TASK IDENTIFICATION (ID)
========================

TASKID : AM0067 DDOC 01
TITLE : ISDN NX64 CALL PROCESSING
UPDATED: 900406

RELEASE: 34

SYSTEM : DMS
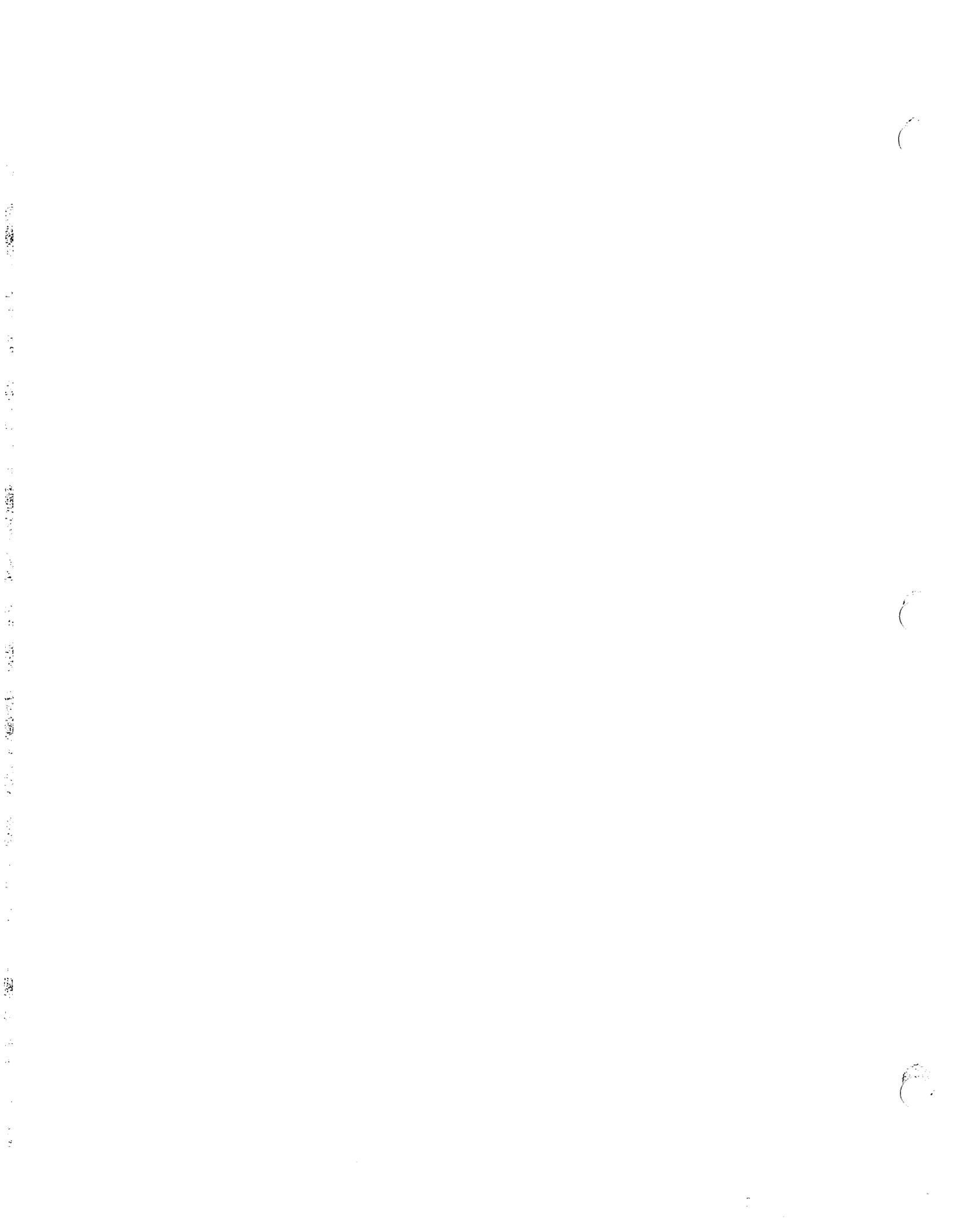PROJECT: USSPRINT

PROJECT MANAGER: LEWIS.HE   DEPT: 2G60
PRIME NAME   : PHAM.TV   PRIME DEPT: 2G62

ABSTRACT : THIS FEATURE WILL PERMIT THE DELIVERY OF ISDN NX64 SERVICES
           TO THE IEC NETWORK. THIS IS THE CULMINATION OF THE BCS31
           PREP ACTIVITY (AM0072).

SECTIONS: NEEDED   O = Optional Sections
========   ======

Functional Description   FN   Y
Design Description   DD   Y   Restricted distribution
Engineering Information EI   Y   Internal Use Only (BNR & NT)
Data Schema   DS   <Y>O Required if parms/data tables affected
Operational Measurements OM   <Y>O
Service Orders   SO   <N>O
Man Machine Interface   MM   <N>O
Logs   LG   <N>O
References   RF   <N>O Restricted distribution
Real Time   RT   Y   Restricted distribution
Designer Test plan   DT   Y   Restricted distribution
Test Plan   TP   <N>O For use by system test group only
AMA/Billing   AM   <N>O Required if AMA/SMDR/Billing affected

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DDOC STATUS: FR

CODE COVERAGE % for AM0067SOFT01: 0
CODE COVERAGE % for AM0067SOFT02: 0
CODE COVERAGE % for AM0067SOFT03: 0

FEATURE TITLE : ISDN NX64 CALL PROCESSING

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1.0 FEATURE SYNOPSIS

1.1 RATIONALE

As Primary Rate Interface (PRI) connectivity evolves, DMS-250 Networks will increasingly support wideband services such as video conferencing, fast facsimile, and rapid data transfer. This feature provides an evolutionary step towards Wideband Services by providing new service offerings based upon "bandwidth on demand".

1.2 INTRODUCTION

Prior to this feature, PRIs were capable of switching single channels (DS-0's) of a T-1 (DS-1) digital carrier at rates up to 64 Kbps. To achieve the significantly higher rates necessary for wideband services, bit rates higher than those offered by a single channel are required.

The intent of this feature is to supplement the existing 56 Kbps and 64 Kbps data transfer rates supported between PRI agencies to include Nx64 Kbps rates where $2 \leq N \leq 24$. The end-user has the option of using the entire T-1 span as a high speed channel or selecting the necessary number of channels needed to accommodate their bandwidth requirements. Transmission rates from 128 Kbps (2x64) to 1536[1] Kbps (24x64) are now supported.

This feature does not provide the ability to tandem wideband calls across a CCS7 interface. As such, PRI must be part of the backbone of the overlay network.

The implementation of Nx64 ISDN PRI wideband circuit-switched services requires software development both in the DMS-250 Central Control (CC) and in the XPM-based Digital Trunk Controller for ISDN (DTCI). The scope of this feature is limited to Central Control call processing enhancements. For information on XPM enhancements, please refer to feature AM0178 - "NX64KB SERVICES - XPM". For information on table control enhancements, refer to feature AM0192 - "ISDN NX64 TABLE CONTROL".

The delivery of ISDN Nx64 services to the IEC network is the culmination of the BCS31 preparatory features AM0072, "ISDN NX64 CALL CONTROL - PREP" and AM0068, "ISDN NX64 XPM PRA PREP".

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[1] The actual rate of a T-1 is 1544 Kbps, however, the 8 Kbps is for transmission information.

2.0 FEATURE DESCRIPTION

The intent of this feature is to provide the end-user with wide-band services on PRI-to-PRI connections only. The availability of wideband services is subject to certain hardware restrictions:

1. The Enhanced Network (ENET) is required to provide constant channel delay among all the wideband channels across the switching network.   Please refer to DDOC AL0583, "ENET CON-NECTION CONTROL", for further information on ENET.

2. The DTCI must be equipped with the new Digital Cellular Time Switch (DCTS) NTAX78AA which provides a constant delay across the DTCI.

3. DMS-250 SUPERNODE switch is required as ENET is only avail-able on SUPERNODE.

The additional bandwidths necessary for wideband services are provided by allowing multiple circuit-switched B-channels to be grouped together to form a wideband channel with a higher bit rate.   The individual B-channels that make-up the wideband chan-nel are restricted to being on the same T-1 interface and having the same D-channel.[2]

As the T-1 multiplexed carrier system has 24 channels, and each channel can operate at a maximum data rate of 64 Kbps, trans-mission rates ranging from 128 Kbps to 1536 Kbps (in 64 Kbps in-crements) are now supported.

2.1 CHANNEL STRUCTURE

For PRI wideband services, the user has the option of selecting the number of necessary B-channels to accommodate their bandwidth requirement. PRI recognizes the following channel structures:

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[2] The D-channel need not necessarily be on the same T-1 span as the B-channels.

TYPE	NUMBER OF CHANNELS	RATE
D	1 D-channel	64 Kbps
B	1 B-channel	64 Kbps
H0	6 B-channels	384 Kbps
H11	24 B-channels	1536 Kbps

Figure 1.   Channel Structure

NOTE: If the channel type in octet 3.2 of the Channel Identifica-
tion (CID) information element in the SETUP message is encoded as
H0, the six channels are contiguous and boundary aligned. Bound-
ary alignement is restricted to timeslots 1-6, 7-12, 13-18, and
19-24.[3] For information on how the CID information element in the
SETUP message is encoded to indicate boundary alignement, refer
to "H0-Channel" on page 28.

2.2 PROTOCOL

Wideband signalling uses the Layer 3 signalling protocol conform-
ing to:

• ISDN Primary Rate User-Network Interface Specification (NIS
  A211-4).

• American National Standard for Telecommunications – Digital
  Subscriber Signalling System No. 1 – Layer 3 Signalling Spec-
  ification for Circuit Switched Bearer Service (T1-607).

• AT&T Technical Reference Publication 41449 – ISDN Primary
  Rate Interface Specification, 1989

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[3] The DS-1 framing format consists of 24 8-bit bytes and one
     framing bit. Channels are identified consecutively from the
     frame bit as timeslots 1 through 24.

- AT&T Technical Reference Publication 41459 - ISDN Primary Rate Interface and Special Application Specification User-Network Interface Description, 1989.

The protocol used is determined by the "VERSION" field in table TRKSGRP. Please refer to feature AM0192 for additional information on the enhancements to this field.

A wideband call is identified by means of the Bearer Capability (BC) and the Channel Identification (CID) information elements in the SETUP message. The individual B-channels grouped together to form the wideband channel are identified in the CID information element. The transfer rate is identified in the BC information element. The number of channels should correspond to the information transfer rate in the BC information element. If there is a mismatch, a RELease COMplete message with a cause value of INVALID INFORMATION ELEMENT CONTENTS is returned.

Each of the above mentioned information elements are explained in detail in the following sections.

2.2.1 SETUP Message - Bearer Capability Information Element

Due to the increased number of transfer rates required for wideband services, new values are defined for the "information transfer rate" field in the Bearer Capability information element. This field is located in octets 4 and 4b[4] and is defined as:

Information Transfer Rate

```
    Bits
    5  4  3  2  1
    -------------
```

The following are already defined by ANSI:

```
    0  0  0  0  0 - This code is used for packed mode only
    1  0  0  0  0 - 64   Kbps  (1x64)
    1  0  0  1  1 - 384  Kbps  (6x64)
    1  0  1  0  0 - 1472 Kbps  (23x64)   **
    1  0  1  0  1 - 1536 Kbps  (24x64)
```

The following are not defined by ANSI but are defined in Technical Reference Publication 41449:

```
    1  0  0  0  1 - 128  Kbps  (2x64)
    0  0  0  0  1 - 192  Kbps  (3x64)
```

---

[4] The complete layout of the Bearer Capability information element can be found in the American National Standard for Telecommunications (T1-607).

```
0   0   0   1   0  -  256  Kbps  (4x64)
0   0   0   1   1  -  320  Kbps  (5x64)
0   0   1   0   0  -  448  Kbps  (7x64)
0   0   1   0   1  -  512  Kbps  (8x64)
0   0   1   1   0  -  576  Kbps  (9x64)
0   0   1   1   1  -  640  Kbps  (10x64)
0   1   0   0   0  -  704  Kbps  (11x64)
0   1   0   0   1  -  768  Kbps  (12x64)
0   1   0   1   0  -  832  Kbps  (13x64)
0   1   0   1   1  -  896  Kbps  (14x64)
0   1   1   0   0  -  960  Kbps  (15x64)
0   1   1   0   1  -  1024 Kbps  (16x64)
0   1   1   1   0  -  1088 Kbps  (17x64)
0   1   1   1   1  -  1152 Kbps  (18x64)
1   1   0   0   0  -  1216 Kbps  (19x64)
1   1   0   0   1  -  1280 Kbps  (20x64)
1   1   0   1   0  -  1344 Kbps  (21x64)
1   1   0   1   1  -  1408 Kbps  (22x64)
1   1   1   0   0  -  1472 Kbps  (23x64)   **
```

** NOTE: ANSI defines the encoding for 1472 Kbps as "10100" whereas Technical Reference Publication 41449 defines it as "11100". When the information element is encoded/decoded, the "VERSION" field in table TRKSGRP is checked to determine the value expected.

If the BC transfer rate in the incoming SETUP message does not correspond to one of the values listed above, a RELease COMplete message with a cause value of BEARER CAPABILITY NOT IMPLEMENTED is returned.

2.2.2 SETUP Message - Channel Identification Information Element

The purpose of the CID information element is to identify the channel(s) used in a call. If more than one B-channel is identified, and the bearer capability is greater than 64 Kbps then a request for wideband services is assumed.

The Channel Identification information element is defined as:

8	7	6	5	4	3	2	1	Octet
0	0	0	1	1	0	0	0	1
	Channel Identification Information Element							
Length of Channel Identification Contents								2
1 ext	Int id presnt	Int type	0 spare	Pref/ Excl	D-chnl ind.	Info channel selection		3
0/1 ext	Interface Identifier							3.1 (Note 1)
1 ext	Coding Standard		Numbr/ Map	Channel type/ Map element type				3.2
Channel Number/Slot Map (Note 2)								3.3

Figure 2.   Channel Identification Information Element

1. Note 1 -   When the "interface identifier present" field in octet 3 (bit 7) indicates "interface implicitly identified", octet 3.1 is omitted. When octet 3.1 is present, it may be extended by using the extension bit (bit 8).

2. Note 2 - When channel number is used, bit 8 is reserved for use as extension bit and is thus set to "1".

Coding of these fields is as follows:

2.2.2.1 Channel Identification Information Element (octet 1)

```
Bits
7 6 5 4 3 2 1
-------------
0 0 1 1 0 0 0
```

2.2.2.2 Length of Channel Identification Information Element (octet 2)

A binary value equal to the number of octets in the information element that follow the length field.

2.2.2.3 Interface Identifier Present (octet 3)

Bit
7
---

0 - Interface implicitly identified.

   The interface which includes the D-channel carrying this information is indicated.

1 - Interface explicitly identified in one or more octets beginning with octet 3.1

2.2.2.4 Interface Type (octet 3)

Bit
6
---
0 - Basic interface.

1 - Other interface; (e.g.) primary rate.

For PRI wideband services, "1" is the expected value for this field.

The type of interface should be understood because the interface is identified by "interface identifier present" field (octet 3, bit 7) and the "interface identifier" field (octet 3.1), if any.

2.2.2.5 Spare (octet 3)

Bit
5

Spare

2.2.2.6 Preferred/Exclusive (octet 3)

```
Bit
 4
---
```

0 - Indicated channel is preferred.

1 - Exclusive; only the indicated channel is acceptable.

For PRI wideband services, "1" is the expected value for this field.

Preferred/Exclusive has significance only for B-channel selection.

2.2.2.7 D-channel Indicator (octet 3)

```
Bit
 3
---
```

0 - The channel identified is not the D-channel.

1 - The channel identified is the D-channel.

For PRI wideband services, "0" is the expected value for this field.

D-channel indication has significance in D-channel use. No other information affects D-channel use.

2.2.2.8 Information Channel Selection (octet 3)

```
Bits
2 1    Other interfaces
----   ----------------
0 0 -  no channel

0 1 -  as indicated in following octets

1 0 -  reserved

1 1  - any channel
```

For PRI wideband services, "01" is the expected value for this field.

2.2.2.9 Interface Identifier (octet 3.1)

Binary code assigned to the interface at subscription time. This information is obtained from table LTCPSINV and is sent down to the XPM in static data.

Note: When the interface is implicitly identified, octet 3.1 is omitted.

2.2.2.10   Coding Standard (octet 3.2)

```
Bits
7  6
----
```

0   0 - CCITT standardized coding.

1   0 - National standard.

1   1 - Standard defined for Network.

NOTE: For PRI wideband services, national standard is not sup-ported.

2.2.2.11   Number/Map (octet 3.2)

```
Bit
 5
---
```

0 - Channel is indicated by the number in the following octet.

1 - Channel is indicated by the slot map (Map) in the following octet(s)

2.2.2.12   Channel Type/Map Element Type (octet 3.2)

```
Bits
4  3  2  1
----------
0  0  1  1 - B-channel units

0  1  1  0 - H0-channel units

1  0  0  0 - H11-channel units
```

All other values are reserved.

Note: An H10-channel type (0111) is defined by ANSI, but is not
supported in this release of wideband services. The equivalent
of an H10-channel can be achieved by encoding B-Channel (0011)
and using the three octet slot map to indicate the channels se-
lected.

2.2.2.13   Channel Number / Slot Map (octet 3.3)

Either "Channel Number" or "Slot Map" is used exclusively depend-
ing on the "Number/Map" information.

Channel Number (octet 3.3)

Binary number assigned to the channel. For B-channels, the
channel number equals the timeslot number.   See CCITT Recom-
mendation I.431.

Slot Map (octet 3.3)

Bit position(s) in slot map corresponding to timeslot(s) used
by the channel is/are set to 1.

Note: The length of the Slot Map is decided by a combination
of channel unit size on which the slot map is mapped and map
element type (e.g. B-channel).

For examples of how the CID information element may be encoded,
please refer to "Appendix A. Channel Identification Examples" on
page 28.

For a summary of where the DMS-250 implementation   of wideband
services does not adhere to the ANSI protocol specified for the
BC and CID information elements, please refer to "Appendix B. De-

viations from ANSI Standards" on page 34. For a summary of what wideband services are supported by ANSI, CCITT and AT&T, please refer to "Appendix C. ANSI vs AT&T vs CCITT" on page 35

2.3 CALL ESTABLISHMENT

The calling USER initiates a wideband call request by sending a SETUP message over a PRI link to the NETWORK. If there are no protocol violations, the network allocates the B-channels indicated in the CID information element of the SETUP message.

2.3.1 "Master" Channel

A wideband call uses the concept of a MASTER-SLAVE relationship. The master channel is defined to be the one on the lowest numbered timeslot. All the other channels are slaves. The master is used to control the flow of the wideband call:

- Signalling messaging between the CC and XPM are sent to/from this channel.

- Logs that require a trunk group member number use the member number of the master.

- The trunk group member number of the agent associated with this channel is captured in the ORIGMEM field of the Call Detail Record (CDR).

2.3.2 CDR Field NUMWBCKT

Once a wideband call is established, the number of circuits grouped together to form the wideband channel is captured in the NUMWBCKT field of the CDR. This field has a range of 2 through 24 with a default of "0". A value of "0" indicates that wideband services were not used.

NUMWBCKT was implemented by feature AM0179, "USSPRINT CDR ENHANCEMENTS FOR BCS32". Please refer to this document for additional information.

2.3.3 Channel Negotiation

Channel negotiation is not supported in the initial release of wideband services. If the requested channels are not available

or cannot be allocated, a RELease COMplete message with a cause
value of NO CHANNEL OR CIRCUIT AVAILABLE is returned.

2.3.4 Integrity

All channels are monitored for integrity, and, in the event that
any one or more of the channel(s) loses integrity, the call is
taken down.

2.3.5 Cut-through Dialling

DTMF cut-through dialling is not supported for wideband services.
The SETUP message must contain all the address and call authori-
zation information necessary to complete the call.

If the address is incomplete, partial dial (PDIL) treatment is
applied. For detailed information on how call authorization is
handled, please refer to "CALL AUTHORIZATION AND SCREENING".

2.4 CALL AUTHORIZATION AND SCREENING

Call authorization on the DMS-250 is performed against five char-
acteristics: Authorization Codes (AUTHCODE), Personal Identifi-
cation Numbers (PIN), Account Codes (ACCT), Calling Line
Identifiers (CLID), and Calling Card Numbers (CCN).

2.4.1 Authcode

Only completely filed authcodes are allowed - i.e. the authcode
datafilled in table CALLATTR must be a 7-digit authcode. If this
is not the case, invalid authcode (INAU) treatment is applied to
the call. If the authcode is of sufficient length, authcode val-
idation and call screening are performed. Please refer to
"Screening" on page 13 for additional information on call screen-
ing.

2.4.1.1 PIN Digits

PIN digits are used as another level of screening beyond the
authcode and are based on the authcode parameter PINDIGS. If the
authcode specifies that PIN digits are required, this is ignored
and the call is allowed to proceed.

2.4.1.2 Account Code Digits

Account codes are used to allow charge-back of calls to projects, departments, or accounts. The requirement to enter an account code is specified by the authcode parameter ACCTLEN. If the authcode specifies that ACCT digits are required, INAU treatment is applied to the call.

2.4.2 Calling Line Identification

The CLID is received in the SETUP message. It is validated and screened in the same manner as for any other PRI call.[5] Similar to what is detailed for authcodes:

2.4.2.1 PIN Digits

If PIN digits are datafilled against the CLID, the PINDIGS field is ignored and the call is allowed to proceed.

2.4.2.2 Account Code Digits

If the CLID specifies that ACCT code digits are required, ANI database failure (ADBF) treatment is applied to the call.

2.4.3 Calling Card

The SETUP messages cannot contain a calling card number, and, as DTMF cut-through digit collection is not allowed, this is not a valid authorization method for wideband services.

2.4.4 Screening

With the exception of Class of Service (COS) Screening, wideband calls adhere to the same screening mechanisms as narrowband (single B-channel) calls; i.e. incoming exclusion, restricted usage by day and time, trunk group class of service screening, etc.

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[5]   Refer to DDOC AM0077, "ISDN ISA CLID/CSI SCREENING", for details on CLID screening.

The only difference for COS screening is that COS Override
(COSOVE) is not supported. This is a direct result of cut-
through digit collection not being allowed for wideband services.
If the call should fail COS screening, class of service exceeded
(COSX) treatment is applied to the call.

2.5 TRANSLATIONS AND ROUTING

Translation of wideband calls is similar to single B-channel
calls. However, certain restrictions are placed on the terminat-
ing route selected from the route list:

1. The selector in the route list must be supported for wideband
    services. The following route selectors are supported:

    a. S   - Standard
    b. T   - Table Routing
    c. N   - Non-standard
    d. ST   - Allows chaining of route lists
    e. CND - Time of day screening
    f. RX   - retranslation
    g. EXDS - extended digit screening
    h. ISA - PRI routing (except for OHQ and CBQ)

    These selectors are <u>not</u> supported[6]:

    a. SQ   - standard queueing
    b. NQ   - non-standard queuing
    c. QH   - queue header
    d. TPBX - Tandem PBX
    e. MEM - member selection
    f. FEAT - for international IMTs
    g. ISA - OHQ and CBQ options

2. The trunk group must be PRI.

3. The trunk group must support wideband services; i.e. The
    OPTIONS vector in table TRKGRP must have "WBS" datafilled.

4. The allowable range of transmission rates for the trunk group
    selected must allow the transmission rate of the wideband
    call. i.e. The RATE subfield of the "WBS" OPTION in table
    TRKGRP must be within range.

Additional information on the "WBS" OPTION and it's related sub-
fields can be found in feature AM0192 and AD3891, "PRI NX64 SE-
LECTION ALGORITHM".

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[6] The following selectors are not used by DMS-250: MN, TS, RT,
     TL, DN, NIL, INS, NODE, DCRT and NPOS.

If any of the above mentioned criteria are not met, the next element in the route list is checked (route advance). If the route list is exhausted, generalized no circuit (GNCT) treatment is applied to the call.

If all the conditions are met, an attempt is made to select the required number of available channels.

2.5.1 SELECTION ALGORITHM

A new selection algorithm is created for selecting available channels on trunks supporting wideband services. The algorithm allows channel selection to be done on a T-1 basis. This method was chosen as the B-channels that make up the wideband channel are restricted to being on the same T-1. The same selection algorithm is used for the narrowband and wideband traffic on the trunk group.

2.5.1.1 TRKGRP SELSEQ OPTIONS

As part of the new selection algorithm, two new selection options, WBABF and WBDBF, are added to the SELSEQ field in table TRKGRP. WBABF (WideBand Ascending BestFit) and WBDBF (WideBand Descending BestFit) are the only selection options supported if wideband services are allowed on the trunk group. Also, WBABF and WBDBF cannot be datafilled if wideband services are not allowed. Please refer to Figure 3 on page 16 for sample TRKGRP datafill.

For the wideband selection algorithm, selection time is reduced by configuring the search structure as a list of T-1's containing its associated members. The search begins at the top (head) of the list for WBABF and at the end (tail) for WBDBF as shown on Figure 4 on page 17. Please refer to feature AD3891 for more exact details on the new wideband selection sequence.

To minimize glare, each office should use the opposite trunk selection method. For example, if a PRI trunk connects Fort Worth to Kansas City, and Fort Worth uses an ascending bestfit selection algorithm, the Kansas City office should use a descending bestfit selection algorithm. Referring to Figure 4 on page 17, the Fort Worth office will select channels starting from span 0 whereas Kansas City will select channels starting from span 19. Please refer to feature AD3892, PRI NX64 GLARE, MAINTENANCE, CC SWACT, for more detailed information on wideband glare handling.

CLLI	WBPRI
GRPTYP	PRA250
TRAFSNO	0
PADGRP	NPDGP
NCCLS	NCIT
CUSTOMER	USSPRINT
ZONE	0
FASTIDGT	4
BCNAME	64KDATA
SELSEQ	WBASEQ
TRAFCLS	NIL
TIMEBIAS	0
SNPA	312
LTID	ISDN 45
OPTIONS	WBS 2 24 NONCON
OPTIONS	$

Figure 3.   Wideband TRKGRP Entry

```
┌─────────────────────────────────────────────────────────────────────┐
│  Fort Worth       Trunk Group WBPRI              Kansas City          │
├─────────────────────────────────────────────────────────────────────┤
│                                                                       │
│     WBABF            B-channel                                        │
│                    ┌──────────┐                                      │
│      P │             │    1     │   first T-1 on the list            │
│        │             │    2     │                                     │
│        │             │    .     │                                     │
│        V             │    .     │                                     │
│                      │   23     │                                     │
│                      │   24     │                                     │
│                      │    1     │   second T-1 on the list           │
│                      │    2     │                                     │
│                      │    .     │                                     │
│                      │    .     │                                     │
│                      │    .     │                                     │
│                      │    1     │   last T-1 on the list             │
│                      │    2     │                                     │
│                      │    .     │                              A     │
│                      │    .     │                              │     │
│                      │   23     │                              │     │
│                      │   24     │                              │  Q  │
│                      └──────────┘                                    │
│                                                             WBDBF    │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
```
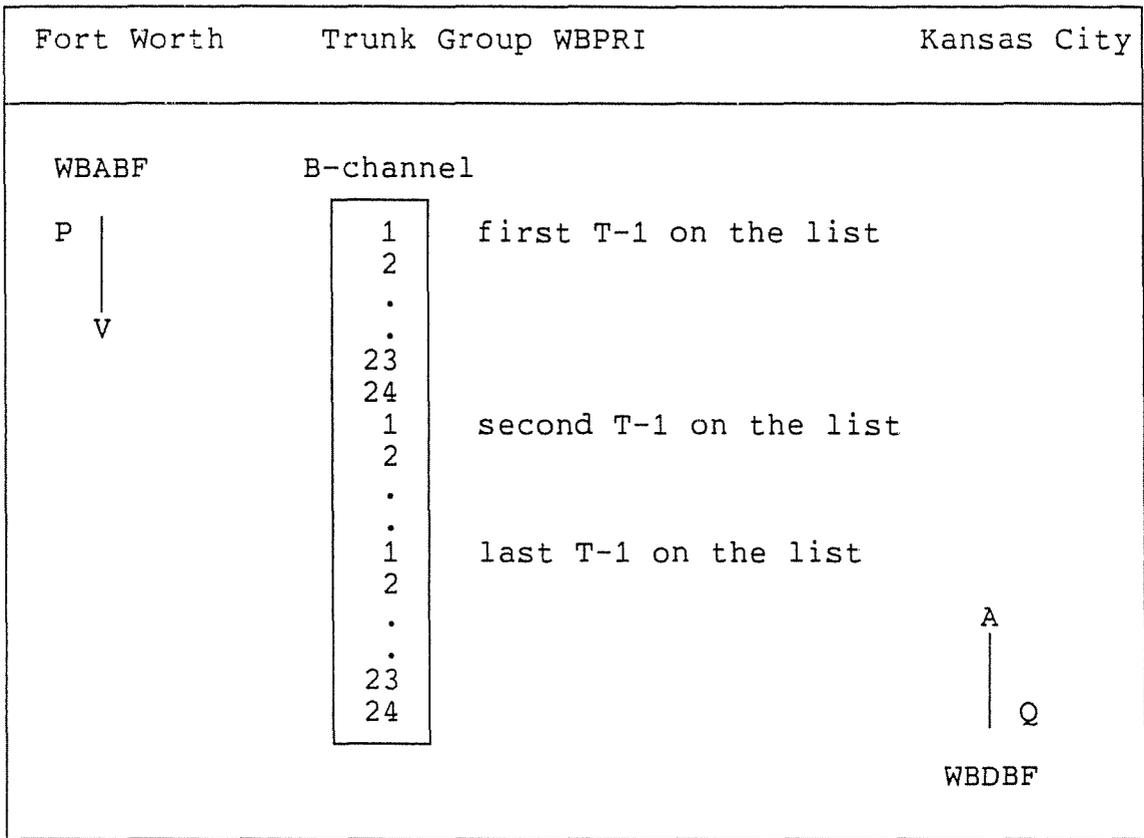
Where P - a PRA250 wideband trunk group at Fort Worth
      Q - a PRA250 wideband trunk group at Kansas City

Figure 4. Minimizing Glare

2.5.1.2 FRAGMENTATION

Fragmentation occurs when an insufficient number of B-channels
exist on one T-1 interface, but the desired number of B-channels
exist sparsely distributed over many T-1 interfaces. Inorder to
lessen the possibility of fragmentation, B-channels should be
datafilled densely on each T-1 interface rather then distributed
widely over many T-1s. This method of conservative datafilling
reduces the risk of wideband calls having to check the next ele-
ment in the route list, or being released due to an insufficient
number of available agents on the same T-1.

WBPRI TRUNK - AGENTS DATAFILLED ACROSS FOUR T-1 SPANS

```
┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│    SPAN  0      │   │    SPAN  2      │   │    SPAN  3      │   │    SPAN  5      │
│                 │   │                 │   │                 │   │                 │
│ 110110xxxxxx    │───│ 110011xxxxxx    │───│ 111000xxxxxx    │───│ 010100xxxxxx    │
│ xxxxxxxxxxxx    │   │ xxxxxxxxxxxx    │   │ xxxxxxxxxxxx    │   │ xxxxxxxxxxxx    │
│                 │   │                 │   │                 │   │                 │
│ 2 idle          │   │ 2 idle          │   │ 3 idle          │   │ 4 idle          │
│ channels        │   │ channels        │   │ channels        │   │ channels        │
│                 │   │                 │   │                 │   │                 │
└─────────────────┘   └─────────────────┘   └─────────────────┘   └─────────────────┘
```
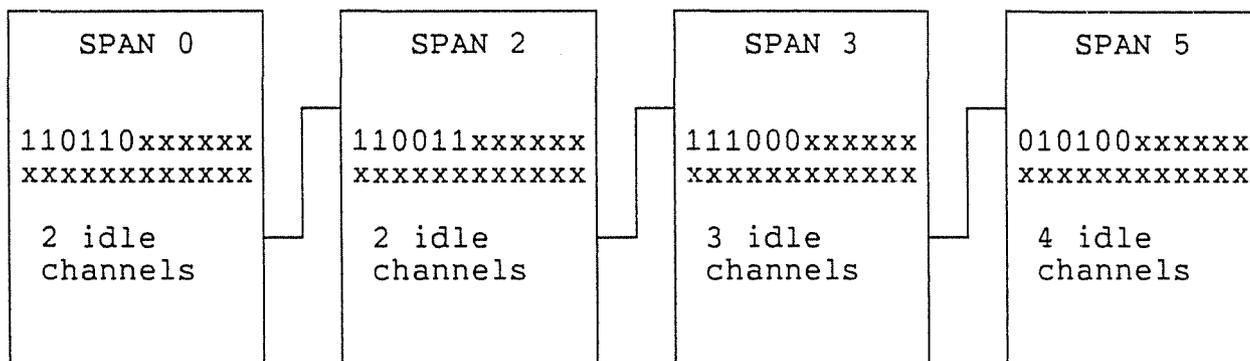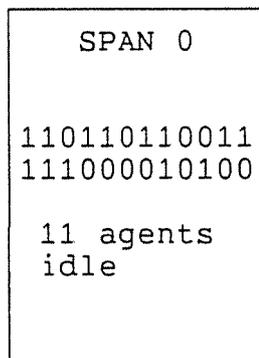
1 = Busy WBPRI channels
0 = Idle WBPRI channels
x = Not WBPRI channels

Figure 5.   Fragmented Datafill

WBPRI TRUNK - AGENTS DATAFILLED ON ONE T-1 SPAN

```
            ┌─────────────────┐
            │    SPAN  0      │
            │                 │
            │                 │
            │ 110110110011    │
            │ 111000010100    │
            │                 │
            │ 11 agents       │
            │ idle            │
            │                 │
            │                 │
            └─────────────────┘
```

1 = Busy WBPRI channels
0 = Idle WBPRI channels

Figure 6.   Minimize Fragmented Datafill

Referring to Figure 5 and Figure 6:

Figure 5 shows only six B-channels datafilled on each T-1. If a
wideband call needed six B-channels, the WBPRI trunk could not
fulfill the requirement as not enough agents are available on the
same T-1.   The call would advance to the next element in the

route list or, if the route list was exhausted, the call would be released. Datafilling this way, distributing B-channels over many T-1s, can waste call processing time by needlessly searching too many T-1's, needlessly advancing to the next element in the route list, or even releasing the call.

The possibility of this dilemma can be lessened if B-channels are datafilled in a denser way, see Figure 6 on page 18. In this case the same number of B-channels have been datafilled but they are all on one T-1 interface. Now when searching for six B-channels, they are found on T-1 span 0. Advancing to the next route list element or releasing the call is prevented.

Routing narrowband traffic over the same interface as wideband traffic can also cause fragmentation. This fragmentation can become a hazard when attempting to route a wideband call requiring an H0-channel (six contiguous B-channels). Referring to Figure 6 on page 18, there are enough B-channels available, but due to poor routing techniques an H0-channel cannot be found as the channels are not contiguous and they are not aligned on timeslots 1-6, 7-12, 13-18, or 19-24.

One solution to this would be, whenever possible, route single B-channel calls over PRI links which do not support wideband services. Only ˙when no other route is available, route single B-channel calls over trunk groups supporting wideband services.

2.5.1.3 CONTIGUOUS CHANNELS

Terminating channels are selected contiguously under the following circumstances:

1. The protocol for the T-1 interface is P41449, the transfer rate requested is 384 Kbps (H0).

    The protocol is specified in the VERSION field of table TRKSGRP. In this case, not only are the channels chosen contiguous but they must also be on one of four timeslot boundaries: 1-6, 7-12, 13-18, or 19-24.

2. The terminating trunk is outgoing to Customer Premise Equipment (CPE), the WBSEL subfield of the "WBS" option in table TRKGRP is set to FLXCON (FLeXible CONtiguous) or BNDCON (BouNDed CONtiguous). Please refer to AD3891 for more detailed information regarding the TRKGRP "WBS" subfield WBSEL.

2.6 NETWORK CONNECTION

Once terminating channels have been selected, a terminating "master" is identified for the wideband call. As with the originat-

ing master, this is the agent on the lowest numbered timeslot.
Signalling messaging between the CC and XPM relating to the ter-
minator are sent via this channel. The trunk group member number
of the master is captured in the TERMMEM field of the CDR.

A network connection is established using ENET and an outgoing
SETUP message is sent from the NETWORK. The B-channels that
make-up the outgoing wideband call are identified in the CID in-
formation element. As with narrowband PRI calls, the BC informa-
tion element from the incoming SETUP message is passed unchanged
to the outgoing BC information element unless the call has been
marked as data through translations.[7]

2.7 GLARE

Glare is the blocking of a call by the simultaneous seizure of a
trunk at both ends. It is up to the XPM to determine, based on
the BCHGLARE field in table TRKSGRP, the end that is to yield and
the one that is to stand.

If the termination is set to yield, a terminating trunk group is
selected from the next valid route list element.[8] If the route
list is exhaused, generalized no circuit (GNCT) treatment is ap-
plied to the call.

If the origination is set to yield, a release complete message is
returned to the far end.

Please refer to feature AM0178 for details on how glare is han-
dled in the XPM and feature AD3892 for details on how glare is
handled in the CC.

2.8 TREATMENT

In BCS33, feature AD3334, "TREATMENT AND LOG ENHANCEMENTS", pro-
vides the option for incoming PRI calls to supply audible treat-
ment if the TRKGRP option AUDBTRMT is set. For wideband calls,
setting the TRKGRP option AUDBTRMT has no effect. All treatments
incurred on originating PRI trunks as wideband calls results in a
DISConnect or RELease message with a cause which is obtained
through treatment- to-cause mapping. This feature does not

---

[7] Refer to DDOC AD0883 for information on calls marked data
through translations.

[8] This is different from narrowband calls in that single
circuit-switched calls try and reselect another member from
the same trunk group. The next route list element is checked
only when the attempt to select another member fails.

change the way treatment is handled for narrowband calls. Please refer to DDOC AD3334 and AD0883, "BASIC PRA CALL PROCESSING FOR DMS-250", for more detailed information.

2.9 MAINTENANCE

No new maintenance functions are implemented for the initial release of wideband services.

If a force release (FRLS) command is issued from a Maintenance Administration Position (MAP) and the trunk posted is a PRI channel associated with a wideband call, a warning message is displayed to the craftsperson and the craftsperson is prompted if he/she wishes to continue. If the craftsperson wishes to continue, the channel being force released is set to "MANB" and the other channels are set to "IDL". Please note, a force release can be done on the master channel or any one of the slave channels.

If any of the agents in the wideband call changes state to Carrier FaiL (CFL) or PM Busy (PMB), the call is taken down. Please refer to feature AD3892 for more details on wideband services maintenance.

3.0 SUPPLEMENTARY INFORMATION

3.1 ENGINEERING/HARDWARE INFORMATION

The following hardware are required for wideband services:

    ENET
    DCTS NTAX78AA
    SUPERNODE

3.2 SUPPLEMENTARY INFORMATION (DDOC SECTIONS)

3.2.1 LOGS (LG)

No logs are added or changed.

3.2.2 DATA SCHEMA (DS)

A new office parameter, NUM_WIDEBAND_EXT_BLKS, is added to table OFCENG. This office parameter controls the provisioning of the new wideband extension block, WIDEBAND_EXT_BLK, and has a range of 0 to 4096. The extension block controls the number of wideband calls that can be up at one time. Each extension block uses 200 words of data storage. The default value for NUM_WIDEBAND_EXT_BLKS is 50. A restart cold is required to increase/decrease this value.

The data storage impact is:

        NUM_WIDEBAND_EXT_BLKS * 200 words

The SELSEQ field in table TRKGRP is enhanced to allow WBASEQ and WBDSEQ to be datafilled if wideband services are allowed on the trunk group.

Refer to the DS section of this document for further details.

Please refer to the feature AM0192 for other table control data schema changes required for wideband services.

3.2.3 SERVICE ORDERS (SO)

No change.

3.2.4 MAN MACHINE INTERFACE (MM)

No change.

3.2.5 OPERATIONAL MEASUREMENTS (OM)

The usage counts of the wideband extension blocks allocated is accumulated in the OM group EXT. The info field is called EXTINFO and the OM name is the name of the extension block (WIDEBAND_EXT_BLK). The value of the OM register can be queried with the OMSHOW command or output in the log report OMPR.

Existing call related OMs are updated once per wideband call. Channel/circuit related OMs are updated "N" times, once for each channel.

Please refer to the OM section of this document for further information.

3.2.6 AMA/BILLING INFORMATION (AM)

The number of B-channels grouped together to form a wideband channel is reflected in the NUMWBCKT field of the CDR. This is a new field added by feature AM0179, "USSPRINT CDR ENHANCEMENTS FOR BCS32". NUMWBCKT has a range of values from 2 through 24 with 0 as the default. The default value indicates wideband services were not used. Please refer to AM0179 for additional information.

The ORIGMEM and TERMMEM fields of the CDR contain the originating and terminating trunk member numbers respectively. For wideband calls:

* ORIGMEM - contains the trunk group member number of the originating master.

* TERMMEM - contains the trunk group member number of the terminating master.

3.2.7 <u>OPTIONALITY/PACKAGING</u>

Wideband services is an optional feature. Optionality is
achieved by packaging the feature in NTXL45AA.

4.0 FEATURE IMPACT

4.1 INTERACTIONS

This feature interacts with the following features:

        AM0178 - NX64KB SERVICES - XPM
        AM0179 - USSPRINT CDR ENHANCEMENTS FOR BCS32
        AM0192 - ISDN NX64 TABLE CONTROL
        AM0211 - PRI IMT SUPPORT FOR NX64
        AD3891 - PRI NX64 SELECTION ALGORITHM
        AD3892 - PRI NX64 GLARE, MAINTENANCE, CC SWACT

4.2 RESTRICTIONS/LIMITATIONS

1. The following are not supported on wideband calls:

    - off-hook queuing (OHQ)
    - satellite hop
    - test lines
    - cut-through digit collection
    - tandeming across a CCS7 interface
    - channel negotiation
    - reoriginating
    - PRI throttling
    - three-way conference calling
    - Release Link Trunk (RLT)
    - operator Assisted calls
    - echo cancellor not supported for WSS, but will be supported for B-channel calls.

2. The following route selectors are not supported:

    - SQ   - standard queueing
    - NQ   - non-standard queuing
    - QH   - queue header
    - TPBX   - Tandem PBX
    - MEM   - member selection
    - FEAT   - for international IMTs
    - ISA   - OHQ and CBQ options

3. The individual B-channels in a wideband call must reside on the same T-1 span and have the same D-channel. The D-channel need not necessarily be on the same T-1 span as the B-channels.

4. Wideband calls are only supported between PRI agencies.

5. Additional restrictions are documented under features AM0178 and AM0192.

5.0 DEFINITIONS & ABBREVIATIONS

ANSI   American National Standards Institute

CC   Central Control

CCN   Calling Card Number

CCS7   Common Channel Signalling #7

CDR   Call Detail Record

CID   Channel IDentification

CLID   Calling Line IDentifier

CLLI   Common Language Location Identifier

COS   Class Of Service

COSOVE   Class Of Service OVErride

CPE   Customer Premise Equipment

DCTS   Digital Cellular Time Switch

DS-0   Single 64 Kbps channel of a T-1.

DTCI   Digital Trunk Controller for ISDN

ENET   Enhanced NETwork

H0   six B-channels

H11   twenty-four B-channels

IEC   Inter-Exchange Carrier

ISDN   Integrated Services Digital Network

Kbps   KiloBits Per Second

PRI   Primary Rate Interface

T-1   24-channel, 1.544 Mb/s multiplexed carrier system. This
          digital carrier carries a signal whose electrical spec-
          ification is termed DS-1.

WBS   WideBand Services

XPM   eXtended Peripheral Module

6.0 <u>REFERENCES</u>

1. AD0883 - BASIC PRA CALL PROCESSING FOR DMS-250

2. AL0583 - ENET CONNECTION CONTROL

3. AM0074 - ISDN CCS7 BEARER CAPABILITY & ROUTING

4. AM0077 - ISDN ISA CLID/CSI SCREENING

5. AM0178 - NX64KB SERVICES - XPM

6. AM0179 - USSPRINT CDR ENHANCEMENTS FOR BCS32

7. AM0192 - ISDN NX64 TABLE CONTROL

8. AM0211 - PRI IMT SUPPORT FOR NX64

9. AD3891 - PRI NX64 SELECTION ALGORITHM

10. AD3892 - PRI NX64 GLARE, MAINTENANCE, CC SWACT

11. AD3334 - TREATMENT AND LOG ENHANCEMENTS

12. ISDN PRIMARY RATE USER-NETWORK INTERFACE SPECIFICATION (NIS A211-4)

13. AMERICAN NATIONAL STANDARD FOR TELECOMMUNICATIONS - DIGITAL SUBSCRIBER SIGNALLING SYSTEM NO. 1 - LAYER 3 SIGNALLING SPEC-IFICATIONS FOR CIRCUIT SWITCHED BEARER SERVICE.

14. TECHNICAL REFERENCE PUBLICATION 41449

APPENDIX A. CHANNEL IDENTIFICATION EXAMPLES

A.1 HO-CHANNEL

There are two different ways to encode an HO-channel:

1. HO-channel identified by one octet channel number.

    The channel type is encoded '0110' (HO-channel). This implies
    that the six B-channels are contiguous and on timeslots 1-6
    (group 1), 7-12 (group 2), 13-18 (group 3), or 19-24 (group
    4). The timeslot group is identified by a one octet channel
    number as follows:

            Group 1 -   00000001
            Group 2 -   00000010
            Group 3 -   00000011
            Group 4 -   00000100

2. HO-channel identified by one octet slot map.

    The channel type is encoded '0110' (HO-channel) which implies
    that the six B-channels are contiguous and on a specific
    timeslot boundary. The timeslot group is identified by a one
    octet slot map as follows:

            Group 1 -   00000001
            Group 2 -   00000010
            Group 3 -   00000100
            Group 4 -   00001000

The DMS-250 will only encode the first one in the CID information
element of the outgoing SETUP message, but can recognize and sup-
port both in the incoming SETUP message.

A.1.1 HO - Identified by one octet Channel Number

8	7	6	5	4	3	2	1	Octet
0	0	0	1	1	0	0	0	
	Channel Identification Information Element							1
0	0	0	0	0	0	1	1	
	Length of Channel Identification Contents							2
1 ext	0 Int id presnt	1 Int type	0 spare	0 Pref/ Excl	0 D-chnl ind.	0 Info channel selection	1	3
1 ext	0 Coding Standard	0	0 Numbr/ Map	0 Channel type/	1	1 Map element type	0	3.2
0	0	0	0	0	0	1	1	
	Channel Number/Slot Map							3.3

- Channel is identified by channel number
- Channel is an HO-channel that consists of six contiguous B channels in timeslots 13-18 (group 3).
- Indicated channel is preferred
- Channel is located in the same interface as the D-channel

A.1.2 H0 – Identified by one octet Slot Map

The DMS-250 will not encode an H0-channel in this manner, but the
DMS-250 is able to recognize this encoding. For an H0-channel with
six contiguous B-channels on a specific timeslot boundary, the en-
coding detailed under "H0 – Identified by one octet Channel Number"
on page 29 is used.

8	7	6	5	4	3	2	1	Octet
0	0	0	1	1	0	0	0	
Channel Identification Information Element								1
0	0	0	0	0	0	1	1	
Length of Channel Identification Contents								2
1 ext	0 Int id presnt	1 Int type	0 spare	0 Pref/ Excl	0 D-chnl ind.	0 Info channel selection	1	
								3
1 ext	0 Coding Standard	0	1 Numbr/ Map	0 Channel type/	1	1 Map element type	0	
								3.2
0	0	0	0	0	1	0	0	
Channel Number/Slot Map								3.3

- Channel is identified by slot map
- Channel is an H0-channel that consists of six contiguous B-channels in timeslots 13-18 (group 3).
- Indicated channel is preferred
- Channel is located in the same interface as the D-channel

A.2 H11-CHANNEL

8	7	6	5	4	3	2	1	Octet
0	0	0	1	1	0	0	0	
Channel Identification Information Element								1
0	0	0	0	0	1	0	0	
Length of Channel Identification Contents								2
1 ext	1 Int id presnt	1 Int type	0 spare	0 Pref/ Excl	0 D-chnl ind.	0 Info channel selection	1	3
0 ext	0	0 (See Note 1)	1	1	1	0	0	3.1
1 ext	0 Coding Standard	0	0 Numbr/ Map	1 Channel type/	0	0 Map element type	0	3.2
0	0	0	0	0	0	0	1	
Channel Number/Slot Map								3.3.1

Note 1: The interface identifier is obtained from table LTCPSINV and is sent down to the XPM in static data.

- Channel is identified by channel number.
- H11-channel requested
- Indicated channel is preferred
- Channel is located on a different interface from the D-channel
- Interface identifier present

A.3 B-CHANNELS

A.3.1 Three B-Channels - Identified by Slot Map

0	0	0	1	1	0	0	0	1
Channel Identification Information Element								
0	0	0	0	0	1	0	1	2
Length of Channel Identification Contents								
1 ext	0 Int id presnt	1 Int type	0 spare	0 Pref/ Excl	0 D-chnl ind.	0 Info channel selection	1	3
1 ext	0 Coding Standard	0	1 Numbr/ Map	0 Channel type/	0	1 Map element type	1	3.2
0	1	0	0	0	0	0	0	3.3.1
Channel Number/Slot Map								
0	0	0	0	0	0	0	1	3.3.2
0	0	0	1	0	0	0	0	3.3.3

- Three B-channels requested - timeslots 5, 9, and 23.
- Indicated channel is preferred
- Channel is located in the same interface as the D-channel
- Channel is identified by slot map

A.3.2 Six B-Channels - Identified by Slot Map

The same transfer rate as an HO-channel can be achieved by encoding the channel type as B-channel and indicating the channels in the three octet slot map. The channels may or may not be contiguous and may or may not be boundary aligned.

8	7	6	5	4	3	2	1	Octet
0	0	0	1	1	0	0	0	1
	Channel Identification Information Element							
0	0	0	0	0	1	0	1	2
	Length of Channel Identification Contents							
1 ext	0 Int id presnt	1 Int type	0 spare	0 Pref/Excl	0 D-chnl ind.	0 Info channel selection	1	3
1 ext	0 Coding Standard	0	1 Numbr/Map	0 Channel type/	0	1 Map element type	1	3.2
0	0	0	0	0	0	0	1	3.3.1
	Channel Number/Slot Map							
0	1	1	0	1	0	0	1	3.3.2
0	1	0	0	0	0	0	0	3.3.3

- Channel is identified by slot map
- Six B-channels requested - timeslots 7, 9, 12, 14, 15, and 17. This provides the same transfer rate as an HO-channel.
- Indicated channel is preferred
- Channel is located in the same interface as the D-channel

APPENDIX B. DEVIATIONS FROM ANSI STANDARDS

For reference, the following is a summary of where the protocol used for wideband services deviates from the American National Standard for Telecommunications (T1-607).

B.1 CHANNEL IDENTIFICATION INFORMATION ELEMENT

- **Coding Standard (octet 3.2)**

    The DMS-250 will default to CCITT (0 0) for wideband services. National standard (0 1) will not be used.

- **Channel Type/Map Element Type (octet 3.2)**

    An H10-channel (0 1 1 1) is not supported. H10 requires the coding standard to be National and the DMS-250 uses CCITT for wideband services.

    The same transfer capability of an H10-channel (1472 Kbps) can be achieved by encoding B-channel (0 0 1 1) in this field and using the three octet slot map to identify the twenty-three channels.

B.2 BEARER CAPABILITY INFORMATION ELEMENT

- **Information Transfer Rate (octets 4 and 4b)**

    ANSI only defines a subset of the information transfer rates supported by this feature, namely:

         384 Kbps - 6x64
        1472 Kbps - 23x64
        1536 Kbps - 24x64

    The values encoded for (2x64 through 5x64) and (7x64 through 22x64) are in-line with Technical Reference Publication 41449.

APPENDIX C. ANSI VS AT&T VS CCITT

For reference, the following is a summary of what is supported for ANSI, AT&T and CCITT in the BC and CID information elements.

BEARER CAPABILITY

	ANSI	AT&T	CCITT
TRANSFER RATE	64,384,1472 1536	ALL	64,128,384, 1536, 1920
	H10=10100	H10=11100	H10=undefined
TRANSFER CAPABILITY	NO VIDEO	NO VIDEO	VIDEO

CHANNEL IDNETIFICATION

		ANSI	AT&T	CCITT
STANDARD	CCITT	ALL BUT H10	128,384,1536	NOT
	NATIONAL	H10	NONE	DEFINED
	NETWORK	NONE	ALL EXCEPT ABOVE	
CHANNEL TYPE/MAP		B,H0,H10,H11	B,H0,H11	B,H0,H11,H12
CHANNEL NO		SUPPORT	NOT SUPPORTED	SUPPORT
SLOT MAP		SUPPORT	SUPPORT	SUPPORT