpose of this mapping.

The mapping shall take account of all relevant progress descriptions received up to the point where RTI is to be generated.

If progress description 1, but not 16, has been received, RTI with a Parameter indicating "Decadic encountered" shall be generated.

If progress description 16, but not 1, has been received, RTI with a Parameter indicating "Public ISDN encountered" shall be generated.

If both progress descriptions 1 and 16, have been received, RTI with a Parameter indicating "PSTN encountered" shall be generated.

2.5.2 DPNSS 1 to ISDN

If RTI is received indicating "Decadic encountered", a Progress indicator information element containing progress description 1 shall be generated.

If RTI is received indicating "public ISDN encountered", a Progress Indicator information element containing progress description 16 shall be generated.

If RTI is received indicating "PSTN encountered", a Progress Indicator information element containing progress description 16 and a Progress Indicator information element containing progress description 1 shall be generated.

INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 5 - GENERAL SIGNALLING PROCEDURES

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HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]

1 GENERAL

1.1 The Layer 3 signalling procedures for interworking between DPNSS 1 and ISDN signalling systems are defined by the details given in SECTION 6 of this specification, in conjunction with the general signalling procedures of the individual signalling systems that are contained in other DPNSS 1 specifications and ETSI specifications.

1.2 Subsection 2 describes the conventions used for the specification of Layer 3 procedures used in SECTION 6 of this specification.

1.3 Subsection 3 references the signalling procedures applicable for a Gateway PBX over and above those specified in SECTION 6 of this specification, and includes a description of the "SAVE" mechanism for extending the Indication Blocks of NAMs and CCMs which is required for the support of certain aspects of Enhanced Interworking. Also contained in Subsection 3 is a brief description of some of the issues relating to the interworking of numbering plans which may be applicable at DPNSS 1/ISDN Gateway PBXs.

2 SPECIFICATION FORMAT

2.1 SERVICE SECTION FORMAT

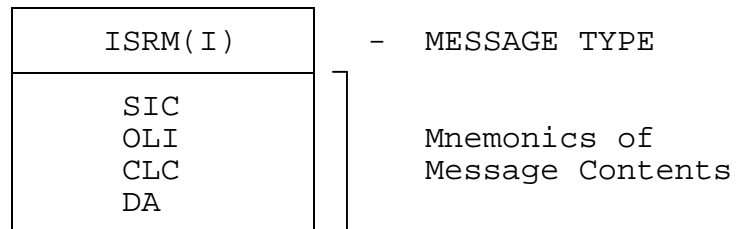
The Service Section (SECTION 6) is written to a standard format as follows:

- a separate Subsection is allocated to each signalling system for which interworking with DPNSS 1 is described;
- each Subsection begins with a definition of the interworking to be described;
- an Outline of Operation indicates a breakdown of the description into separate aspects of the interworking;
- each aspect of interworking is described by means of explanatory text supported by Message Sequence Diagrams (MSDs).

2.2 MSD SYMBOLS

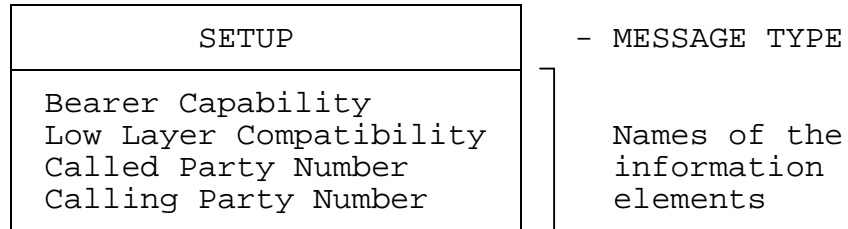
The Message Sequence Diagrams conform to a standard layout and use the following symbols and conventions:

2.2.1 A DPNSS 1 Message



Coding details for, and the meaning of the mnemonics relating to DPNSS 1 Messages are given in SECTION 4 of this specification.

2.2.2 An ISDN Message



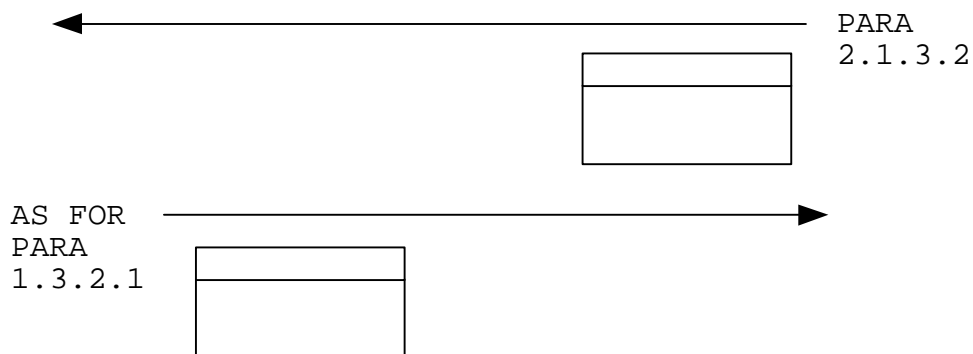
NOTE: Only information elements that are relevant to interworking are shown on the MSDs (eg "Call Reference" would not be shown).

Coding details for the information elements of ISDN Messages are given in the relevant ISDN specification (see SECTION 1).

2.2.3 Signalling Message Flow



2.2.4 Reference to Text for Explanation of PBX Action and Possible Alternative Sequences



2.2.5 Connection State of a Traffic Channel



2.3 TEXT AND MSD CONVENTIONS

2.3.1 Terminology

The terminology used throughout this specification is based on the standards set in DPNSS[188] and DPNSS[189] for text relating to DPNSS 1 signalling; text relating to ISDN signalling adopts the style and nomenclature of the relevant ETSI standards.

2.3.2 ISRM Convention

In the text and MSDs the use of the term "ISRM" indicates that either a single ISRM(C), a single ISRM(I) or an ISRM(I) followed by one or more SSRMs [the last of which may be an SSRM(C)] may be used to convey the contents of the Selection Block.

The use of the term "ISRM(C)" represents either a single ISRM(C) or an ISRM(I) followed by one or more SSRMs, the last of which is an SSRM(C).

The use of the term "ISRM(I)" represents either a single ISRM(I) or an ISRM(I) followed by one or more SSRM(I)s.

The use of the term "SSRM(I)" represents either a single SSRM(I) or a sequence of SSRM(I)s.

The use of the term "SSRM(C)" represents either a single SSRM(C) or a sequence of one or more SSRM(I)s followed by an SSRM(C).

2.4 PROGRESS DESCRIPTIONS

In the text reference is made to certain progress descriptions by number, as defined in the relevant ISDN standards. The meanings of these descriptions are as follows:

2.4.1 CCITT Defined:

- 1 Call is not end-to-end ISDN: further progress information may be available in-band
- 2 Destination address is non-ISDN
- 3 Origination address is non-ISDN
- 4 Call has returned to the ISDN
- 8 In-band information or appropriate pattern now available

2.4.2 ECMA/ETSI Defined:

- 16 Interworking with a public network
- 17 Interworking with a network unable to supply a release signal
- 18 Interworking with a network unable to supply a release signal before answer
- 19 Interworking with a network unable to supply a release signal after answer

NOTE: In the above progress descriptions the term "ISDN" can refer to a public or a private ISDN.

3 SIGNALLING PROCEDURES

3.1 ISDN

The handling of messages and message contents, and the control of simple circuit switched calls, on the ISDN side of a Gateway PBX shall be as defined in the appropriate ISDN specification (see SECTION 6).

3.2 DPNSS 1

The handling of messages and message contents, and the control of simple circuit switched calls, on the DPNSS 1 side of a Gateway PBX shall be as defined in DPNSS[188] and DPNSS[189], and shall be in addition to those Interworking Procedures that are supported by the Gateway PBX.

3.3 MAPPING

Mapping between ISDN and DPNSS 1 messages and message contents is very much context dependent, although some mappings are applicable in a number of contexts. The more common mapping details are given in SECTION 4, ANNEX 1. These details are referenced from the appropriate parts of SECTION 6. Additional mappings are given within the text of the Subsections of SECTION 6; in general these additional mappings are specific to the part of the interworking procedures in which they are described.

3.4 DESTINATION ADDRESS/NUMBERING

Since there is no equivalent in DPNSS 1 to the ISDN concepts of Numbering Plan Identification and Type of Number, as contained in the Called Party Number information element, consideration needs to be given to the different way in which numbering is handled in DPNSS 1 networks and in ISDN networks when mapping between Called Party Number and Destination Address.

In DPNSS 1 networks, routing is based on analysis of Destination Address digits which may represent destinations internal to the private network, or destinations external to the private network, for example in the PSTN. When routing a call across a DPNSS 1 network to destinations outside the private network, the format of the Destination Address will be dependent on the private network numbering scheme.

For example on calls to the PSTN via DPNSS 1, in order to generate a suitable DPNSS 1 Destination Address, the PSTN address digits may need to be prefixed by digits which indicate that PSTN access is required and/or by digits that cause routing to a particular public network Gateway. In such a case the digits sent to be public network would be a subset of the DPNSS 1 Destination Address.

In ISDN, the number digits may be used in a similar manner to the DPNSS 1 Destination Address by setting the Numbering Plan Identification and Type of Number to "unknown". Alternatively, the number digits may be identified explicitly by the Numbering Plan Identification and Type of Number, as being formatted in accordance with a particular numbering scheme.

3.4.1 ISDN to DPNSS 1

When routing from ISDN to DPNSS 1, the DPNSS 1 Destination Address digits shall be derived from the Numbering Plan Identification and the Type of Number as well as the Number digits. In some cases it may be appropriate to use the Number Digits as the DPNSS 1 Destination Address without modification; in other cases the Numbering Plan Identification and Type of Number may affect the way in which the DPNSS 1 Destination Address digits are derived from the Number Digits.

3.4.2 DPNSS 1 to ISDN

When routing from DPNSS 1 to ISDN, the contents of the Called Party Number information element in terms of Numbering Plan Identification, Type of Number and Number Digits shall all be derived from the DPNSS 1 Destination Address digits.

3.5 EXTENSION OF THE INDICATION BLOCKS OF THE NAM AND THE CCM

Enhanced Interworking defines procedures that, depending on the amount of information received on the ISDN side of a Gateway PBX, could require more strings to be returned at the time of sending a NAM or CCM than can be fitted into these messages. The following paragraphs define the mechanism to be used when there is a need to extend the capacity of the Indication Field of a NAM and/or a CCM.

The mechanism defined in this Subsection involves the use of the SAVE String. The SAVE String shall be used only as defined in paragraphs 3.5.1 to 3.5.3 and, apart from the use with NSI, the SAVE mechanism shall be used only in the circumstances explicitly specified in SECTION 6 of this specification.

A PBX shall be required to support the SAVE mechanism only in those circumstances where compliance with SECTION 6 procedures that specify its use is claimed.

3.5.1 General

Certain strings may be included in a NIM rather than a NAM, with the receiving PBX being informed by the inclusion of the string SAVE that the information included in the NIM is related to the NAM which is to follow. Similarly certain Strings may be included in an EEM rather than a CCM, with the receiving PBX being informed by the inclusion of the String SAVE that the information included in the EEM is related to the CCM which is to follow.

In this issue of this specification the Strings that are valid for use with the SAVE mechanism are as follows:

- I-CPN
- I-CSA
- I-LLC
- I-PROG
- NSI Strings

Further Strings may be added to this list in later issues of this specification, together with explicit specification for their use in conjunction with SAVE.

3.5.2 Use of SAVE in a NIM

A PBX sending a NIM containing SAVE shall follow it either by another NIM containing SAVE or by a NAM.

On receipt of one or more NIMs containing SAVE, the Strings that the PBX recognises as valid for use with SAVE shall be saved for processing along with the Strings contained in the subsequent NAM.

If a PBX receives a String accompanied by SAVE in a NIM, in a context in which it does not itself support the SAVE mechanism, then it is not obliged to save that String, even though it may be recognised by the PBX. If such a String is not saved for processing with the contents of the NAM to follow, it shall be processed immediately as part of the contents of the NIM, as if SAVE had not been received.

It is an implementation option whether the unrecognised Strings in NIMs containing SAVE are dealt with immediately in accordance with the rules for handling unrecognised Strings in a NIM, or whether the entire Indication Field is saved for processing along with the NAM. In the latter case the Indication Fields(s) of the NIM(s) and the Indication Field of the NAM may be treated as a single Indication Block, in which case any unrecognised Strings received shall be handled according to the rules for handling unrecognised Strings in a NAM.

3.5.3 Use of SAVE in an EEM

A PBX sending an EEM sequence containing SAVE shall follow it either by another EEM sequence containing SAVE or by a CCM. In this context "an EEM sequence" means an EEM(C) or one or more EEM(I)s followed by an EEM(C). In the latter case, the String SAVE shall be included in only one of the messages, ie SAVE shall not be added more than once to the same Indication Block.

On receipt of one or more EEM sequences containing SAVE, the Strings that the PBX recognises as valid for use with SAVE shall be saved for processing along with the Strings contained in the subsequent CCM.

If a PBX receives a String accompanied by SAVE in an EEM, in a context in which it does not itself support the SAVE mechanism, then it is not obliged to save that String, even though it may be recognised by the PBX. If such a String is not saved for processing with the contents of the CCM to follow, it shall be processed immediately as part of the contents of the EEM, as if SAVE had not been received.

It is an implementation option whether the unrecognised Strings in EEMs containing SAVE are dealt with immediately in accordance with the rules for handling unrecognised strings in an EEM, or whether the entire Indication Block is saved for processing along with the CCM. In the latter case the Indication Block(s) of the EEM sequence(s) and the Indication Field of the CCM may be treated as a single Indication Block in which case any unrecognised strings received shall be handled according to the rules for handling unrecognised strings in a CCM.

INTERWORKING BETWEEN DPNSS 1 AND ISDN SIGNALLING SYSTEMS

SECTION 6 - SIMPLE CIRCUIT SWITCHED VOICE AND DATA CALLS

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HISTORY

Issue 1 - December 1992

Issue 2 - October 2001 - Specification renamed as DPNSS[189-I]
- Options added for mapping of a NAM
containing CLC-DEC or CLC-PSTN to
ALERTING/PROGRESS

1 GENERAL

1.1 This Section details the signalling requirements for PBXs which support interworking between DPNSS 1 and ISDN signalling systems for simple circuit switched voice and data calls.

1.2 Subsection 2 details simple calls when DPNSS 1 interworks with different ISDN signalling systems.

1.3 The description is given in the form of example Message Sequence Diagrams (MSDs) for typical calls, followed by explanatory text.

1.4 Alternative action (eg for unsuccessful calls) not shown in MSDs is included in the text.

1.5 Subsection 3 shows the Compliance.

1.6 Coding of the contents of messages is given in SECTION 4 of this specification.

2 INTERWORKING OF DPNSS 1 WITH ISDN SIGNALLING SYSTEMS

2.1 INTERWORKING WITH A PRIVATE ISDN AT AN ETS 300 172 INTERFACE

This Subsection deals with a simple call at a Gateway between a DPNSS 1 private network and an ETS 300 172 private ISDN.

ETS 300 172 signalling is only specified where it interacts with the DPNSS 1 signalling.

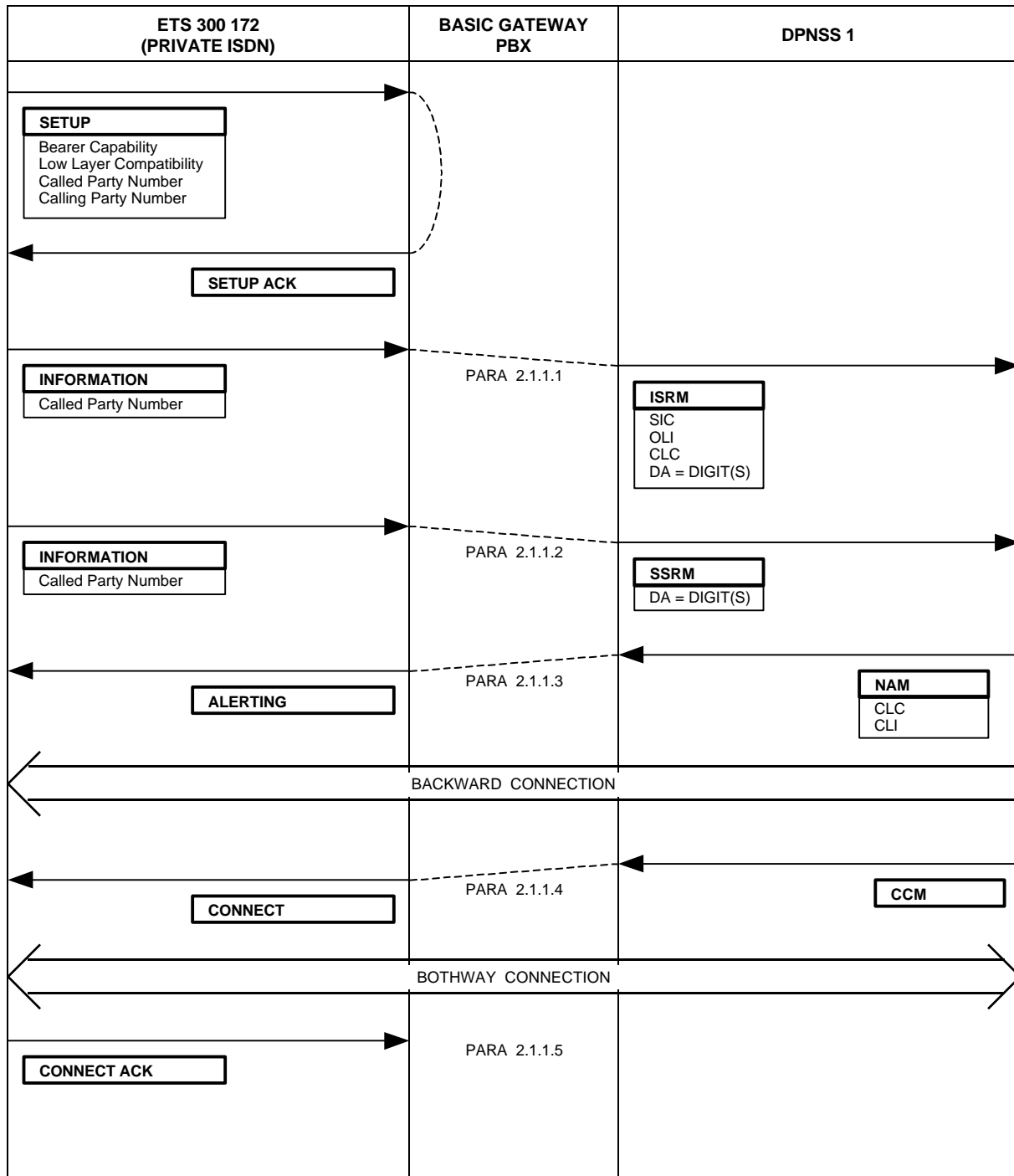
OUTLINE OF OPERATION

The signalling procedures are described in six parts:

- 2.1.1 Simple Call Setup from ETS 300 172 to DPNSS 1 at a Basic Gateway
- 2.1.2 Simple Call Setup from DPNSS 1 to ETS 300 172 at a Basic Gateway
- 2.1.3 Simple Call Clearing between DPNSS 1 and ETS 300 172 at a Basic Gateway
- 2.1.4 Simple Call Setup from ETS 300 172 to DPNSS 1 at an Enhanced Gateway
- 2.1.5 Simple Call Setup from DPNSS 1 to ETS 300 172 at an Enhanced Gateway
- 2.1.6 Simple Call Clearing between DPNSS 1 and ETS 300 172 at an Enhanced Gateway

2.1.1 SIMPLE CALL SETUP FROM ETS 300 172 TO DPNSS 1 AT A BASIC GATEWAY

The following diagram illustrates a possible message sequence. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.1.1.1 On receipt of a SETUP message and sufficient INFORMATION messages to enable a call on a suitable outgoing DPNSS 1 route to be initiated, a free channel shall be selected and an ISRM shall be sent, containing a SIC, a CLC, and if appropriate, other contents, as described below.

Any Destination Address digits derived from the received called party number information shall be included in the ISRM.

If the SETUP or an INFORMATION message contains a Sending Complete information element, an ISRM(C) or SSRM(C) may be used. An ISRM(C) or SSRM(C) may also be used if the Gateway PBX otherwise determines that the Destination Address is complete.

If the ISRM is sent after receipt of one or more INFORMATION messages, the Gateway PBX should have already returned a SETUP ACKNOWLEDGE as the first backward ISDN message. If the ISRM is sent on the basis of the SETUP message alone, the Gateway PBX shall return either SETUP ACKNOWLEDGE or CALL PROCEEDING as appropriate.

The SIC included in the ISRM shall be derived from the Bearer Capability information element and, if present, Low Layer Compatibility information element (as described in SECTION 4, ANNEX 1, paragraph 2.1.1).

CLC-DEC may be used unconditionally for the CLC to be included in the ISRM. Alternatively, if sufficient information in terms of Party Category or progress descriptions has been received, this may be used to derive the CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, either CLC-DEC or CLC-ORD shall be used. Irrespective of what information is available, neither CLC-ORD nor CLC-OP shall be used unless it is also possible to include an OLI in the ISRM.

If CLC-ORD or CLC-OP is included in the ISRM, an OLI representing a DPNSS 1 Destination Address shall also be included; this would normally be derived from Calling Party Number. If CLC-ISDN is included in the ISRM, an OLI may be included only if it contains an A Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with CLC-ISDN.

If the number contained in a Calling Party Number information element is indicated as presentation restricted, then that number shall not be sent as an OLI unless it is accompanied in the ISRM by NPR-A indicating total restriction. The choice of which suffix to give NPR-A is an option, depending on the requirements of the network with respect to how PBXs that do not recognise NPR-A should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

If a Transit Counter information element is received, and Supplementary Service: Loop Avoidance is supported by the Gateway PBX, the Transit Count may be used to derive the Parameter to LA (as described in SECTION 4, ANNEX 1, paragraph 2.4.1).

2.1.1.2 On receipt of an INFORMATION message, if a CALL PROCEEDING message has not already been sent and neither an ISRM(C) nor an SSRM(C) has been sent, the Gateway PBX shall send, in one or more SSRMs, any Destination Address digits derived from received called party number information. If the Gateway PBX recognises that the Destination Address is complete, eg by receipt of a Sending Complete information element in an INFORMATION message or by expiry of a timer, an SSRM(C) may be used and a CALL PROCEEDING message may be returned.

2.1.1.3 On receipt of a NAM the incoming and outgoing channels shall be connected in the backward direction (if not already connected). If the NAM contains CLC-ORD, CLC-OP or CLC-ISDN, an ALERTING message shall be sent. If the NAM contains CLC-DEC or CLC-PSTN, progress description 1 shall be sent (in an appropriate message) if it has not already been sent.

Note: Receipt of the NAM indicates that sufficient address information has been received from the ISDN side (irrespective of the CLC contained in the NAM).

If ALERTING is sent, and the SIC originally sent forward in the ISRM indicated a speech call, progress description 8 shall be included in ALERTING. In addition, the CLC received in the NAM may be used to generate Party Category and Progress Indicator information elements (as described in SECTION 4, ANNEX 1, paragraph 2.5.2).

If, before receipt of a NAM, a NIM containing RTI is received with a Routing Information Parameter indicating Decadic, PSTN or Public ISDN encountered, a PROGRESS message may be sent containing progress descriptions derived from the Parameter to RTI (as described in SECTION 4, ANNEX 1, paragraph 2.5.2).

2.1.1.4 On receipt of a CCM, the Gateway PBX shall send a CONNECT message and the incoming and outgoing channels shall be connected in both directions (if not already connected).

Any CLC received in the CCM, or the CLC that was previously received in the NAM, may be used to generate Party Category and/or Progress Indicator information elements for inclusion in the CONNECT message (as described in SECTION 4, ANNEX 1, paragraph 2.2.2).

The Gateway PBX may include a Connected Number information element in the CONNECT message, its contents being derived from the CLI, if received, in the CCM or NAM. If NPR-B has been received and is recognised by the Gateway PBX, the Connected Number shall be marked as presentation restricted.

2.1.1.5 Receipt of a CONNECT ACKNOWLEDGE message does not result in any DPNSS 1 signalling. Non receipt of CONNECT ACKNOWLEDGE may result in the call being cleared (see paragraph 2.1.3.3).

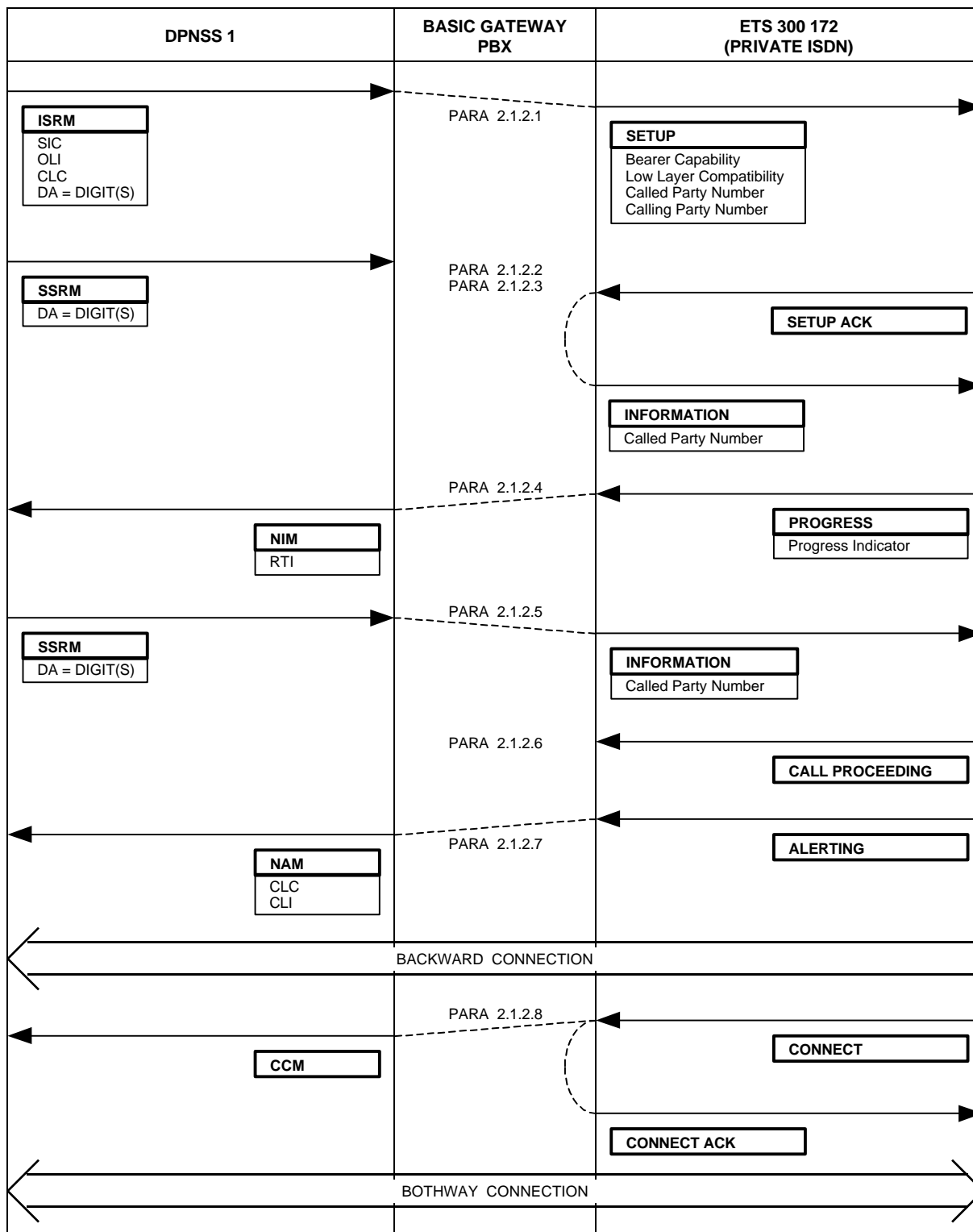
2.1.1.6 If at any time following the sending of CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.1.3.1 and 2.1.3.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM containing a Clearing Cause derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1). A CIM shall be expected in response.

2.1.2 SIMPLE CALL SETUP FROM DPNSS 1 TO ETS 300 172 AT A BASIC GATEWAY

The following diagram illustrates a possible message sequence. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.1.2.1 On receipt of an ISRM and sufficient SSRMs to enable a call on a suitable outgoing ETS 300 172 route to be initiated, a SETUP message shall be sent on the outgoing route.

Depending on Destination Address analysis and whether en-bloc sending is to be used on the outgoing route, it may be possible to identify the outgoing route but not to initiate the call because the complete called party number is required but has not yet been determined. In such a case, further address information shall be awaited before sending the SETUP.

The identification and negotiation of which channel to use on the outgoing route is dependent upon the arrangements for channel selection at the Gateway PBX.

The Called Party Number information element included in the SETUP shall be derived from the Destination Address in the ISRM.

The Bearer Capability information element included in the SETUP and any Low Layer Compatibility information element that may optionally be included in the SETUP shall be derived from the SIC contained in the ISRM (as described in SECTION 4, ANNEX 1, paragraph 2.1.2).

If it is determined that the called party number is complete, a Sending Complete information element may also be included.

The CLC received in the ISRM may be used to generate Party Category and/or Progress Indicator information elements (as described in SECTION 4, ANNEX 1, paragraph 2.2.2).

If the ISRM contains OLI, this may be used to derive a Calling Party Number information element for inclusion in the SETUP. If Calling Party Number is included, the Type of Number and Numbering Plan Identity fields shall be set to "unknown" unless the Gateway PBX can determine more appropriate values. In addition, if NPR-A has been received and is recognised by the Gateway PBX, the Calling Party Number, if it is included, shall be marked as presentation restricted.

OLI shall not be used to generate Calling Party Number (other than "number not available due to interworking") if it is accompanied by CLC-PSTN or CLC-DEC.

If no OLI is present or the OLI is not suitable for use, the Calling Party Number information element shall either be omitted from the SETUP or it shall indicate "number not available due to interworking".

A Transit Counter information element may be included in the SETUP message with the transit count field set either to 0 or to a value determined by the Parameter to LA in the ISRM, if it has been received and the Supplementary Service: Loop Avoidance is supported by the PBX. In the latter case, the value shall be determined as described in SECTION 4, ANNEX 1, paragraph 2.4.2.

2.1.2.2 Any additional address information received in SSRMs following the sending of the SETUP message shall be stored by the Gateway PBX whilst awaiting a response to the SETUP message.

2.1.2.3 If a SETUP ACKNOWLEDGE message is received and the channel indicated is acceptable, the Gateway PBX may connect the incoming and outgoing channels. Any further address information to be sent shall be forwarded in one or more INFORMATION messages. If the Gateway PBX determines that the called party number is complete, a Sending Complete information element may be included.

If the SETUP ACKNOWLEDGE message indicates that no suitable channel can be agreed upon for the call, then the ETS 300 172 part of the call shall be cleared and either another attempt to route the call shall be made or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

If CALL PROCEEDING or ALERTING or CONNECT is received as the first backward message, any address information not already sent shall be discarded and processing shall continue as described below in paragraphs 2.1.2.6, 2.1.2.7 or 2.1.2.8 respectively, unless the message received indicates that no suitable channel can be agreed upon for the call. In the latter case the ETS 300 172 part of the call shall be cleared and either another attempt to route the call shall be made or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

2.1.2.4 If, at any time following receipt of SETUP ACKNOWLEDGE or CALL PROCEEDING but before a NAM has been sent, a PROGRESS message is received without a Cause information element but containing a progress description that can be mapped onto RTI, and the option to map progress descriptions onto CLC is to be used (see paragraph 2.1.2.8 and SECTION 4, ANNEX 1, paragraph 2.2.1), then a NIM may be sent containing RTI with a Routing Information Parameter value derived from received progress description(s), as described in SECTION 4, ANNEX 1, paragraph 2.5.1.

If at any time following the receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing progress description 1 or 8 is received, which does not contain the Cause information element, the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

2.1.2.5 After SETUP ACKNOWLEDGE has been received and before any receipt of CALL PROCEEDING, ALERTING or CONNECT, any additional address information received in SSRMs shall be forwarded in one or more INFORMATION messages. If at any point the Gateway PBX determines that the called party number is complete, a Sending Complete information element may be included.

2.1.2.6 Following receipt of CALL PROCEEDING, any further SSRMs received shall be discarded.

2.1.2.7 If an ALERTING message is received, a NAM shall be sent containing a CLC and other contents if appropriate, as described below. If ALERTING contains progress description 1 or 8, the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

The NAM may unconditionally contain CLC-DEC. Alternatively, if sufficient information in terms of Party Category or progress descriptions has been received, either in ALERTING, or in earlier PROGRESS messages, this may be used to derive the CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, either CLC-DEC, or CLC-ORD shall be used.

If the NAM is to contain CLC-ORD or CLC-OP, then the NAM shall also include CLI. The Parameter to CLI shall be derived from the Destination Address digits received during call routing.

If the NAM is to contain CLC-DEC, CLC-PSTN or CLC-ISDN, then it shall be preceded by a NIM containing RTI with a corresponding Routing Information Parameter value (ie "Decadic encountered", "PSTN encountered" or "Public ISDN encountered", respectively).

If one or more NIMs containing RTI have already been sent, and the last RTI Routing Information Parameter value sent corresponds with the CLC to be sent in the NAM, then another NIM need not be sent. If the option to use CLC-DEC is always employed, the NIM (indicating "Decadic encountered") may be sent earlier, any time after the SETUP has been sent.

Following receipt of ALERTING, any further SSRMs received shall be discarded.

2.1.2.8 On receipt of a CONNECT message, a CCM shall be sent, and the Gateway PBX shall connect the incoming and outgoing channels in both directions (if not already connected). A CONNECT ACKNOWLEDGE shall also be sent.

If a NAM has not already been sent, because ALERTING was not received before CONNECT, a NAM containing at least a CLC shall be sent before the CCM. The NAM may unconditionally contain CLC-DEC. Alternatively, if sufficient information in terms of Party Category or progress descriptions has been received, either in CONNECT, or in earlier PROGRESS messages, this may be used to derive the CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, either CLC-DEC or CLC-ORD shall be used.

If the NAM is to contain CLC-ORD or CLC-OP, then the NAM shall also include CLI. The Parameter to CLI shall be derived, either from the Destination Address digits received during call routing, or from the Connected Number information element if received in CONNECT. If CLI is derived from Connected Number, and the Connected Number was marked as presentation restricted, NPR-B indicating total restriction shall also be included in the NAM. The choice of which suffix to give NPR-B is an option, depending on how PBXs that do not recognise NPR-B should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

If the NAM is to contain CLC-DEC, CLC-PSTN or CLC-ISDN, then it shall be preceded by a NIM containing RTI with a corresponding Routing Information Parameter value (ie "Decadic encountered", "PSTN encountered" or "Public ISDN encountered", respectively). If one or more NIMs containing RTI have already been sent, and the last RTI Routing Information Parameter value sent corresponds with the CLC to be sent in the NAM, then another NIM need not be sent.

CLC and/or CLI may optionally be included in the CCM.

If a CLC is to be included, the CLC sent in the NAM shall be used, unless sufficient information in terms of Party Category or progress descriptions has been received since the NAM was sent which allows a different CLC to be derived (in accordance with SECTION 4, ANNEX 1, paragraph 2.2.1).

The CLI may be derived, either from the Destination Address received during call routing, or from the Connected Number information element, if received in the CONNECT message. The Parameter to CLI shall be a B Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with the CLC sent in the CCM (if any), or, if CLC was not included in the CCM, for use with the CLC sent in the NAM.

If Connected Number is used to derive the CLI, and presentation restriction is indicated, then NPR-B indicating total restriction shall be included in the CCM. The choice of which suffix to give NPR-B is an option, depending on the requirements of the network with respect to how PBXs that do not recognise NPR-B should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

Following receipt of CONNECT, any further SSRMs received shall be discarded.

2.1.2.9 If at any time following the receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.1.3.1 and 2.1.3.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

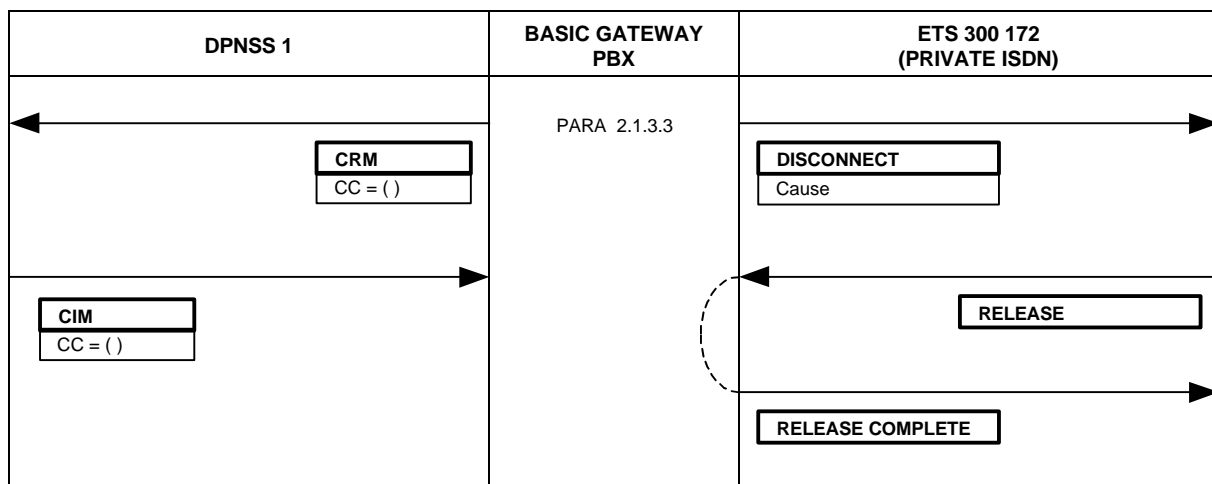
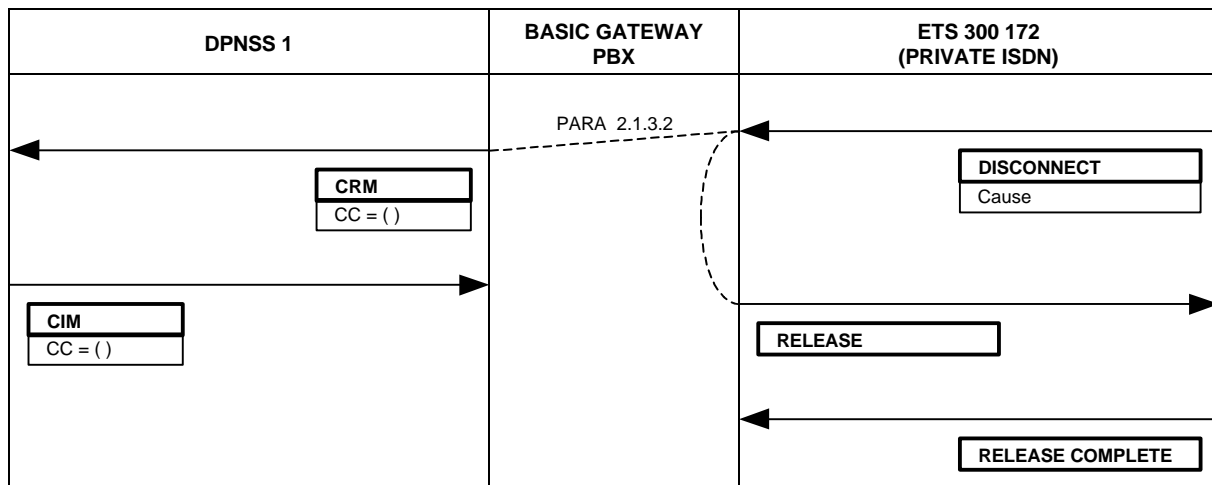
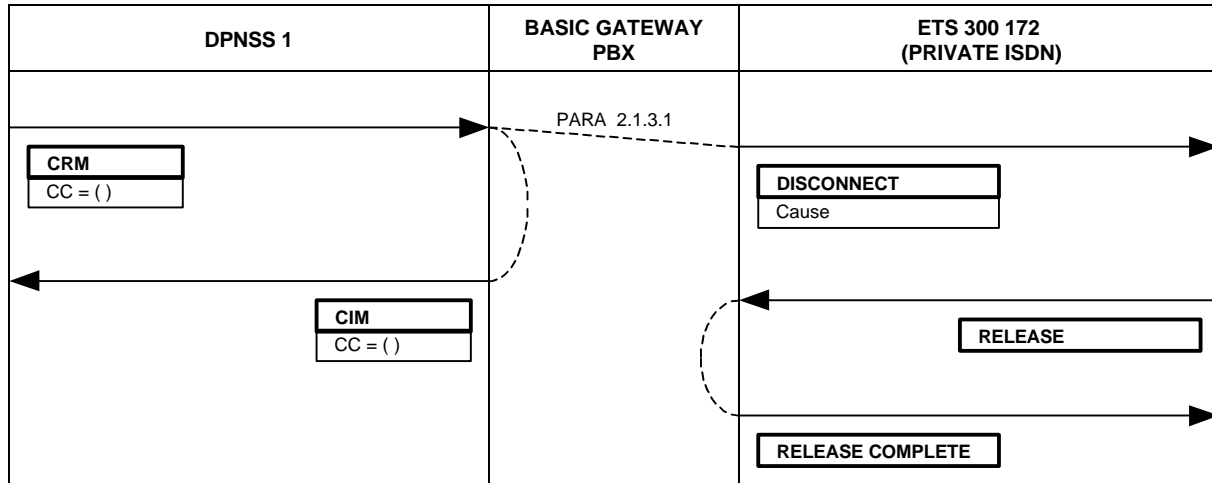
If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM containing a Clearing Cause derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1). A CIM shall be expected in response.

If clearing is not initiated immediately and if a NAM has not already been sent and if the PROGRESS message contains a progress description that can be mapped onto RTI, a NIM containing RTI may be sent, with a Routing Information Parameter value derived from received progress descriptions (as described in SECTION 4, ANNEX 1, paragraph 2.5.1).

In addition, if clearing is not initiated immediately and the PROGRESS message contains progress description 1 or 8, the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

2.1.3 SIMPLE CALL CLEARING BETWEEN DPNSS 1 AND ETS 300 172 AT A BASIC GATEWAY

The following diagrams illustrate possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.1.3.1 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives a CRM, a CIM shall be returned and clearing shall be initiated on the ETS 300 172 part of the call by sending a DISCONNECT message, unless alternative routing is appropriate.

If alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 172 part of the call and make another attempt to route the call.

If alternative routing is not appropriate, the Cause included in the DISCONNECT message shall be derived from the Clearing Cause received in the CRM (as described in SECTION 4, ANNEX 1, paragraph 2.3.2).

2.1.3.2 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives an ISDN clearing message (ie DISCONNECT, RELEASE or RELEASE COMPLETE), the DPNSS 1 part of the call shall be cleared by sending a CRM and awaiting a CIM in response, unless alternative routing is appropriate.

If a NAM has not already been sent and alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case, a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

If alternative routing is not appropriate, the Clearing Cause included in the CRM shall be derived from the Cause received in the clearing message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1).

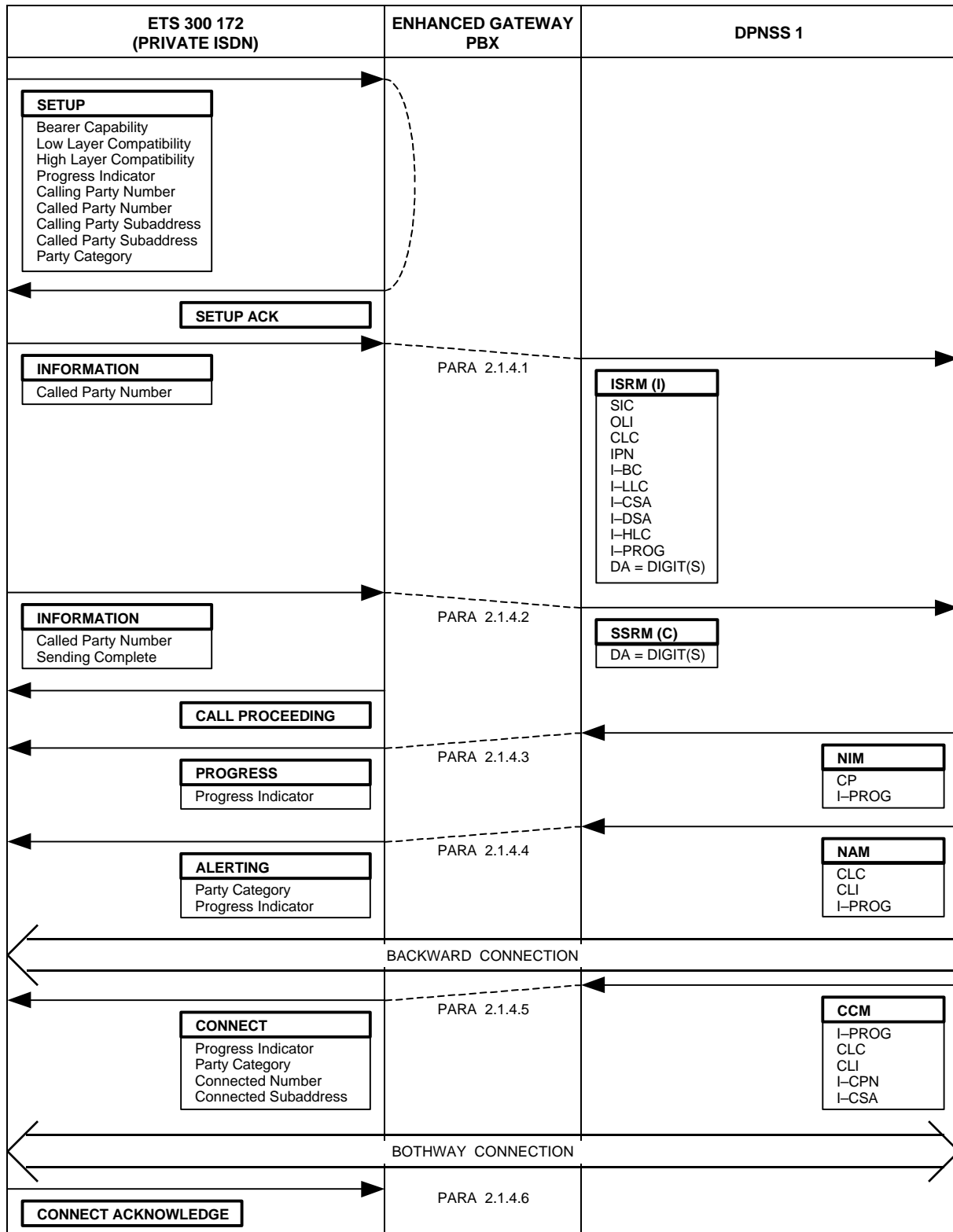
2.1.3.3 If, at any point after the outgoing part of the call has been initiated, the Gateway PBX decides to abort the call, eg due to expiry of a timer, clearing procedures shall be invoked in both directions and continue independently, unless alternative routing is appropriate.

If the incoming route is the ETS 300 172 part of the call and alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 172 part of the call and make another attempt to route the call.

If the incoming route is the DPNSS 1 part of the call, then if a NAM has not already been sent and if alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case, a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

2.1.4 SIMPLE CALL SETUP FROM ETS 300 172 TO DPNSS 1 AT AN ENHANCED GATEWAY

The following diagram illustrates a possible message sequence. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.1.4.1 On receipt of a SETUP message and sufficient INFORMATION messages to enable a call on a suitable outgoing DPNSS 1 route to be initiated, a free channel shall be selected and an ISRM shall be sent containing a SIC, a CLC, IPN, and if appropriate, other contents, as described below.

Any Destination Address digits derived from the received called party number information shall be included in the ISRM.

If the SETUP or an INFORMATION message contains a Sending Complete information element, an ISRM(C) or SSRM(C) may be used. An ISRM(C) or SSRM(C) may also be used if the Gateway PBX otherwise determines that the Destination Address is complete.

If the ISRM is sent after receipt of one or more INFORMATION messages, the Gateway PBX should already have returned a SETUP ACKNOWLEDGE as the first backward ISDN message. If the ISRM is sent on the basis of the SETUP message alone, the Gateway PBX shall return either SETUP ACKNOWLEDGE or CALL PROCEEDING as appropriate.

The SIC included in the ISRM shall be derived from the Bearer Capability information element and, if present, Low Layer Compatibility information element (as described in SECTION 4, ANNEX 1, paragraph 2.1.1).

I-BC shall be included in the ISRM, derived from the received Bearer Capability information element, unless the Bearer Capability contains non-CCITT coded information - in which case, the inclusion of I-BC in the ISRM is optional (see SECTION 4, ANNEX 1, paragraph 2.1.1).

If a Low Layer Compatibility information element is present in the SETUP message, then I-LLC shall be included in the ISRM, unless the Low Layer Compatibility contains non-CCITT coded information - in which case, the inclusion of I-LLC in the ISRM is optional (see SECTION 4, ANNEX 1, paragraph 2.1.1).

I-BC and/or I-LLC may require a "B" String Suffix as described in SECTION 4, ANNEX 1, paragraph 2.1.1.

If a High Layer Compatibility information element is present in the SETUP message then I-HLC shall be included in the ISRM.

If a Called Party Subaddress information element is present in the SETUP message, then I-DSA shall be included in the ISRM.

If a Calling Party Subaddress information element is present in the SETUP message, then I-CSA shall be included in the ISRM.

If sufficient information in terms of Party Category or progress descriptions has been received, this shall be used to derive the CLC to be included in the ISRM (as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, then either CLC-DEC (with indications of inability to release included as appropriate) or CLC-ORD shall be used. Where, however, CLC-ORD or CLC-OP would be used, but it is not possible to include an OLI in the ISRM, CLC-DEC shall be used instead.

If CLC-ORD or CLC-OP is included in the ISRM, an OLI representing a DPNSS 1 Destination Address shall also be included; this would normally be derived from Calling Party Number. If CLC-ISDN is included in the ISRM, an OLI may be included only if it contains an A Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with CLC-ISDN.

If the number contained in a Calling Party Number information element is indicated as presentation restricted, then that number shall not be sent as an OLI unless it is accompanied in the ISRM by NPR-A indicating total restriction. The choice of which suffix to give NPR-A is an option, depending on how PBXs that do not recognise NPR-A should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

If Calling Party Number has been received, I-CPN derived from it shall be included in the ISRM (irrespective of whether or not any OLI has been included).

Any progress descriptions included in the SETUP message shall be mapped onto the Parameters of I-PROG and included in the ISRM.

If a Transit Counter information element is received, and the Supplementary Service: Loop Avoidance is supported by the Gateway PBX, the Transit Count may be used to derive the Parameter to LA (as described in SECTION 4, ANNEX 1, paragraph 2.4.1).

There is a possibility that in some cases the amount of information to be included in the ISRM [ie ISRM(I) and a sequence of SSRMs] may exceed the maximum Selection Block length limit of some PBXs in the network, particularly if the minimum limit (135 octets) has been used on one or more of the PBXs.

Where a Selection Block generated by a Gateway PBX would exceed the limit imposed by the network, the Gateway PBX shall either:

- reduce the length of the Selection Block so that it is within this limit by omitting some of the Strings specified above, or;
- attempt the call with the full Selection Block, as long as on receipt of a CRM containing SNU with Parameter "F", a repeat attempt is made to establish the call with a reduced Selection Block length. This process shall be repeated as many times as necessary until the Selection Block length has been reduced to not more than 135 octets or until the call ceases to fail in this manner.

The Strings that may be omitted in order to reduce the Selection Block length to within the limit are: I-HLC, I-CSA and I-CPN. The precedence given to the omission of these Strings is an implementation option.

2.1.4.2 On receipt of an INFORMATION message, if a CALL PROCEEDING message has not already been sent and neither an ISRM(C) nor an SSRM(C) has been sent, the Gateway PBX shall send, in one or more SSRMs, any Destination Address digits derived from received called party number information. If the Gateway PBX recognises that the Destination Address is complete, eg by receipt of a Sending Complete information element in an INFORMATION message or by expiry of a timer, an SSRM(C) may be used and a CALL PROCEEDING message may be returned.

2.1.4.3 If a NIM is received containing CP and no CALL PROCEEDING has been sent, then the Gateway PBX may send a CALL PROCEEDING message.

If a NIM containing I-PROG is received by the Gateway PBX then a PROGRESS message containing Progress Indicator information elements derived from the Parameters to I-PROG shall be sent, unless SAVE is also present in the NIM, in which case sending the Progress Indicators shall be delayed until the NAM is received as described in paragraph 2.1.4.4.

Note: A NIM may contain both CP and I-PROG, however, it should not contain both CP and SAVE.

If a NIM containing RTI is received with a Routing Information Parameter indicating Decadic, PSTN or Public ISDN encountered, a PROGRESS message shall be sent containing progress descriptions derived from the Parameter to RTI (as described in SECTION 4, ANNEX 1, paragraph 2.5.2) except when any of these progress descriptions are already to be sent as a result of having received I-PROG in the same NIM.

Note: A NIM should not contain both RTI and SAVE.

2.1.4.4 On receipt of a NAM, the incoming and outgoing channels shall be connected in the backward direction (if not already connected). An ALERTING message shall be sent if the NAM contains CLC-ORD, CLC-OP or CLC-ISDN. If the NAM contains CLC-DEC or CLC-PSTN, the sending of ALERTING is optional.

Note: Receipt of the NAM indicates that sufficient address information has been received from the ISDN side (irrespective of the CLC contained in the NAM).

If ALERTING is sent, it shall contain Party Category and/or Progress Indicator information elements derived from the received CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.2). In addition, if the SIC originally sent forward in the ISRM indicated a speech call, progress description 8 shall be included in any ALERTING message sent.

If I-PROG is present in the NAM, or has already been received in a preceding NIM accompanied by SAVE, then Progress Indicator information elements derived from the Parameters to I-PROG shall be sent in an appropriate message (eg ALERTING or PROGRESS).

2.1.4.5 On receipt of a CCM, the Gateway PBX shall send a CONNECT message and the incoming and outgoing channels shall be connected in both directions (if not already connected).

If a CLC is present in the CCM this shall be used to generate Party Category and/or Progress Indicator information elements (as described in SECTION 4, ANNEX 1, paragraph 2.2.2).

If CLI is present in the CCM or has already been received in the NAM, or if I-CPN is contained in the CCM or has already been received in an EEM accompanied by SAVE, a Connected Number information element generated from CLI or I-CPN shall be included in the CONNECT message. Where both CLI and I-CPN have been received, I-CPN shall be used in preference to CLI. If CLI is used and NPR-B has been received, the Connected Number shall be marked as presentation restricted. Where a presentation indicator is included and no screening information is available, "User-provided not screened" shall be indicated.

If I-LLC is present in the CCM or has already been received in an EEM accompanied by SAVE, then a Low Layer Compatibility information element derived from I-LLC shall be included in the CONNECT message.

If I-PROG is present in the CCM or has already been received in an EEM accompanied by SAVE, then Progress Indicator information elements derived from the Parameters to I-PROG shall be included in the CONNECT message.

If I-CSA is present in the CCM or has already been received in an EEM accompanied by SAVE, then a Connected Subaddress information element derived from I-CSA shall be included in the CONNECT message.

2.1.4.6 Receipt of a CONNECT ACKNOWLEDGE message does not result in any DPNSS 1 signalling. Non receipt of CONNECT ACKNOWLEDGE may result in the call being cleared (see paragraph 2.1.6.3).

2.1.4.7 If at any time following receipt of the NAM an EEM containing I-PROG is received, a PROGRESS message containing a Progress Indicator information element for each Parameter to I-PROG shall be sent, unless SAVE is also contained in the EEM and a CONNECT message has not yet been sent, in which case sending the Progress Indicators shall be delayed until the CONNECT message is sent as described in paragraph 2.1.4.5.

If at any time following the sending of CONNECT, a PROGRESS message is received that does not contain the Cause information element, the progress descriptions received shall be sent by including I-PROG in an EEM.

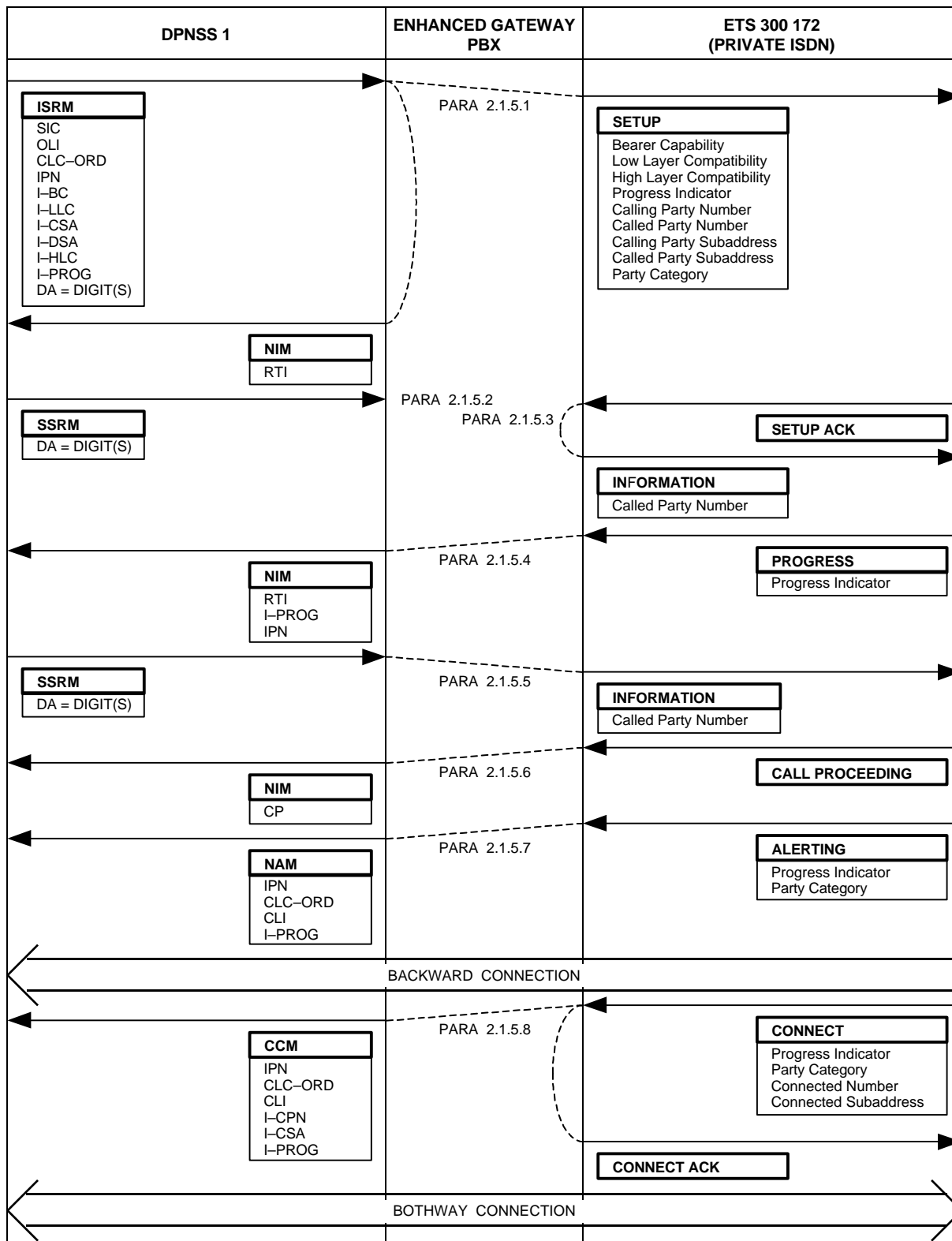
If at any time following the sending of CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.1.6.1 and 2.1.6.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM and awaiting a CIM in response. The Clearing Cause contained in the CRM shall be derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1) and I-CC shall be included in the CRM to represent the ISDN Cause received.

2.1.5 SIMPLE CALL SETUP FROM DPNSS 1 TO ETS 300 172 AT AN ENHANCED GATEWAY

The following diagram illustrates a possible message sequence. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.1.5.1 On receipt of an ISRM and sufficient SSRMs to enable a call on a suitable outgoing ETS 300 172 route to be initiated, a SETUP message shall be sent on the outgoing route and a NIM containing RTI indicating "Private ISDN encountered" shall be returned in the backward direction.

Depending on Destination Address analysis and whether en-bloc sending is to be used on the outgoing route, it may be possible to identify the outgoing route but not to initiate the call because the complete called party number is required but has not yet been determined. In such a case, further address information shall be awaited before sending the SETUP. The NIM shall not be returned before the SETUP has been sent.

The identification and negotiation of which channel to use on the outgoing route is dependent upon the arrangements for channel selection at the Gateway PBX.

The Called Party Number information element included in the SETUP shall be derived from the Destination Address in the ISRM.

If I-BC is present in the ISRM, the Bearer Capability information element included in the SETUP shall be derived from the Parameter to I-BC. If I-LLC is also present in the ISRM, a Low layer Compatibility information element derived from the Parameter to I-LLC shall also be included in the SETUP. If I-BC has not been received, then Bearer Capability and optionally Low Layer Compatibility shall be derived from the SIC (as described in SECTION 4, ANNEX 1, paragraph 2.1.2).

If it is determined that the called party number is complete, eg due to receiving an ISRM(C) or SSRM(C), a Sending Complete information element may be included in the SETUP message.

If the ISRM contains I-HLC, the SETUP shall contain a High Layer Compatibility information element derived from the Parameter to I-HLC.

If the ISRM contains I-CSA, the SETUP shall contain a Calling Party Subaddress information element derived from the Parameter to I-CSA.

If the ISRM contains I-DSA, the SETUP shall contain a Called Party Subaddress information element derived from the Parameter to I-DSA.

Party Category and/or Progress Indicator information elements shall be included in the SETUP derived from the received CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.2).

If the ISRM contains I-PROG, the SETUP shall contain Progress Indicator information elements derived from the Parameters to I-PROG except for those already included from consideration of the CLC.

A Calling Party Number information element for inclusion in the SETUP message shall be derived from either OLI or I-CPN if received in the ISRM. When both OLI and I-CPN have been received, I-CPN shall be used in preference to OLI. If OLI is used and NPR-A has been received, the Calling Party Number shall be marked as presentation restricted. Where a presentation indicator is to be included and no screening information is available, "User-provided not screened" shall be indicated.

OLI shall not be used to generate Calling Party Number (other than "number not available due to interworking") if it is accompanied by CLC-PSTN or CLC-DEC.

If I-CPN is not present and OLI is not present or not suitable for use, the Calling Party Number information element shall either be omitted from the SETUP or it shall indicate "number not available due to interworking".

A Transit Counter information element may be included in the SETUP message with the transit count field set either to 0 or to a value determined by the Parameter to LA in the ISRM if it has been received and the Supplementary Service: Loop Avoidance is supported by the PBX. In the latter case, the value shall be determined as described in SECTION 4, ANNEX 1, paragraph 2.4.2.

2.1.5.2 Any additional address information received in SSRMs following the sending of the SETUP message shall be stored by the Gateway PBX whilst awaiting a response to the SETUP message.

2.1.5.3 If a SETUP ACKNOWLEDGE message is received and the channel indicated is acceptable, the Gateway PBX may connect the incoming and outgoing channels. Any further address information to be sent shall be forwarded in one or more INFORMATION messages. If the Gateway PBX determines that the called party number is complete, a Sending Complete information element may be included and a NIM containing CP may be returned.

If the SETUP ACKNOWLEDGE message indicates that no suitable channel can be agreed upon for the call, then the ETS 300 172 part of the call shall be cleared and either another attempt to route the call shall be made, or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

If CALL PROCEEDING or ALERTING or CONNECT is received as the first backward message, any address information not already sent shall be discarded and processing shall continue as described in paragraphs 2.1.5.6, 2.1.5.7 or 2.1.5.8 respectively, unless the message received indicates that no suitable channel can be agreed upon for the call. In the latter case the ETS 300 172 part of the call shall be cleared and either another attempt to route the call shall be made, or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

2.1.5.4 If at any time following receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message is received that does not contain a Cause information element, then the progress descriptions received shall be sent as Parameters to I-PROG.

If a NAM has not already been sent I-PROG shall be sent in a NIM and if the PROGRESS message contains a progress description that can be mapped onto RTI, the NIM shall also contain RTI with a Routing Information Parameter value derived from received progress description(s), as described in SECTION 4, ANNEX 1, paragraph 2.5.1. If RTI is included the NIM shall also contain IPN.

If a NAM has already been sent, I-PROG shall be sent in an EEM (RTI shall not be included).

In addition, if progress description 1 or 8 is received the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

2.1.5.5 After SETUP ACKNOWLEDGE has been received and before any receipt of CALL PROCEEDING, ALERTING or CONNECT, any additional address information received in SSRMs shall be forwarded in one or more INFORMATION messages. If at any point the Gateway PBX determines that the called party number is complete, a Sending Complete information element may be included and a NIM containing CP may be returned.

2.1.5.6 If a CALL PROCEEDING message is received before ALERTING or CONNECT, a NIM containing CP may be sent, if CP has not already been sent.

Following receipt of CALL PROCEEDING, any further SSRMs received shall be discarded.

2.1.5.7 If an ALERTING message is received, a NAM shall be sent containing IPN, a CLC, and other contents, if appropriate, as described below. If ALERTING contains progress description 1 or 8, the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

If sufficient information in terms of Party Category or progress descriptions has been received, either in ALERTING or in earlier PROGRESS messages, this shall be used to derive the CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, either CLC-DEC (with indications of inability to release included as appropriate) or CLC-ORD shall be used.

If the NAM is to contain CLC-ORD or CLC-OP, then the NAM shall also include CLI. The Parameter to CLI shall be derived from the Destination Address digits received during call routing.

If the NAM is to contain CLC-DEC, CLC-PSTN or CLC-ISDN, then it must be preceded by a NIM containing RTI with a corresponding Routing Information Parameter value (ie "Decadic encountered", "PSTN encountered" or "Public ISDN encountered", respectively) and IPN. If one or more NIMs containing RTI have already been sent and the last RTI Routing Information Parameter value sent corresponds with the CLC to be sent in the NAM, then another NIM need not be sent.

Any progress descriptions contained in the ALERTING message shall be included in I-PROG sent in the NAM, or in a NIM sent before the NAM. In the latter case, the NIM shall also contain SAVE to indicate that the information contained in the NIM is related to the NAM which is to follow. Where both a NIM containing RTI and a NIM containing SAVE are to be sent, these shall be sent as separate NIMs with the NIM containing RTI sent first.

If ALERTING contains progress descriptions 1 or 8, the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

Following receipt of ALERTING, any further SSRMs received shall be discarded.

2.1.5.8 On receipt of a CONNECT message, a CCM shall be sent, and the Gateway PBX shall connect the incoming and outgoing channels in both directions (if not already connected). A CONNECT ACKNOWLEDGE shall also be sent.

If a NAM has not already been sent, because ALERTING was not received before CONNECT, a NAM containing IPN and a CLC shall be sent before the CCM (and any EEM containing SAVE). If sufficient information in terms of Party Category or progress descriptions has been received, either in ALERTING, or in earlier PROGRESS messages, this shall be used to derive the CLC (as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, either CLC-DEC (with indications of inability to release included as appropriate) or CLC-ORD shall be used.

If the NAM is to contain CLC-ORD or CLC-OP, then the NAM shall also include CLI. The Parameter to CLI shall be derived, either from the Destination Address digits received during call routing, or from the Connected Number information element if received in CONNECT. If CLI is derived from Connected Number, and the Connected Number was marked as presentation restricted, NPR-B indicating total restriction shall also be included in the NAM. The choice of which suffix to give NPR-B is an option, depending on how PBXs that do not recognise NPR-B should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

If the NAM is to contain CLC-DEC, CLC-PSTN or CLC-ISDN, then it must be preceded by a NIM containing RTI with a corresponding Routing Information Parameter value (ie "Decadic encountered", "PSTN encountered" or "Public ISDN encountered", respectively) and IPN. If one or more NIMs containing RTI have already been sent and the last RTI Routing Information Parameter value sent corresponds with the CLC to be sent in the NAM, then another NIM need not be sent.

The contents of the CCM, if any, shall be derived from the information received in the CONNECT message and any PROGRESS messages received since the NAM was sent.

If sufficient information in terms of Party Category or progress descriptions has been received, a CLC shall be included in the CCM (derived as described in SECTION 4, ANNEX 1, paragraph 2.2.1). If insufficient information has been received to allow a CLC to be derived in this manner, either the CLC that was included in the NAM or no CLC at all shall be included in the CCM. If a CLC is included in the CCM, IPN shall also be included.

CLI may be included in the CCM, derived either from any Connected Number information element received in CONNECT or from other information available (eg the Destination Address digits received during call routing). The Parameter to CLI shall be a B Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with the CLC sent in the CCM (if any), or, if CLC was not included in the CCM, for use with the CLC sent in the NAM.

If CLI is derived from a Connected Number which is marked as presentation restricted, then NPR-B indicating total restriction shall also be included in the CCM. The choice of which suffix to give NPR-B is an option, depending on how PBXs that do not recognise NPR-B should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

Any progress descriptions contained in the CONNECT message shall be included in I-PROG sent in the CCM, or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

If Connected Number has been received, I-CPN derived from it shall be included in the CCM (irrespective of whether or not CLI has been included) or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

If the CONNECT message contains Low Layer Compatibility, then I-LLC derived from it shall be included in the CCM or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

If the CONNECT message contains Connected Subaddress, then I-CSA derived from it shall be included in the CCM or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

Where more than one String is to be included in an EEM accompanied by SAVE, a single EEM containing SAVE and all the Strings may be used.

Following receipt of CONNECT, any further SSRMs received shall be discarded.

2.1.5.9 If at any time after sending a NAM an EEM containing I-PROG is received, a PROGRESS message shall be sent containing a corresponding Progress Indicator information element for each Parameter to I-PROG.

2.1.5.10 If at any time following the receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.1.6.1 and 2.1.6.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

If clearing is not initiated immediately the Gateway PBX shall send the received progress descriptions as Parameters to I-PROG.

If a NAM has not already been sent the I-PROG shall be sent in a NIM and if the PROGRESS message contains a progress description that can be mapped onto RTI, the NIM shall also contain RTI with a Routing Information Parameter value derived from received progress descriptions (as described in SECTION 4, ANNEX 1, paragraph 2.5.1). If RTI is included the NIM shall also contain IPN.

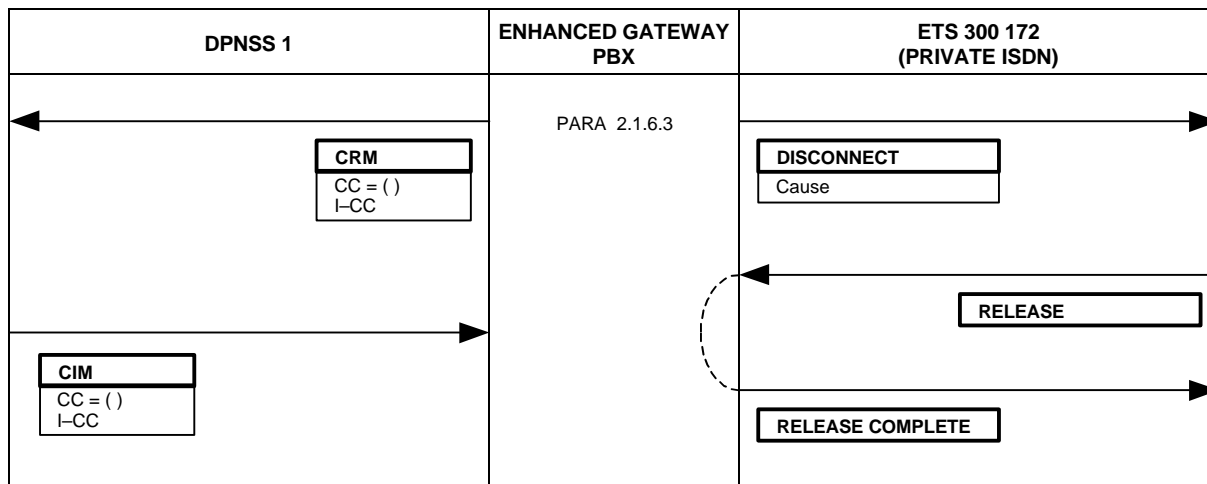
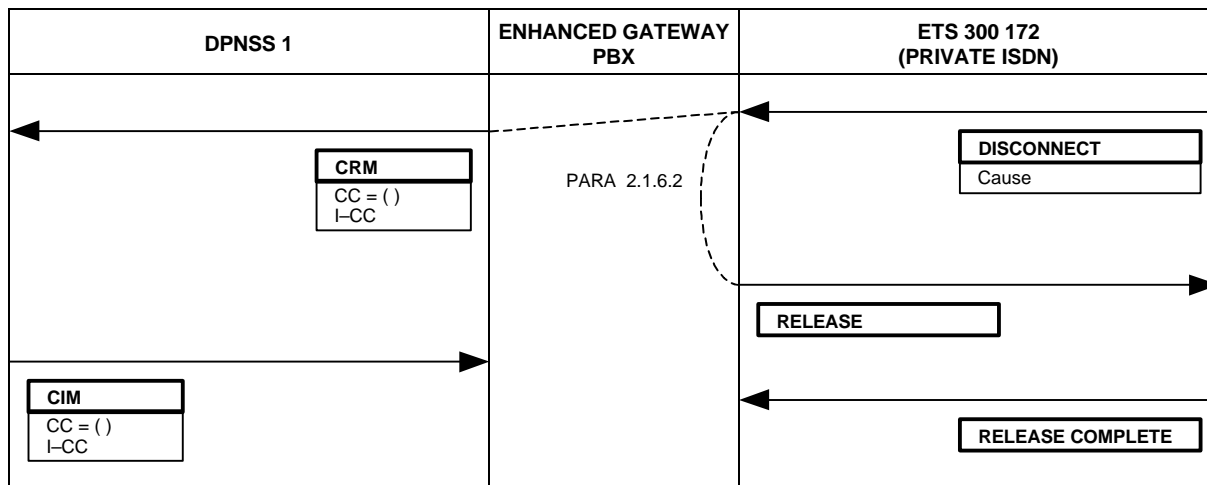
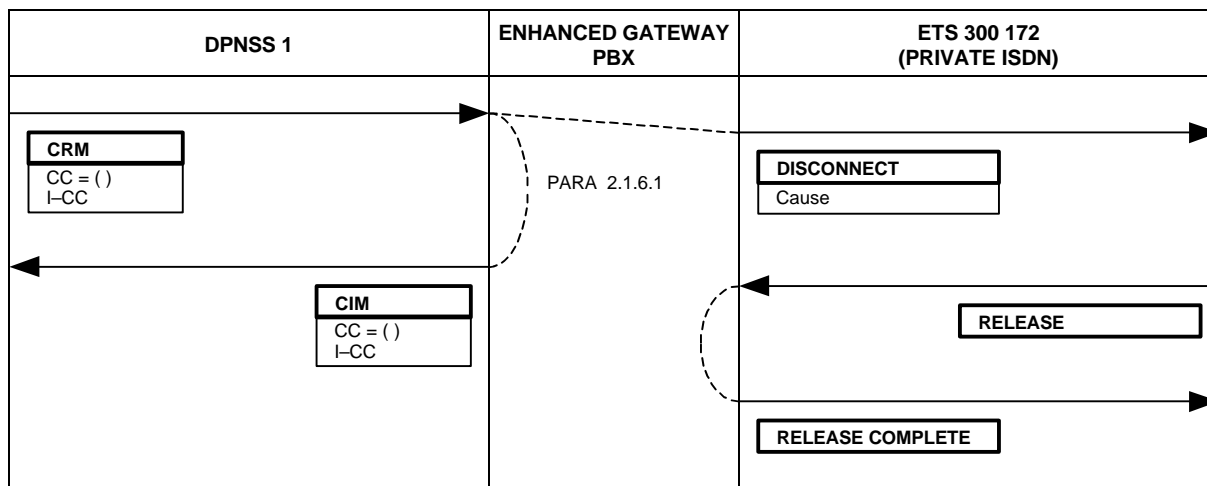
If a NAM has already been sent, the I-PROG shall be sent in an EEM (RTI shall not be included).

In addition, if clearing is not initiated immediately and the PROGRESS message contains progress description 1 or 8, the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM and awaiting a CIM in response. The Clearing Cause contained in the CRM shall be derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1) and I-CC shall be included in the CRM to represent the ISDN Cause received.

2.1.6 SIMPLE CALL CLEARING BETWEEN DPNSS 1 AND ETS 300 172 AT AN ENHANCED GATEWAY.

The following diagrams illustrate possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.1.6.1 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives a CRM, a CIM shall be returned and clearing shall be initiated on the ETS 300 172 part of the call by sending a DISCONNECT message, unless alternative routing is appropriate.

If alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 172 part of the call and make another attempt to route the call.

If alternative routing is not appropriate, the Cause included in the DISCONNECT message shall be derived from the Clearing Cause received in the CRM (as described in SECTION 4, ANNEX 1, paragraph 2.3.2) unless I-CC has been received in which case the Cause represented by the Parameter to I-CC shall be used.

2.1.6.2 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives an ISDN clearing message (ie DISCONNECT, RELEASE or RELEASE COMPLETE), the DPNSS 1 part of the call shall be cleared by sending a CRM and awaiting a CIM in response, unless alternative routing is appropriate.

If a NAM has not already been sent and alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place. If the alternative route is also via ETS 300 172, "Private ISDN encountered" shall also be indicated in the Parameter to RTI.

If alternative routing is not appropriate, the Clearing Cause included in the CRM shall be derived from the Cause received in the clearing message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1) and I-CC shall be included in the CRM to represent the ISDN Cause received.

2.1.6.3 If at any point after the outgoing part of the call has been initiated the Gateway PBX decides to abort the call, eg due to expiry of a timer, clearing procedures shall be invoked in both directions and continue independently unless alternative routing is appropriate.

If the incoming route is the ETS 300 172 part of the call and alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 172 part of the call and make another attempt to route the call.

If the incoming route is the DPNSS 1 part of the call, then if a NAM has not already been sent and if alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case, a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

2.2 INTERWORKING WITH A PUBLIC ISDN AT AN ETS 300 102 INTERFACE

This Subsection deals with a simple call at a Gateway between a DPNSS 1 private network and an ETS 300 102 interface to a public ISDN using the point-to-point mode of operation.

ETS 300 102 signalling is only specified where it interacts with the DPNSS 1 signalling.

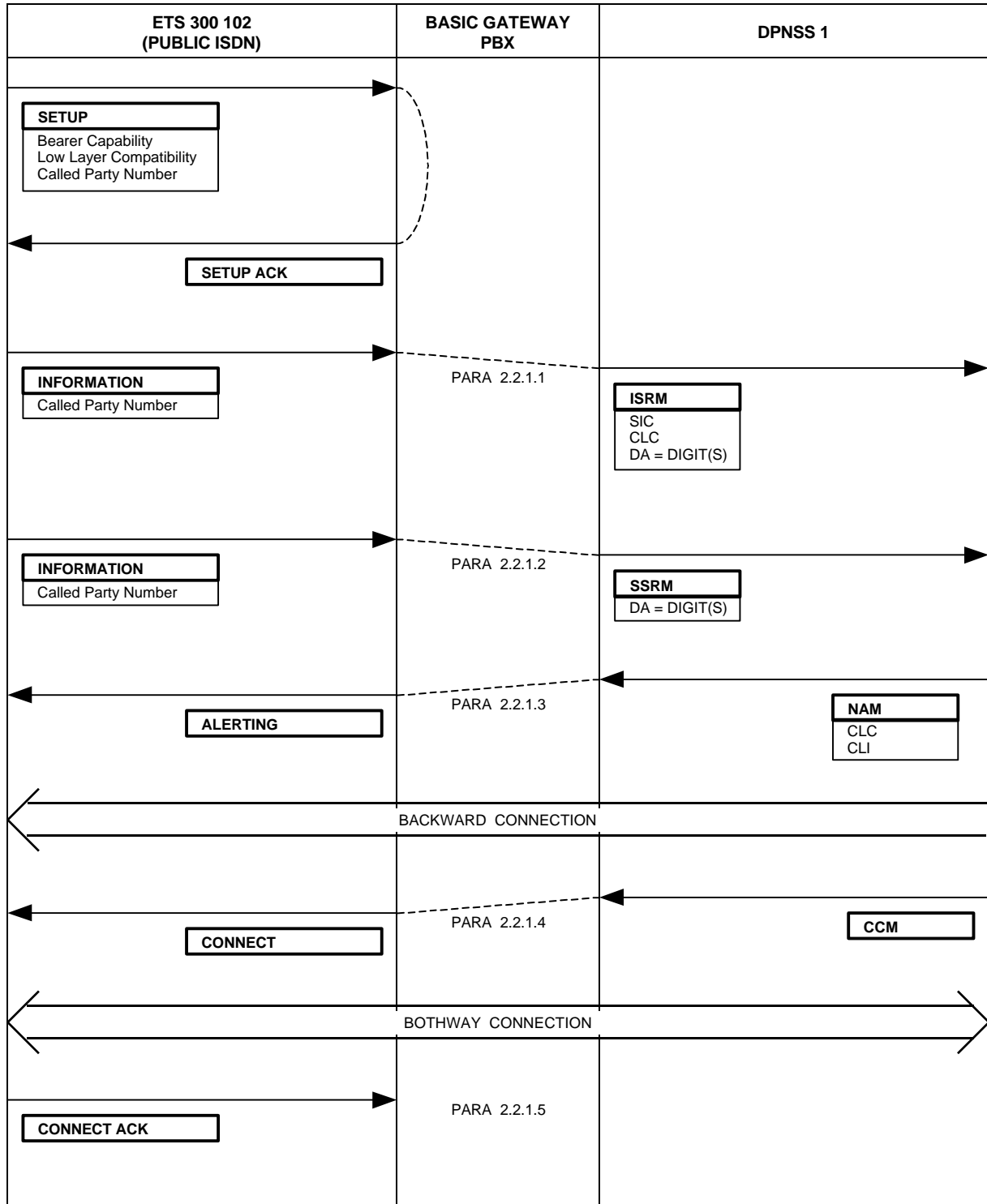
OUTLINE OF OPERATION

The signalling procedures are described in six parts:

- 2.2.1 Simple Call Setup from ETS 300 102 to DPNSS 1 at a Basic Gateway
- 2.2.2 Simple Call Setup from DPNSS 1 to ETS 300 102 at a Basic Gateway
- 2.2.3 Simple Call Clearing between DPNSS 1 and ETS 300 102 at a Basic Gateway
- 2.2.4 Simple Call Setup from ETS 300 102 to DPNSS 1 at an Enhanced Gateway
- 2.2.5 Simple Call Setup from DPNSS 1 to ETS 300 102 at an Enhanced Gateway
- 2.2.6 Simple Call Clearing between DPNSS 1 and ETS 300 102 at an Enhanced Gateway

2.2.1 SIMPLE CALL SETUP FROM ETS 300 102 TO DPNSS 1 AT A BASIC GATEWAY

The following diagram illustrates possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.2.1.1 On receipt of a SETUP message and sufficient INFORMATION messages to enable a call on a suitable outgoing DPNSS 1 route to be initiated, a free channel shall be selected and an ISRM shall be sent, containing a SIC, a CLC, and if appropriate, other contents, as described below.

Any Destination Address digits derived from received called party number information shall be included in the ISRM.

If the SETUP or an INFORMATION message contains a sending complete indication, an ISRM(C) or SSRM(C) may be used. An ISRM(C) or SSRM(C) may also be used if the Gateway PBX otherwise determines that the Destination Address is complete.

If the ISRM is sent after receipt of one or more INFORMATION messages, the Gateway PBX should have already returned a SETUP ACKNOWLEDGE as the first backward ISDN message. If the ISRM is sent on the basis of the SETUP message alone, the Gateway PBX shall return, either SETUP ACKNOWLEDGE, or CALL PROCEEDING as appropriate.

The SIC included in the ISRM shall be derived from the Bearer Capability information element and, if present, Low Layer Compatibility information element (as described in SECTION 4, ANNEX 1, paragraph 2.1.1).

Either CLC-ISDN or CLC-PSTN shall be included in the ISRM. The choice of which CLC to use is an implementation option.

If the SETUP contains a Calling Party Number information element this may be used to derive OLI. If CLC-ISDN is used, then OLI may be included only if it contains an A Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with CLC-ISDN.

If the number contained in a Calling Party Number information element is indicated as presentation restricted, then that number shall not be sent as an OLI unless it is also accompanied by NPR-A indicating total restriction. The choice of which suffix to give NPR-A is an option, depending on the requirements of the network with respect to how PBXs that do not recognise NPR-A should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

2.2.1.2 On receipt of an INFORMATION message, if a CALL PROCEEDING message has not already been sent and neither an ISRM(C) nor an SSRM(C) has been sent, the Gateway PBX shall send, in one or more SSRMs, any Destination Address digits derived from received called party number information. If the Gateway PBX recognises that the Destination Address is complete, eg by receipt of a sending complete indication in an INFORMATION message or by expiry of a timer, an SSRM(C) may be used and/or a CALL PROCEEDING message may be returned.

2.2.1.3 On receipt of a NAM the incoming and outgoing channels shall be connected in the backward direction (if not already connected). If the NAM contains CLC-ORD, CLC-OP or CLC-ISDN, an ALERTING message shall be sent. If the NAM contains CLC-DEC or CLC-PSTN, progress description 1 shall be sent (in an appropriate message) if it has not already been sent.

Note: Receipt of the NAM indicates that sufficient address information has been received from the ISDN side (irrespective of the CLC contained in the NAM).

If ALERTING is sent, and the SIC originally sent forward in the ISRM indicated a speech call, progress description 8 shall be included in ALERTING.

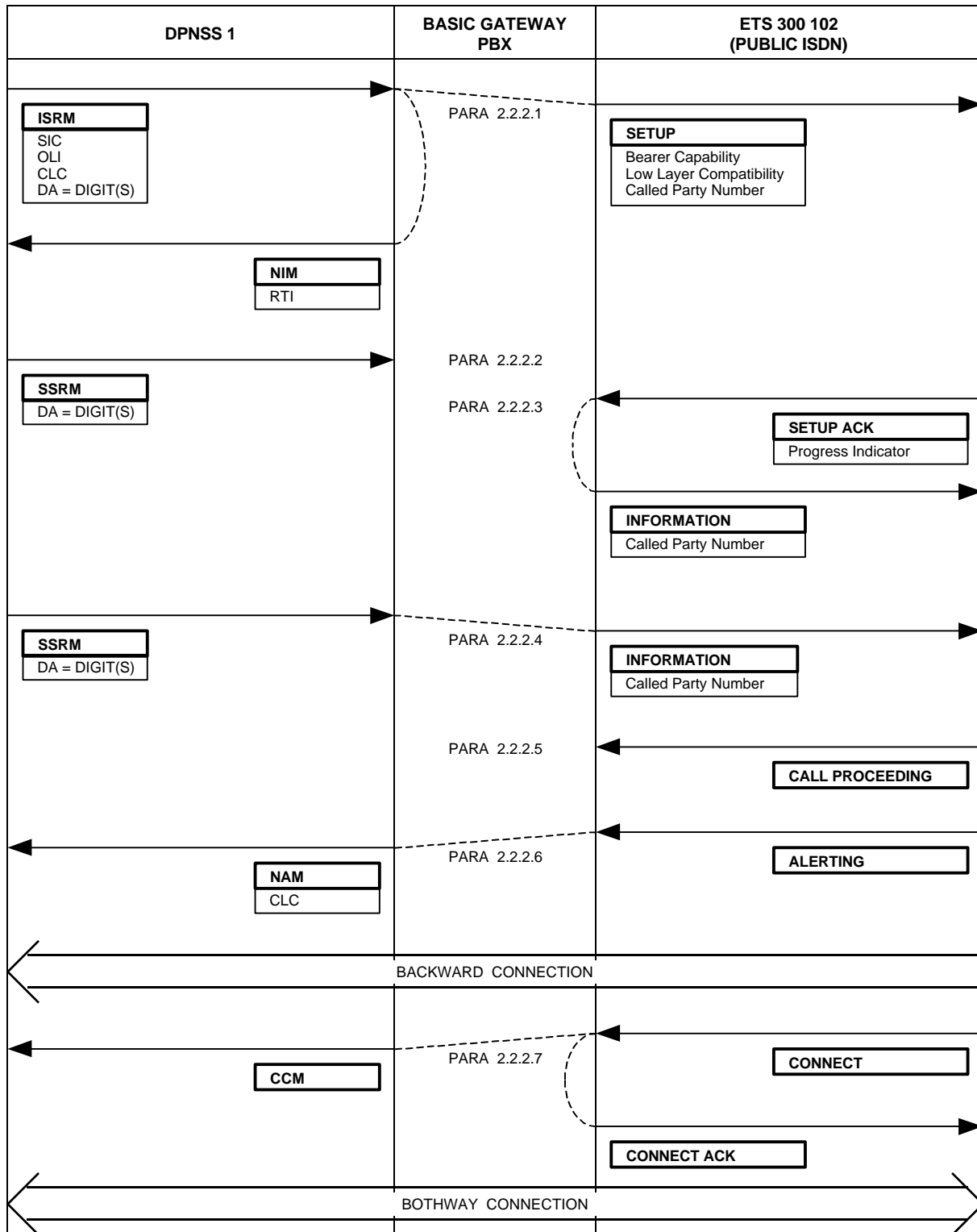
2.2.1.4 On receipt of a CCM, the Gateway PBX shall send a CONNECT message and the incoming and outgoing channels shall be connected in both directions (if not already connected).

The Gateway PBX may include a Connected Number information element in the CONNECT Message, its contents being derived from the CLI in the CCM or NAM, if received. If NPR-B has been received and is recognised by the Gateway PBX, the Connected Number, if it is included, shall be marked as presentation restricted.

2.2.1.5 Receipt of CONNECT ACKNOWLEDGE at the Gateway PBX does not result in any DPNSS 1 signalling. Non receipt of CONNECT ACKNOWLEDGE may result in the call being cleared (see paragraph 2.2.3.3).

2.2.2 SIMPLE CALL SETUP FROM DPNSS 1 TO ETS 300 102 AT A BASIC GATEWAY

The following diagram illustrates possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.2.2.1 On receipt of an ISRM and sufficient SSRMs to enable a call on a suitable outgoing ETS 300 102 route to be initiated, a SETUP message shall be sent on the outgoing route and a NIM containing RTI with a Routing Information Parameter indicating either "public ISDN encountered" or "PSTN encountered" shall be returned in the backward direction. The choice of which indication to use is an implementation option.

If, however, the ISRM contains a CLC with a Service Marking Parameter set to PSTN barred, the call shall not be allowed and a CRM containing the Clearing Cause: AB (Access Barred) shall be sent to the Originating PBX. A CIM shall be expected in response.

Depending on Destination Address analysis and whether en-bloc sending is to be used on the outgoing route, it may be possible to identify the outgoing route but not to initiate the call because the complete called party number is required but has not yet been determined. In such a case, further address information shall be awaited before sending the SETUP. The NIM shall not be returned before the SETUP has been sent.

The identification and negotiation of which channel to use on the outgoing route is dependent upon the arrangements for channel selection at the Gateway PBX.

If a Called Party Number information element is included in the SETUP it shall be derived from the Destination Address in the ISRM.

The Bearer Capability information element included in the SETUP and any Low Layer Compatibility information element that may optionally be included in the SETUP shall be derived from the SIC contained in the ISRM (as described in SECTION 4, ANNEX 1, paragraph 2.1.2).

If it is determined that the called party number is complete, a sending complete indication may also be included.

If the ISRM contains CLC-PSTN or CLC-DEC, a Progress Indicator information element containing progress description 1 may be included in the SETUP.

If the ISRM contains OLI, this may be used to derive a Calling Party Number information element for inclusion in the SETUP. If Calling Party Number is included, the Type of Number and Numbering Plan Identity fields shall be set to "unknown" unless the Gateway PBX can determine more appropriate values. In addition, if NPR-A is present in the ISRM and is recognised by the Gateway PBX, the Calling Party Number, if it is included, shall be marked as presentation restricted.

OLI shall not be used to generate Calling Party Number (other than "number not available due to interworking") if it is accompanied by CLC-PSTN or CLC-DEC.

If no OLI is present or the OLI is not suitable for use, the Calling Party Number information element shall either be omitted from the SETUP or it shall indicate "number not available due to interworking".

2.2.2.2 Any additional address information received in SSRMs following the sending of the SETUP message shall be stored by the Gateway PBX whilst awaiting a response to the SETUP message.

2.2.2.3 If a SETUP ACKNOWLEDGE message is received and the channel indicated is acceptable, the Gateway PBX may connect the incoming and outgoing channels.

If the SETUP ACKNOWLEDGE contains a Progress Indicator information element with progress description 1 or 8 the Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected), or connect an appropriate in-band indication to the DPNSS 1 channel.

When a SETUP message has been sent without any Called Party Number information, the public ISDN may return a dial tone. This tone will NOT necessarily be accompanied by a Progress Indicator in a backward message. The Gateway PBX may either connect this tone to the caller, by connecting the incoming and outgoing channels in the backward direction, or block it.

Any further address information to be sent shall be forwarded in one or more INFORMATION messages. If the Gateway PBX determines that the called party number is complete, a sending complete indication may be included.

If the SETUP ACKNOWLEDGE message indicates that no suitable channel can be agreed upon for the call, then the ETS 300 102 part of the call shall be cleared and either another attempt to route the call shall be made, or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

If CALL PROCEEDING or ALERTING or CONNECT is received as the first backward message, any address information not already sent shall be discarded and processing shall continue as described in paragraphs 2.2.2.5, 2.2.2.6 or 2.2.2.7 respectively, unless the message received indicates that no suitable channel can be agreed upon for the call. In the latter case the ETS 300 102 part of the call shall be cleared and, either another attempt to route the call shall be made, or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

2.2.2.4 After SETUP ACKNOWLEDGE has been received and before any receipt of CALL PROCEEDING, ALERTING or CONNECT, any additional address information received in SSRMs shall be forwarded in one or more INFORMATION messages. If at any point the Gateway PBX determines that the called party number is complete, a sending complete indication may be included.

2.2.2.5 Following receipt of CALL PROCEEDING, any further SSRMs received shall be discarded.

If CALL PROCEEDING contains progress descriptions 1 or 8, the Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected), or connect an appropriate in-band indication to the DPNSS 1 channel.

2.2.2.6 If an ALERTING message is received before CONNECT, a NAM shall be sent containing either CLC-ISDN or CLC-PSTN. The CLC used should correspond to the value of RTI sent earlier in the NIM (see 2.2.2.1). If it does not then the NAM shall be preceded by a NIM, containing RTI with a value corresponding to the CLC to be used.

The Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected), or connect an appropriate in-band indication to the DPNSS 1 channel.

Following receipt of ALERTING, any further SSRMs received shall be discarded.

2.2.2.7 On receipt of a CONNECT message, a CCM shall be sent, and the Gateway PBX shall connect the incoming and outgoing channels in both directions (if not already connected). A CONNECT ACKNOWLEDGE message may also be sent.

If a NAM has not already been sent, because ALERTING was not received before CONNECT, a NAM containing either CLC-ISDN or CLC-PSTN shall be sent before the CCM. The CLC used should correspond to the value of RTI sent earlier in the NIM (see paragraph 2.2.2.1). If it does not then the NAM shall be preceded by a NIM, containing RTI with a value corresponding to the CLC to be used.

If CONNECT contains a Connected Number information element, this may be used to derive a CLI String, for inclusion in the CCM or in a preceding NAM. However, CLI may only be included if CLC-ISDN is used. Furthermore, CLI may only be included if it contains a B-Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with CLC-ISDN. CLI shall not be included if CLC-PSTN is used.

If the number contained in a Connected Number information element is indicated as presentation restricted then that number shall not be sent as a CLI unless it is accompanied by NPR-B indicating total restriction. The choice of which suffix to give NPR-B is an option, depending on the requirements of the network with respect to how PBXs that do not recognise NPR-B should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

Following receipt of CONNECT any further SSRMs received shall be discarded.

2.2.2.8 If at any time following receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing progress description 1 or 8 is received, which does not also contain a Cause information element, the Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected) or connect an appropriate in-band indication to the DPNSS 1 channel.

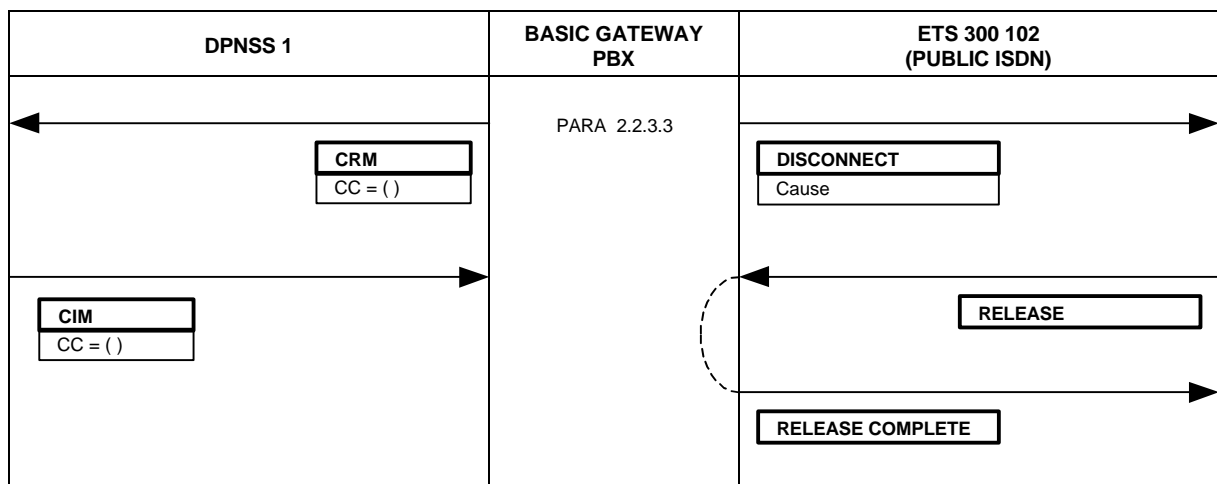
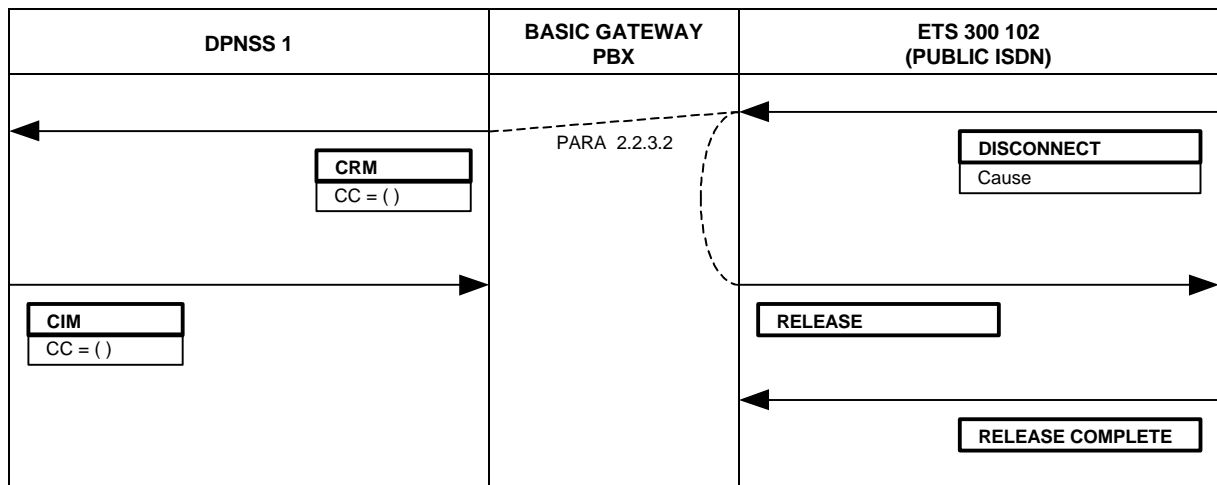
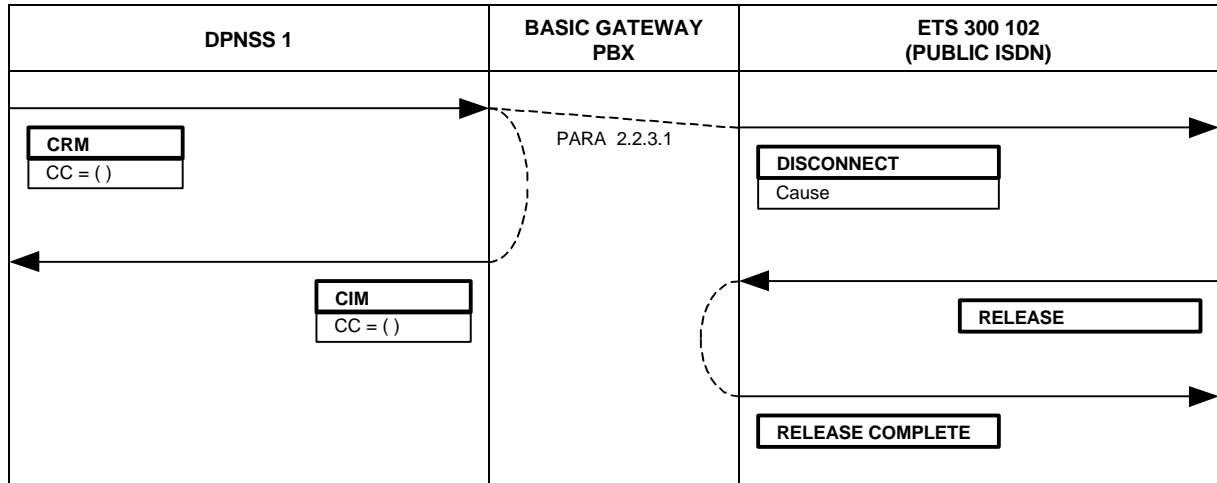
If at any time following receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.2.3.1 and 2.2.3.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM containing a Clearing Cause derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1). A CIM shall be expected in response.

2.2.3 SIMPLE CALL CLEARING BETWEEN DPNSS1 AND ETS 300 102 AT A BASIC GATEWAY

The following diagrams illustrate possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.2.3.1 If at any point after the outgoing part of the call has been initiated, the Gateway PBX receives a CRM, a CIM shall be returned and clearing shall be initiated on the ETS 300 102 part of the call by sending a DISCONNECT message, unless alternative routing is appropriate.

If alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 102 part of the call and make another attempt to route the call.

If alternative routing is not appropriate, the Cause included in the DISCONNECT message shall be derived from the Clearing Cause received in the CRM (as described in SECTION 4, ANNEX 1, paragraph 2.3.2).

2.2.3.2 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives a clearing message (ie DISCONNECT, RELEASE, or RELEASE COMPLETE), the DPNSS 1 part of the call shall be cleared by sending a CRM and awaiting a CIM in response, unless alternative routing is appropriate.

If a NAM has not already been sent and alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

If alternative routing is not appropriate the Clearing Cause included in the CRM shall be derived from the Cause received in the clearing message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1). If more than one Cause information element is received the Gateway PBX shall choose the most appropriate.

If the clearing message contains progress description 8 then the Gateway PBX may connect the incoming and outgoing channels in the backward direction (if not already connected) instead of sending a CRM immediately. In this case the Gateway PBX may initiate clearing after a timeout (by sending a CRM) to protect against clearing not being initiated from either end. The Clearing Cause in the CRM may be derived from the Cause received in the clearing message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1).

If a CRM is received after the clearing message has been received, but before a CRM has been sent, clearing shall be continued by returning a CIM and completing the clearing sequence towards the ETS 300 102 part of the call.

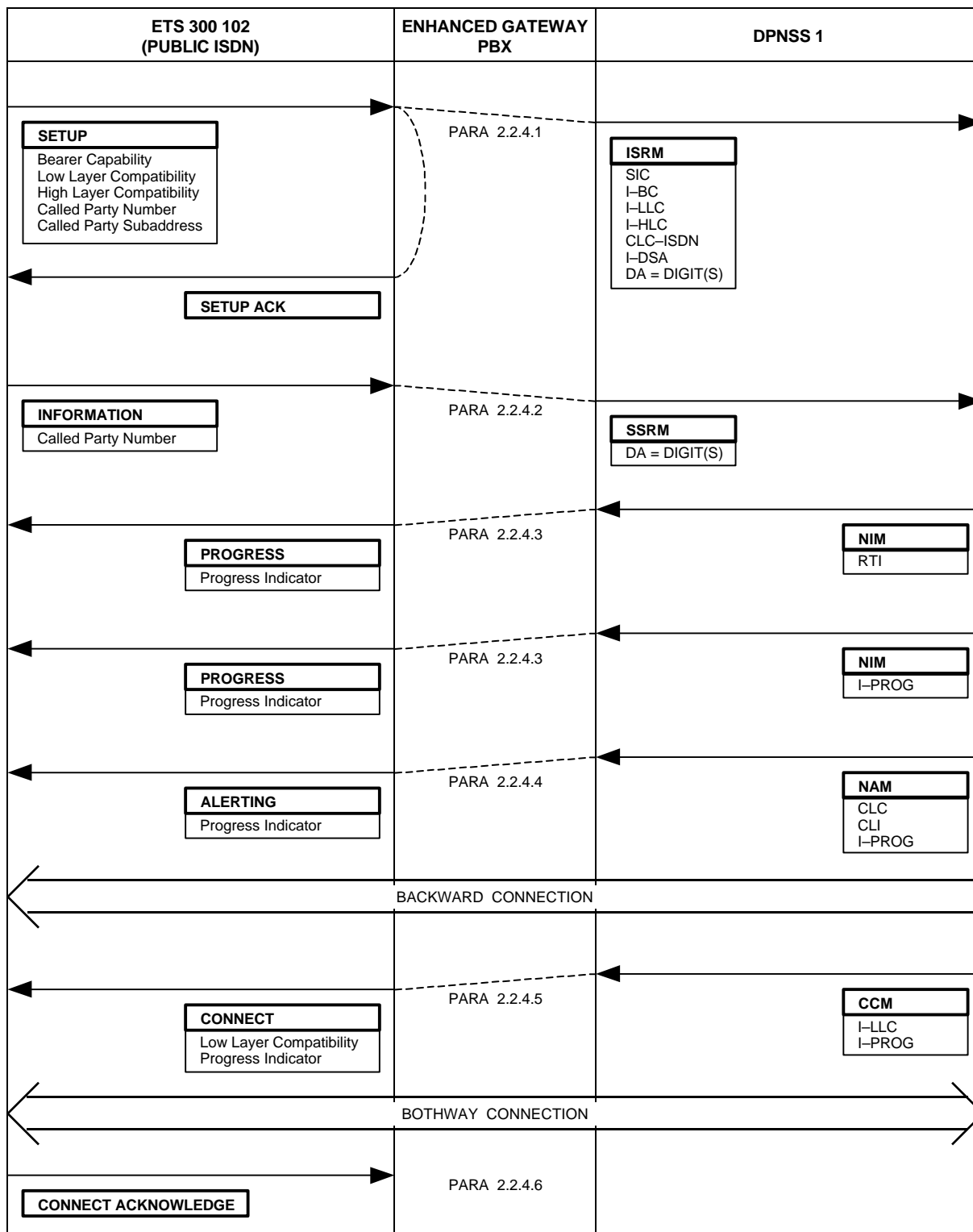
2.2.3.3 If, at any point after the outgoing part of the call has been initiated, the Gateway PBX decides to abort the call, eg due to expiry of a timer, clearing procedures shall be invoked in both directions and continue independently, unless alternative routing is appropriate.

If the incoming route is the ETS 300 102 part of the call and alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 102 part of the call and make another attempt to route the call.

If the incoming route is the DPNSS 1 part of the call, then if a NAM has not already been sent and if alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case, a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

2.2.4 SIMPLE CALL SETUP FROM ETS 300 102 TO DPNSS 1 AT AN ENHANCED GATEWAY

The following diagram illustrates possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.2.4.1 On receipt of a SETUP message and sufficient INFORMATION messages to enable a call on a suitable outgoing DPNSS 1 route to be initiated, a free channel shall be selected and an ISRM shall be sent containing a SIC, CLC-ISDN with an ISDN Type Parameter indicating "ETS 300 102", and if appropriate, other contents, as described below.

Any Destination Address digits, derived from received called party number information, shall be included in the ISRM.

If the SETUP or an INFORMATION message contains a sending complete indication an ISRM(C) or SSRM(C) may be used. An ISRM(C) or SSRM(C) may also be used if the Gateway PBX otherwise determines that the Destination Address is complete.

If the ISRM is sent after receipt of one or more INFORMATION messages, the Gateway PBX should have already returned a SETUP ACKNOWLEDGE as the first backward ISDN message. If the ISRM is sent on the basis of the SETUP message alone, the Gateway PBX shall return either SETUP ACKNOWLEDGE or CALL PROCEEDING as appropriate.

The SIC included in the ISRM shall be derived from the Bearer Capability information element and, if present, Low Layer Compatibility information element (as described in SECTION 4, ANNEX 1, paragraph 2.1.1).

I-BC shall be included in the ISRM, derived from the received Bearer Capability information element, unless Bearer Capability contains non-CCITT coded information, in which case inclusion of I-BC in the ISRM is optional (see SECTION 4, ANNEX 1, paragraph 2.1.1).

If a Low Layer Compatibility information element is present in the SETUP message, then I-LLC shall be included in the ISRM, unless Low Layer Compatibility contains non-CCITT coded information, in which case inclusion of I-LLC in the ISRM is optional (see SECTION 4, ANNEX 1, paragraph 2.1.1).

I-BC and/or I-LLC may require a "B" String Suffix as described in SECTION 4, ANNEX 1, paragraph 2.1.1.

If a High Layer Compatibility information element is present in the SETUP message, then I-HLC shall be included in the ISRM.

If a Called Party Subaddress information element is present in the SETUP message, then I-DSA shall be included in the ISRM.

If a Calling Party Subaddress information element is present in the SETUP message, then I-CSA shall be included in the ISRM.

If a Calling Party Number information element is present in the SETUP message, then this shall be used to derive I-CPN and/or to derive OLI for inclusion in the ISRM.

OLI shall be included only if it contains an A-Party Address Parameter as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with CLC-ISDN. If the Calling Party Number from which OLI is derived is marked as presentation restricted, then that number shall not be sent as an OLI unless it is accompanied in the ISRM by NPR-A indicating total restriction. The choice of which suffix to give NPR-A is an option, depending on the requirements of the network with respect to how PBXs that do not recognise NPR-A should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

If either of the Progress descriptions 1 or 3 is received in the SETUP message, the description shall be mapped onto the Parameters of I-PROG and included in the ISRM.

There is a possibility that in some cases the amount of information to be included in the ISRM [ie ISRM(I) and a sequence of SSRMs] may exceed the maximum Selection Block length limit of some PBXs in the network, particularly if the minimum limit (135 octets) has been used on one or more of the PBXs.

Where a Selection Block generated by a Gateway PBX would exceed the limit imposed by the network, the Gateway PBX shall either:

- reduce the length of the Selection Block so that it falls inside this limit, by omitting some of the Strings specified above, or;
- attempt the call with the full Selection Block, as long as on receipt of a CRM containing SNU with Parameter "F", a repeat attempt is made to establish the call with a reduced Selection Block length. This process shall be repeated as many times as necessary until the Selection Block length has been reduced to not more than 135 octets or until the call ceases to fail in this manner.

The Strings that may be omitted in order to reduce the Selection Block length to within the limit are I-HLC, I-CSA, I-DSA and I-CPN. The precedence given to the inclusion of these Strings is an implementation option.

2.2.4.2 On receipt of an INFORMATION message, if a CALL PROCEEDING message has not already been sent and neither an ISRM(C) nor an SSRM(C) has been sent, the Gateway PBX shall send, in one or more SSRMs, any Destination Address digits derived from received called party number information. If the Gateway PBX recognises that the Destination Address is complete, eg by receipt of a sending complete indication in an INFORMATION message or by expiry of a timer, an SSRM(C) may be used and/or a CALL PROCEEDING message may be returned.

2.2.4.3 If a NIM containing CP is received and a CALL PROCEEDING message has not already been sent, the Gateway PBX may send a CALL PROCEEDING message.

If a NIM containing I-PROG, with a Parameter indicating progress descriptions 1, 2, 4 or 8, is received by the Gateway PBX then each of these progress descriptions received shall be sent to the Public ISDN in Progress Indicator information element(s). If the NIM also contained SAVE, sending of the Progress Indicator(s) shall be delayed until the NAM is received as described in 2.2.4.4. If the NIM did not contain SAVE, then the Progress Indicator information element(s) shall be sent in one or more PROGRESS messages, unless CALL PROCEEDING is being sent, in which case they may alternatively be included in CALL PROCEEDING. In the case where Progress descriptions 1 or 8 are received the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

Note: A NIM may contain both CP and I-PROG, however, it should not contain both CP and SAVE.

If a NIM containing RTI is received with a Parameter indicating Decadic, ISDN or PSTN encountered, a Progress Indicator information element shall be sent, containing progress description 1 in the case of Decadic or PSTN and progress description 8 in the case of ISDN, and the incoming and outgoing channels shall be connected in the backward direction (if not already connected). If CALL PROCEEDING is being sent the Progress Indicator information element may be included in CALL PROCEEDING. Otherwise the Progress Indicator shall be sent in a PROGRESS message.

Note: A NIM should not contain both RTI and SAVE.

2.2.4.4 On receipt of a NAM, the incoming and outgoing channels shall be connected in the backward direction (if not already connected). An ALERTING message shall be sent if the NAM contains CLC-ORD, CLC-OP or CLC-ISDN. If the NAM contains CLC-DEC or CLC-PSTN, the sending of ALERTING is optional.

Note: Receipt of the NAM indicates that sufficient address information has been received from the ISDN side (irrespective of the CLC contained in the NAM).

If ALERTING is sent, and the SIC originally sent forward in the ISRM indicated a speech call, progress description 8 shall be included in ALERTING.

If I-PROG is present in the NAM, or has already been received in a preceding NIM accompanied by SAVE, and indicates progress descriptions 1, 2, 4 or 8, the indicated progress descriptions shall be sent in an appropriate message (eg ALERTING or PROGRESS).

2.2.4.5 On receipt of a CCM, the Gateway PBX shall send a CONNECT message and the incoming and outgoing channels shall be connected in both directions (if not already connected).

If CLI is present in the CCM or has already been received in the NAM, or if I-CPN is present in the CCM or has already been received in an EEM accompanied by SAVE, a Connected Number information element generated from CLI or I-CPN may be included in the CONNECT message. Where both CLI and I-CPN have been received, I-CPN shall be used in preference to CLI. If CLI is used and NPR-B has been received, the number shall be marked as presentation restricted.

If I-LLC is present in the CCM, or has already been received in an EEM accompanied by SAVE, then a Low Layer Compatibility information element derived from I-LLC shall be included in the CONNECT message.

If I-PROG is present in the CCM, or has already been received in an EEM accompanied by SAVE, and indicates progress descriptions 1, 2, 4 or 8, the indicated progress descriptions shall be included in CONNECT.

If I-CSA is present in the CCM, or has already been received in an EEM accompanied by SAVE, then a Connected Subaddress information element derived from I-CSA shall be included in the CONNECT message.

2.2.4.6 Receipt of CONNECT ACKNOWLEDGE at the Gateway PBX does not result in any DPNSS 1 signalling. Non receipt of CONNECT ACKNOWLEDGE may result in the call being cleared (see paragraph 2.2.6.3).

2.2.4.7 If at any time following receipt of the NAM an EEM containing I-PROG is received, with Parameter(s) indicating progress description(s) 1, 2, 4 or 8, a PROGRESS message containing a Progress Indicator information element for each of the indicated progress descriptions shall be sent, unless SAVE is also present in the EEM and a CONNECT message has not already been sent, in which case sending the Progress Indicators shall be delayed until the CONNECT message is sent, as described in paragraph 2.2.4.5.

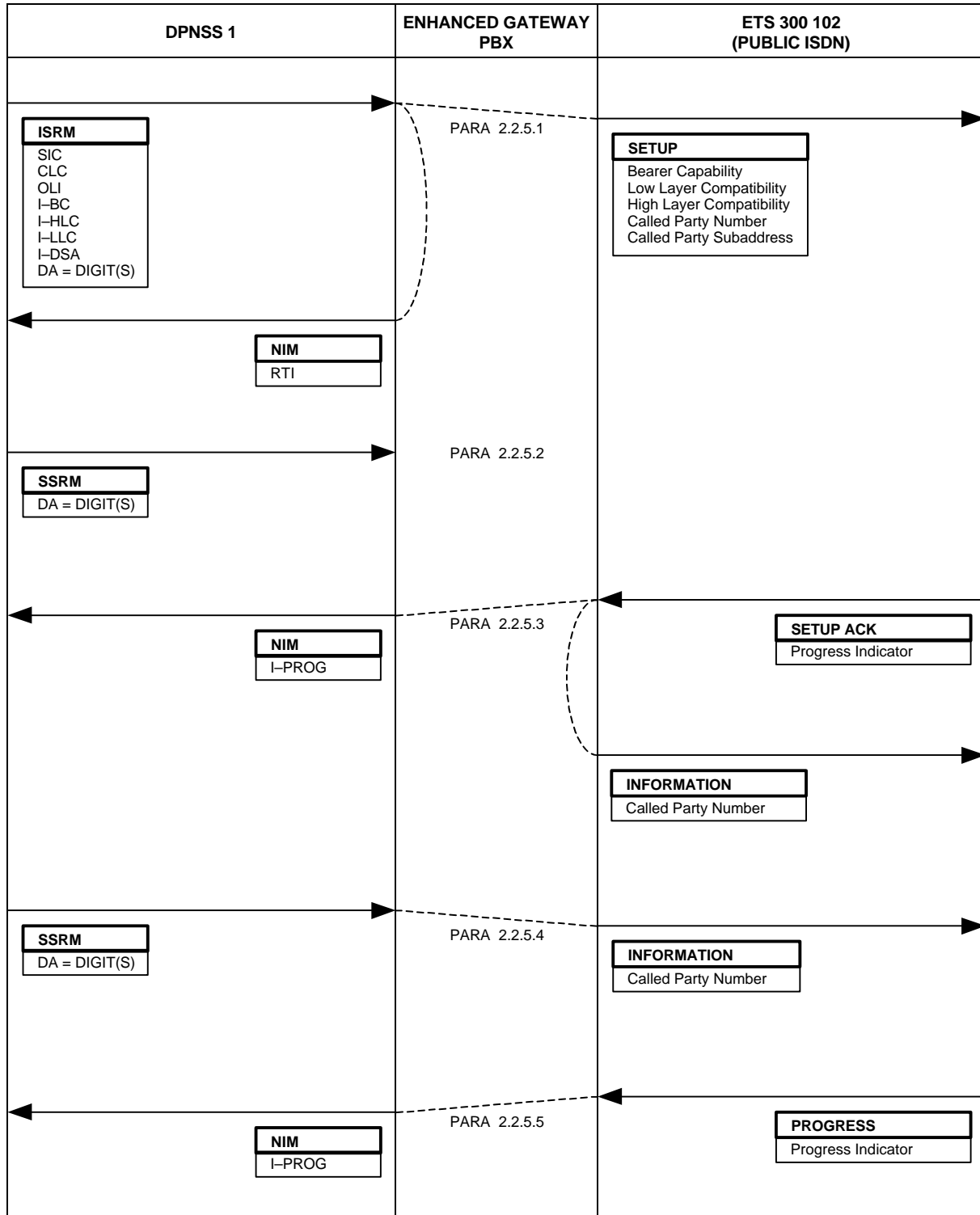
If at any time following the sending of CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.2.6.1 and 2.2.6.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

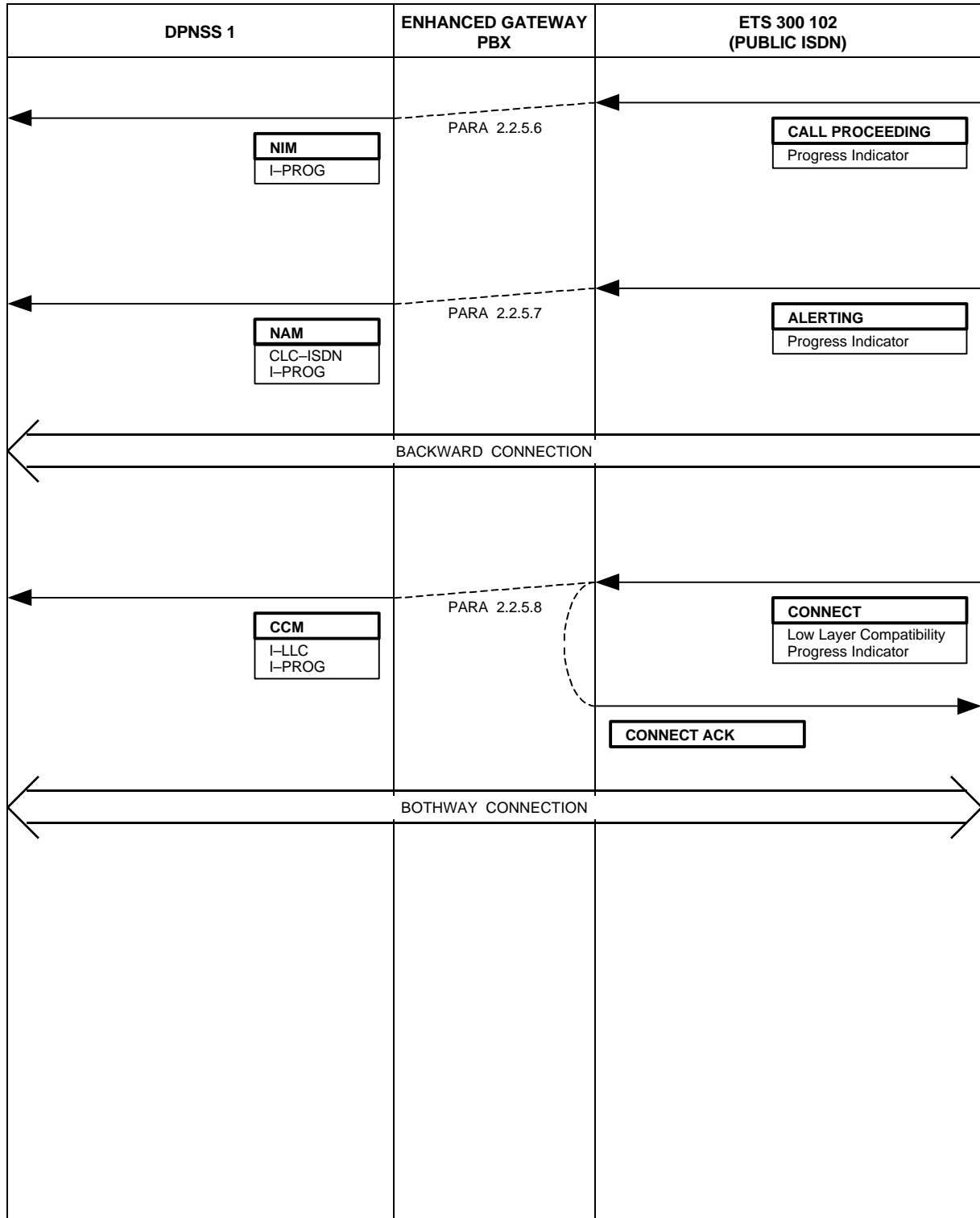
If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM containing a Clearing Cause derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1). A CIM shall be expected in response.

2.2.5 SIMPLE CALL SETUP FROM DPNSS 1 TO ETS 300 102 AT AN ENHANCED GATEWAY

The following diagram illustrates possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.2.5 SIMPLE CALL SETUP FROM DPNSS 1 TO ETS 300 102 AT AN ENHANCED GATEWAY (CONTINUED)



2.2.5.1 On receipt of an ISRM and sufficient SSRMs to enable a call on a suitable outgoing ETS 300 102 route to be initiated, a SETUP message shall be sent on the outgoing route and a NIM containing RTI with Parameters indicating "public ISDN encountered" and "ETS 300 102" shall be returned in the backward direction.

If, however, the ISRM contains a CLC with a Service Marking Parameter set to PSTN barred, the call shall not be allowed and a CRM containing the Clearing Cause: AB (Access Barred) shall be sent to the Originating PBX. A CIM shall be expected in response.

Depending on Destination Address analysis and whether en-bloc sending is to be used on the outgoing route, it may be possible to identify the outgoing route but not to initiate the call because the complete called party number is required but has not yet been determined. In such a case, further address information shall be awaited before sending the SETUP. The NIM shall not be returned before the SETUP has been sent.

The identification and negotiation of which channel to use on the outgoing route is dependent upon the arrangements for channel selection at the Gateway PBX.

If a Called Party Number information element is included in the SETUP it shall be derived from the Destination Address in the ISRM.

If I-BC is present in the ISRM, the Bearer Capability information element included in the SETUP shall be derived from the Parameter to I-BC. If I-LLC is also present in the ISRM, a Low Layer Compatibility information element shall also be included in the SETUP. If I-BC has not been received, then Bearer Capability and optionally Low Layer Compatibility shall be derived from the SIC (as described in SECTION 4, ANNEX 1, paragraph 2.1.2).

If it is determined that the called party number is complete, a sending complete indication may also be included in the SETUP message and/or a NIM containing CP may be returned.

If the ISRM contains I-HLC, the SETUP shall contain a High Layer Compatibility information element derived from the Parameter to I-HLC.

If the ISRM contains I-CSA, the SETUP shall contain a Calling Party Subaddress information element, derived from the Parameter to I-CSA.

If the ISRM contains I-DSA, the SETUP shall contain a Called Party Subaddress information element, derived from the Parameter to I-DSA.

If the ISRM contains CLC-PSTN or CLC-DEC, a Progress Indicator information element containing progress description 1 may be included in the SETUP.

If the ISRM contains I-PROG, the SETUP message may contain Progress Indicator information elements derived from the Parameters to I-PROG if appropriate, unless they have already been included from consideration of the CLC.

If the ISRM contains OLI or I-CPN, this may be used to derive a Calling Party Number information element for inclusion in the SETUP message. If both OLI and I-CPN have been received, I-CPN shall be used in preference to OLI. If OLI is used and NPR-A has been received, the number shall be marked as presentation restricted.

OLI shall not be used to generate Calling Party Number (other than "number not available due to interworking") if it is accompanied by CLC-PSTN or CLC-DEC.

If I-CPN is not present and OLI is either not present or is not suitable for use, the Calling Party Number information element shall either be omitted from the SETUP or it shall indicate "number not available due to interworking".

2.2.5.2 Any additional address information received in SSRMs following the sending of the SETUP message shall be stored by the Gateway PBX whilst awaiting a response to the SETUP message.

2.2.5.3 If a SETUP ACKNOWLEDGE message is received and the channel indicated is acceptable, the Gateway PBX may connect the incoming and outgoing channels.

If the SETUP ACKNOWLEDGE message contains any of the progress descriptions 1, 2, 4 or 8 in Progress Indicator information elements, then each of these progress descriptions received shall be sent to DPNSS 1 in a NIM, as the Parameter(s) to I-PROG.

If progress description 1 or 8 has been received the Gateway PBX shall connect the incoming and outgoing channels in the backward direction.

When a SETUP message has been sent without any Called Party Number information the public ISDN may return a dial tone. This tone will NOT necessarily be accompanied by a Progress Indicator in a backward message. The Gateway PBX may either connect this tone to the caller, by connecting the incoming and outgoing channels in the backward direction, or block it.

Any further address information to be sent shall be forwarded in one or more INFORMATION messages. If the Gateway PBX determines that the called party number is complete, a sending complete indication may be included, and/or a NIM containing CP may be returned.

If the SETUP ACKNOWLEDGE message indicates that no suitable channel can be agreed upon for the call, then the ETS 300 102 part of the call shall be cleared and either another attempt to route the call shall be made, or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

If CALL PROCEEDING or ALERTING or CONNECT is received as the first backward message, any address information not already sent shall be discarded and processing shall continue as described in paragraphs 2.2.5.6, 2.2.5.7 or 2.2.5.8, respectively, unless the message received indicates that no suitable channel can be agreed upon for the call. In the latter case the ETS 300 102 part of the call shall be cleared and either another attempt to route the call shall be made, or the DPNSS 1 part of the call shall also be cleared, by sending a CRM containing Clearing Cause: CON. A CIM shall be expected in response.

2.2.5.4 After SETUP ACKNOWLEDGE has been received and before any receipt of CALL PROCEEDING, ALERTING or CONNECT, any additional address information received in SSRMs shall be forwarded in one or more INFORMATION messages. If at any point the Gateway PBX determines that the called party number is complete, a sending complete indication may be included and/or a NIM containing CP may be returned.

2.2.5.5 If at any time following the receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing progress descriptions 1, 2, 4 or 8 is received, which does not also contain a Cause information element, each of these progress descriptions received shall be sent as the Parameters to I-PROG.

I-PROG shall be included in a NIM if a NAM has not already been sent, otherwise it shall be included in an EEM. In addition, if progress description 1 or 8 has been received the Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected) or connect an appropriate in-band indication to the DPNSS 1 channel.

2.2.5.6 If a CALL PROCEEDING message is received before ALERTING or CONNECT, a NIM containing CP may be sent if CP has not already been sent.

If the CALL PROCEEDING message contains any of the progress descriptions 1, 2, 4 or 8 in a Progress Indicator information element, each of these progress descriptions received shall be sent to DPNSS 1 in a NIM, as the Parameters to I-PROG.

If progress description 1 or 8 has been received the Gateway PBX shall connect the incoming and outgoing channels in the backward direction (if not already connected).

If both I-PROG and CP are sent they shall be sent in the same NIM.

Following receipt of CALL PROCEEDING, any further SSRMs received shall be discarded.

2.2.5.7 If an ALERTING message is received before CONNECT, a NAM shall be sent containing CLC-ISDN with an ISDN Type Parameter indicating "ETS 300 102".

If the ALERTING message contains any of the progress descriptions 1, 2, 4 or 8 in a Progress Indicator information element, each of these progress descriptions received shall be sent to DPNSS 1, as the Parameters to I-PROG, either in a NAM, or in a NIM sent before the NAM. In the latter case, the NIM shall also contain SAVE to indicate that the information contained in the NIM is related to the NAM which is to follow.

The Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected), or connect an appropriate in-band indication to the DPNSS 1 channel.

Following receipt of ALERTING, any further SSRMs received shall be discarded.

2.2.5.8 On receipt of a CONNECT message, the Gateway PBX shall send a CCM and connect the incoming and outgoing channels in both directions (if not already connected). A CONNECT ACKNOWLEDGE message may also be sent.

If a NAM has not already been sent, because ALERTING was not received before CONNECT, a NAM containing CLC-ISDN with an ISDN Type Parameter, indicating "ETS 300 102", shall be sent before the CCM (and before any EEM containing SAVE).

If Connected Number is present in the CONNECT message, then this shall be used to derive CLI for inclusion in the CCM and/or to derive I-CPN for inclusion either in the CCM or in an EEM sent before the CCM.

CLI shall be included only if it contains a B Party Address as defined in DPNSS[188], SECTION 4, ANNEX 2, Subsection 3, for use with CLC-ISDN. If the Connected Number from which CLI is derived is marked as presentation restricted, then NPR-B indicating total restriction shall also be included in the CCM. The choice of which suffix to give NPR-B is an option, depending on how PBXs that do not recognise NPR-B should be forced to respond.

Note: This decision may be influenced by user or regulatory requirements.

If I-CPN is sent in an EEM, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

If the CONNECT message contains any of the progress descriptions 1, 2, 4, or 8 in Progress Indicator information elements, each of these progress descriptions received shall be sent as Parameters to I-PROG, either in the CCM, or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

If the CONNECT message contains Low Layer Compatibility, I-LLC derived from it shall be included, either in the CCM, or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

If Connected Subaddress is present in the CONNECT message, then I-CSA derived from it shall be included, either in the CCM, or in an EEM sent before the CCM. In the latter case, the EEM shall also contain SAVE to indicate that the information contained in the EEM is related to the CCM which is to follow.

Where more than one String is to be included in an EEM accompanied by SAVE, a single EEM containing SAVE and all the Strings may be used.

Following receipt of CONNECT any further SSRMs received shall be discarded.

2.2.5.9 If at any time following receipt of SETUP ACKNOWLEDGE, CALL PROCEEDING, ALERTING or CONNECT, a PROGRESS message containing a Cause information element is received, the Gateway PBX shall:

- leave the connection established until through clearing occurs (see paragraphs 2.2.6.1 and 2.2.6.2), or;
- leave the connection established for a period of time before initiating clearing in both directions, or;
- initiate clearing in both directions immediately.

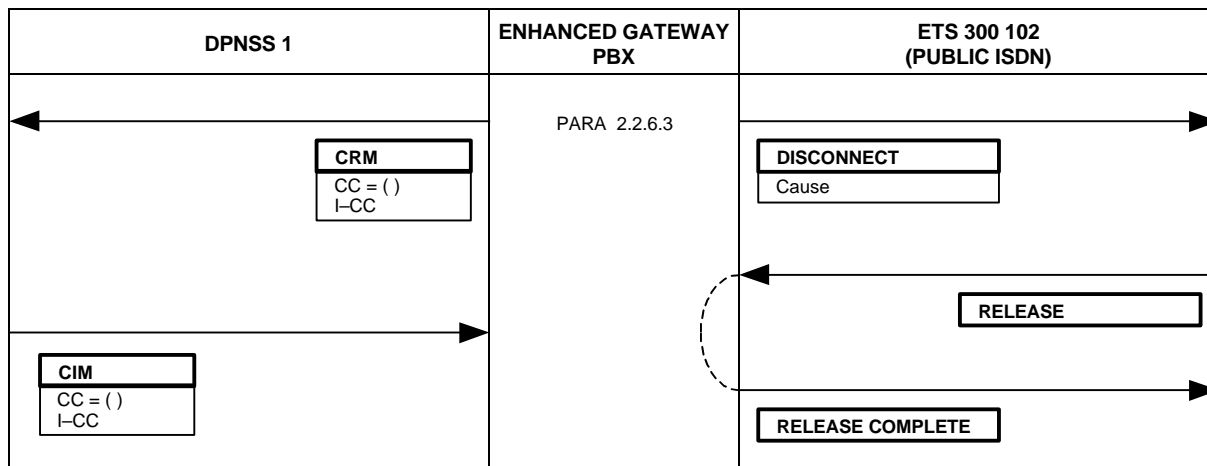
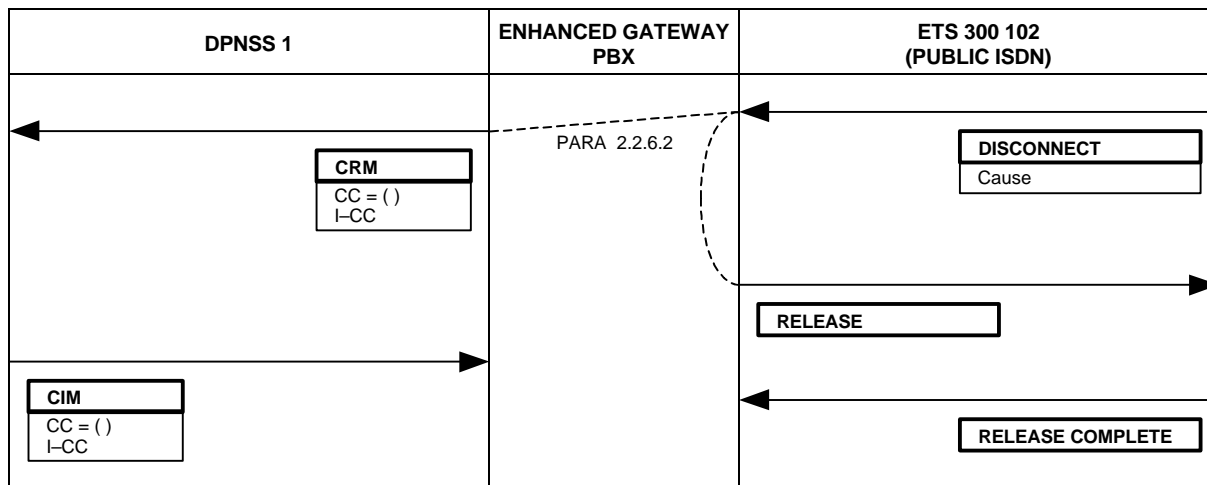
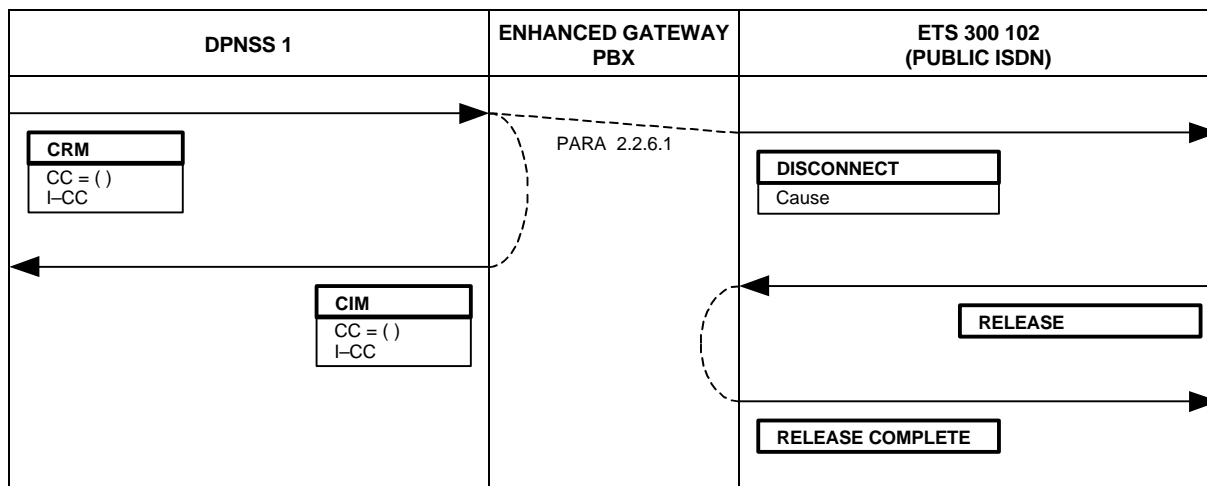
If clearing is not initiated immediately the Gateway PBX shall send the received progress descriptions as the Parameters to I-PROG, in a NIM if a NAM has not already been sent, or otherwise in an EEM.

In addition if clearing is not initiated immediately and the PROGRESS message contains progress descriptions 1 or 8, the Gateway PBX shall either connect the incoming and outgoing channels in the backward direction (if not already connected) or connect an appropriate in-band indication to the DPNSS 1 channel.

If the Gateway PBX initiates clearing in both directions, the DPNSS 1 part of the call shall be cleared by sending a CRM containing a Clearing Cause derived from the Cause received in the PROGRESS message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1). A CIM shall be expected in response.

2.2.6 SIMPLE CALL CLEARING BETWEEN DPNSS1 AND ETS 300 102 AT AN ENHANCED GATEWAY

The following diagrams illustrate possible message sequences. In some cases, the messages and/or their contents may not be present. In other cases additional messages and contents may be present. The accompanying text covers all relevant cases.



2.2.6.1 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives a CRM, a CIM shall be returned and clearing shall be initiated on the ETS 300 102 part of the call by sending a DISCONNECT message, unless alternative routing is appropriate.

If alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 102 part of the call and make another attempt to route the call.

If alternative routing is not appropriate, the Cause included in the DISCONNECT message shall be derived from the Clearing Cause received in the CRM (as described in SECTION 4, ANNEX 1, paragraph 2.3.2) unless I-CC has been received, in which case the Cause indicated by I-CC shall be used.

2.2.6.2 If at any point after the outgoing part of the call has been initiated the Gateway PBX receives a clearing message (ie DISCONNECT, RELEASE, or RELEASE COMPLETE), the DPNSS 1 part of the call shall be cleared by sending a CRM and awaiting a CIM in response, unless alternative routing is appropriate.

If a NAM has not already been sent and alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

If alternative routing is not appropriate, the Clearing Cause included in the CRM shall be derived from the Cause received in the clearing message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1) and I-CC shall be included in the CRM to represent the ISDN Cause received. If more than one Cause information element is received the Gateway PBX shall determine the most appropriate.

If the clearing message contains progress description 8 then the Gateway PBX may connect the incoming and outgoing channels in the backward direction (if not already connected) instead of sending a CRM immediately. In this case the Gateway PBX may initiate clearing after a timeout (by sending a CRM) to protect against clearing not being initiated from either end. The Clearing Cause in the CRM may be derived from the Cause received in the clearing message (as described in SECTION 4, ANNEX 1, paragraph 2.3.1).

If a CRM is received after the clearing message has been received, but before a CIM has been sent, clearing shall continue by returning a CIM and completing the clearing sequence towards the ETS 300 102 part of the call.

2.2.6.3 If, at any point after the outgoing part of the call has been initiated, the Gateway PBX decides to abort the call, eg due to expiry of a timer, clearing procedures shall be invoked in both directions and continue independently, unless alternative routing is appropriate.

If the incoming route is the ETS 300 102 part of the call and alternative routing is appropriate, the Gateway PBX may maintain the ETS 300 102 part of the call and make another attempt to route the call.

If the incoming route is the DPNSS 1 part of the call, then if a NAM has not already been sent and if alternative routing is appropriate, the Gateway PBX may maintain the DPNSS 1 part of the call and make another attempt to route the call. In such a case, a NIM containing RTI shall be sent towards the Originating PBX indicating that alternative routing is taking place.

3 COMPLIANCE

3.1 COMPLIANCE SHEET FOR INTERWORKING OF THE SIMPLE CALL BETWEEN DPNSS 1 AND ETS 300 172

The minimum level of compliance that can be claimed against subsection 2.1 of SECTION 6 of DPNSS[189-I] (this Section) is support of Basic interworking as described in Subsections 2.1.1, 2.1.2 and 2.1.3 of this Section. Support of the extra procedures detailed under Enhanced Interworking in Subsections 2.1.4, 2.1.5 and 2.1.6 of this Section is optional.

A PBX may be compliant to Basic Interworking, or Enhanced Interworking, or a level between the two.

Compliance with respect to Enhanced Interworking can only be claimed for a PBX if a "YES" is entered for every entry where the comment box of TABLE 1 indicates "mandatory for Enhanced Interworking".

TABLE 1

COMPLIANCE TABLE FOR A PBX THAT SUPPORTS INTERWORKING OF THE SIMPLE CALL BETWEEN DPNSS 1 and ETS 300 172		
SERVICE VARIANT		COMMENT
Able to support Basic Interworking as described in Subsections 2.1.1, 2.1.2 and 2.1.3?	YES	
Able to send and receive I-CC as described in Subsections 2.1.4, 2.1.5 and 2.1.6?		Mandatory for Enhanced Interworking
Able to map between CLC and Party Category and Progress descriptions, and support RTI, as described in Subsections 2.1.4 and 2.1.5?		Mandatory for Enhanced Interworking
Able to send and receive I-CPN as described in Subsections 2.1.4 and 2.1.5 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to send and receive I-PROG as described in Subsections 2.1.4 and 2.1.5 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to send and receive I-BC and I-LLC during call establishment as described in paragraphs 2.1.4.1 and 2.1.5.1?		Mandatory for Enhanced Interworking

TABLE 1 (CONTINUED)

COMPLIANCE TABLE FOR A PBX THAT SUPPORTS INTERWORKING OF THE SIMPLE CALL BETWEEN DPNSS 1 and ETS 300 172		
SERVICE VARIANT		COMMENT
Able to send and receive I-LLC on call connection as described in paragraphs 2.1.4.5 and 2.1.5.8 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to send and receive I-HLC as described in paragraphs 2.1.4.1 and 2.1.5.1?		Mandatory for Enhanced Interworking
Able to send and receive I-DSA as described in paragraphs 2.1.4.1 and 2.1.5.1?		Mandatory for Enhanced Interworking
Able to send and receive I-CSA during call establishment as described in paragraphs 2.1.4.1 and 2.1.5.1?		Mandatory for Enhanced Interworking
Able to send and receive I-CSA on call connection as described in paragraphs 2.1.4.5 and 2.1.5.8 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to support mapping between Transit Count and Loop Avoidance as described in paragraph 2.1.4.1?		
Able to react to receipt of SNU with parameter "F" in a CRM by repeating the call attempt with a smaller Selection Block as described in paragraph 2.1.4.1?		Mandatory if able to send Selection Blocks greater than 135 octets in length State action taken

**3.2 COMPLIANCE SHEET FOR INTERWORKING OF THE SIMPLE CALL BETWEEN
DPNSS 1 AND ETS 300 102**

The minimum level of compliance that can be claimed against subsection 2.2 of SECTION 6 of DPNSS[189-I] (this Section) is support of Basic interworking as described in Subsections 2.2.1, 2.2.2 and 2.2.3 of this Section. Support of the extra procedures detailed under Enhanced Interworking in Subsections 2.2.4, 2.2.5 and 2.2.6 of this Section is optional.

A PBX may be compliant to Basic Interworking, or Enhanced Interworking, or a level between the two.

Compliance with respect to Enhanced Interworking can only be claimed for a PBX if a "YES" is entered for every entry where the comment box of TABLE 2 indicates "mandatory for Enhanced Interworking".

TABLE 2

COMPLIANCE TABLE FOR A PBX THAT SUPPORTS INTERWORKING OF THE SIMPLE CALL BETWEEN DPNSS 1 and ETS 300 102		
SERVICE VARIANT		COMMENT
Able to support Basic Interworking as described in Subsections 2.2.1, 2.2.2 and 2.2.3?	YES	
Able to send and receive I-CC as described in Subsections 2.2.4, 2.2.5 and 2.2.6?		Mandatory for Enhanced Interworking
Able to use CLC-ISDN and RTI indicating "Public ISDN encountered" as described in Subsections 2.2.4 and 2.2.5, including the use of ISDN Type Parameter to indicate "ETS 300 102"?		Mandatory for Enhanced Interworking
Able to send I-CPN as described in paragraph 2.2.4.1 and paragraph 2.2.5.8 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to derive Calling Party/Connected Number from I-CPN, as described in paragraphs 2.2.5.1/2.2.4.5 respectively (including the use of SAVE)?		
Able to send and receive I-PROG as described in Subsections 2.2.4 and 2.2.5 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to send and receive I-BC and I-LLC during call establishment as described in paragraphs 2.2.4.1 and 2.2.5.1?		Mandatory for Enhanced Interworking

TABLE 2 (CONTINUED)

COMPLIANCE TABLE FOR A PBX THAT SUPPORTS INTERWORKING OF THE SIMPLE CALL BETWEEN DPNSS 1 and ETS 300 102		
SERVICE VARIANT		COMMENT
Able to send and receive I-LLC on call connection as described in paragraphs 2.2.4.5 and 2.2.5.8 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to send and receive I-HLC as described in paragraphs 2.2.4.1 and 2.2.5.1?		Mandatory for Enhanced Interworking
Able to send and receive I-DSA as described in paragraphs 2.2.4.1 and 2.2.5.1?		Mandatory for Enhanced Interworking
Able to send and receive I-CSA during call establishment as described in paragraphs 2.2.4.1 and 2.2.5.1?		Mandatory for Enhanced Interworking
Able to send and receive I-CSA on call connection as described in paragraphs 2.2.4.5 and 2.2.5.8 (including the use of SAVE)?		Mandatory for Enhanced Interworking
Able to react to receipt of SNU with parameter "F" in a CRM by repeating the call attempt with a smaller Selection Block as described in paragraph 2.2.4.1?		Mandatory if able to send Selection Blocks greater than 135 octets in length State action taken