

# Cisco IOS Voice Gateway – PBX Interoperability: Ericsson MD110 Release BC12 SP5 to E1 QSIG with H.323

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## Introduction

Although specific gateway router models were used to validate its content, this application note also applies to all Cisco 1700/2600/3600/3700/2800/3800 series Cisco IOS voice gateways.

This application note provides configuration guidelines for a toll-bypass network using Cisco IOS voice gateways to connect Ericsson MD110 Release BC12 SP5 PBXs. The PBXs are connected to the Cisco IOS voice gateways by E1 QSIG trunk circuits. The Cisco IOS voice gateways “extend” the E1 QSIG trunk circuits with VoIP, using the H.323 protocol.

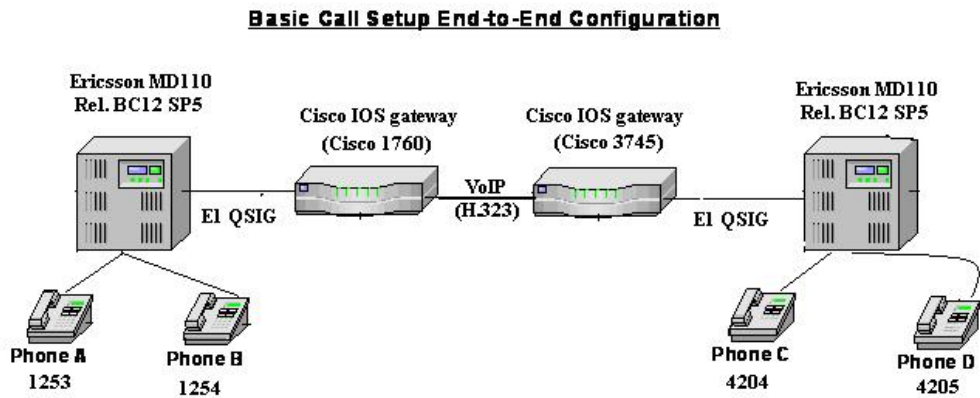
Each Ericsson MD110 BC12 SP5 PBX was connected via E1 QSIG trunk circuits a Cisco IOS voice gateway. The two voice gateways were connected via IP over Ethernet, and configured for VoIP using H.323. End-to-end calls were placed between the PBXs to exercise and test basic calls as well as QSIG supplementary services such as call transfer, call conference, and call forward.

Using the Ericsson PBX configurations and Cisco IOS voice gateway configurations in this application note, successful toll bypass integration was achieved. This includes basic call, call transfer, call conference, call forward, and call hold, with some limitations on Caller ID features during these scenarios.



## Network Topology

Figure 1. Network Topology



## System Components

### Hardware Requirements

- (2) Cisco IOS voice gateways with E1 VWICs (voice/WAN interface cards)
- (2) Ericsson MD110 PBXs
- (4) Ericsson PBX digital station telephones

### Software Requirements

Ericsson MD110: Release BC12 SP5

Cisco IOS voice gateways: Cisco IOS Release Version 12.4(2.10) or later.



## Features Supported

- Basic Call (ENBLOC and Overlap)
- Call Transfer: Supervised Local Transfer
- Call Transfer: Supervised Network/External Transfer
- Call Conference: Local
- Call Conference: Network/External
- Call Forward: Local
- Call Forward: Network/External
- Call Hold

## Limitations

On basic calls, Connected Number was supported in lieu of Called (Alerting) Number. Before the destination connected, dialed number was displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 QSIG trunk.

On Supervised Transfers, the original Calling Name and Number were displayed on the final destination phone only after the destination answered and the transfer was completed. (However, blind transfers also work properly, and the Calling Name/Number information is displayed before the final destination connects.) This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 QSIG trunk.

On conference calls accomplished by a local conference after a network/external call where the conferencing phone was the destination on the original call (e.g., phone C calls phone A, and phone A conferences in phone B), the Connected Name and Number were not updated on the originating phone (C) display when the conferencing phone (A) dropped out. Rather, the conferencing phone name and number were still displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 QSIG trunk.

On conference calls accomplished by a network/external conference after a local call where the conferencing phone was the destination on the original call (e.g., phone A calls phone B, and phone B conferences in phone C), the originating (A) Calling Name and Number were not passed to the remaining conferee (C) when the conferencing phone (B) dropped out. Rather, the conferencing phone name and number were still displayed. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 QSIG trunk.

On all forwarded calls, the forwarding called number was displayed only after the final destination connected, and the forwarding called name was displayed only before the final destination connected. This is inherent to the PBXs and also occurs with the PBXs connected directly via an E1 QSIG trunk.

MWI was not tested, as a local voice mail system was not available on the PBXs at the time of testing.



## Configuration

### Ericsson MD110 BC12 SP5 Global Configuration (both PBXs)

For overlap sending,  
Do NADAP; To show numbering scheme

Remove the external number code for the route you want overlap sending for (e.g. If you want ext 40xx to be sent via overlap sending delete 40):

```
NANLR:EXL=40;
```

Change the ADC parameter under RODDI command so the first position of ADC equals 0 (immediate seizure) e.g. ADC=0707000000000000107001100.

```
RODDE:dest=40; Removes the route destination data if not already set for ovrlp sending
```

```
RODDI:dest=40,rou=101,adc=0707000000000000107001100; Inserts route destination for ovrlp sending
```

- To do ENBLOC Sending

NADAP; To show numbering scheme

Add the external route access code for the extensions you would like to reach across the QSIG/PRI link with enbloc sending. (e.g. If the extension numbers on the other PBX are 4001 – 4099, you would build an access code for external route with number 40)

```
NANLS:EXL=40,min=4,max=4;
```

Change the ADC parameter under RODDI command so the first position of ADC equals 1 (seizure when minimum number length is attained) e.g. ADC=1707100000000000107001101.

```
RODDE:dest=40; Removes the route destination data if not already set for enbloc sending
```

```
RODDI:dest=40,rou=101,adc=1707100000000000107001101; Inserts route destination for enbloc sending.
```

Note: 40 is used only as an example. use the first two digits of your external route (e.g. If the extensions on the far-end PBX are 1200 - 1299, use 12)

### Path Replacement (Route Optimization)

To enable/disable Path Replacement, use the following command:

```
<ASPAC:PARNUM=66,PARVAL=1; //Route optimization allowed. --- FORWARD
```

```
<ASPAC:PARNUM=66,PARVAL=0; //Route optimization NOT allowed.
```

### Call Diversion on Busy/No Reply



To enable/disable Diversion on Busy/No Reply, use the following command:

```
<CDINI:DIR=1154,DIV=4200; // CALL DIVERSION INDIVIDUAL NUMBER INITIATE
```

```
<CDINE:DIR=1154; // CALL DIVERSION INDIVIDUAL NUMBER END
```

Diversion Counter

```
<ASUVP:PARNUM=121; // check current setting for maximum number of hop diversions
```

```
<ASPAC:PARNUM=121,PARVAL= VALUE; // To set maximum number of hop diversions where VALUE range is 0-255
```

```
<ASUVP:PARNUM=121;
```

```
APPLICATION SYSTEM PARAMETER VALUES FOR UNIT
```

```
PARNUM CHA PARVAL MINVAL MAXVAL UNIT REMARK
```

```
121 YES 12 0 255 RMP
```

```
END
```

```
// Type of network services
```

```
ASPAP:PARNUM=223; // check current setting for type of Network Services
```

```
ASPAC:PARNUM=223,PARVAL=7;//Network features Standard SS-Call forwarding, SS-Call Transfer, SS-Path replacement for route optimization
```



**Ericsson MD110 BC12 SP5 PBX#1 Configuration**

<ROCAP:rou=2;  
ROUTE CATEGORY DATA

| ROU SEL | TRM SERV         | NODG | DIST       | DISL | TRAF | SIG | BCAP                         |
|---------|------------------|------|------------|------|------|-----|------------------------------|
| 2       | 7110000000000010 | 5    | 2110030000 | 0    | 30   | 128 | 03151515 111110000031 001100 |

<rodap:rou=2;  
ROUTE DATA

| ROU | TYPE | VARC       | VARI       | VARO       | FILTER |
|-----|------|------------|------------|------------|--------|
| 2   | SL60 | H'00000310 | H'55440000 | H'06300000 | NO     |

<roddp:dest=42;  
EXTERNAL DESTINATION ROUTE DATA

| DEST | DRN | ROU              | CHO       | CUST | ADC | TRC | SRT | NUMACK | PRE |
|------|-----|------------------|-----------|------|-----|-----|-----|--------|-----|
| 42   | 2   | 1707000000000250 | 107001100 | 0    | 1   | 0   |     |        |     |

<ROEDP:rou=2,tru=all;  
ROUTE EQUIPMENT DATA

| ROU | TRU    | EQU         | IP ADDRESS | SQU            | INDDAT | CNTRL |
|-----|--------|-------------|------------|----------------|--------|-------|
| 2   | 001-1  | 001-0-40-01 |            | H'000000000000 |        |       |
| 2   | 001-2  | 001-0-40-02 |            | H'000000000000 |        |       |
| 2   | 001-3  | 001-0-40-03 |            | H'000000000000 |        |       |
| 2   | 001-4  | 001-0-40-04 |            | H'000000000000 |        |       |
| 2   | 001-5  | 001-0-40-05 |            | H'000000000000 |        |       |
| 2   | 001-6  | 001-0-40-06 |            | H'000000000000 |        |       |
| 2   | 001-7  | 001-0-40-07 |            | H'000000000000 |        |       |
| 2   | 001-8  | 001-0-40-08 |            | H'000000000000 |        |       |
| 2   | 001-9  | 001-0-40-09 |            | H'000000000000 |        |       |
| 2   | 001-10 | 001-0-40-10 |            | H'000000000000 |        |       |
| 2   | 001-11 | 001-0-40-11 |            | H'000000000000 |        |       |
| 2   | 001-12 | 001-0-40-12 |            | H'000000000000 |        |       |
| 2   | 001-13 | 001-0-40-13 |            | H'000000000000 |        |       |
| 2   | 001-14 | 001-0-40-14 |            | H'000000000000 |        |       |
| 2   | 001-15 | 001-0-40-15 |            | H'000000000000 |        |       |
| 2   | 001-16 | 001-0-40-17 |            | H'000000000000 |        |       |
| 2   | 001-17 | 001-0-40-18 |            | H'000000000000 |        |       |



```
2 001-18 001-0-40-19 H'000000000000
2 001-19 001-0-40-20 H'000000000000
2 001-20 001-0-40-21 H'000000000000
2 001-21 001-0-40-22 H'000000000000
2 001-22 001-0-40-23 H'000000000000
2 001-23 001-0-40-24 H'000000000000
2 001-24 001-0-40-25 H'000000000000
2 001-25 001-0-40-26 H'000000000000
2 001-26 001-0-40-27 H'000000000000
2 001-27 001-0-40-28 H'000000000000
2 001-28 001-0-40-29 H'000000000000
2 001-29 001-0-40-30 H'000000000000
2 001-30 001-0-40-31 H'000000000000
```

```
<KSCAP:dir=1253;
KEY SYSTEM CATEGORY PRINT
```

```
DIR TRAF SERV CDIV ROC ITYPE TRM ADC LANG
BSEC
1253 00151515 0202720500 011151111 000001 19 0 00100013010000 0
0
```

```
<KSCAP:dir=1254;
KEY SYSTEM CATEGORY PRINT
```

```
DIR TRAF SERV CDIV ROC ITYPE TRM ADC LANG
BSEC
1254 00151515 0202720500 011151111 000001 19 0 00100013010000 0
0
```

END

```
<NIINP:dir=all;
EXTENSION NAMES
```

```
DIR NAME1 NAME2 PRES INFO
1253 BC12-1 ACM-2 10
1254 BC12-2 ACM-2 10
```



Ericsson MD-110 Software Version

```
< CADAP;  
CALENDAR DATA  
IDENTITY=ACM-1  
VERSION=CXP1010101/2/BC12SP5/R2A  
11:19:20  
MON 13 DEC 2004  
END
```





**Ericsson MD110 BC12 SP5 PBX#2 Configuration**

Eircsson MD110 (Unit 3)

<rocap:rou=1;  
ROUTE CATEGORY DATA

| ROU SEL | TRM SERV          | NODG | DIST       | DISL | TRAF | SIG | BCAP                         |
|---------|-------------------|------|------------|------|------|-----|------------------------------|
| 1       | 71100000000000010 | 5    | 2110030000 | 0    | 30   | 128 | 03151515 111110000031 001100 |

END

<rodap:rou=1;  
ROUTE DATA

| ROU | TYPE | VARC       | VARI       | VARO       | FILTER |
|-----|------|------------|------------|------------|--------|
| 1   | SL60 | H'00000310 | H'55440000 | H'06400000 | NO     |

<roddp:dest=12;  
EXTERNAL DESTINATION ROUTE DATA

| DEST | DRN | ROU               | CHO       | CUST | ADC | TRC | SRT | NUMACK | PRE |
|------|-----|-------------------|-----------|------|-----|-----|-----|--------|-----|
| 12   | 1   | 17070000000000250 | 107001100 | 0    | 1   | 0   |     |        |     |

<roedp:rou=1,tru=all;  
ROUTE EQUIPMENT DATA

| ROU | TRU    | EQU         | IP ADDRESS | SQU | INDDAT | CNTRL          |
|-----|--------|-------------|------------|-----|--------|----------------|
| 1   | 001-1  | 001-1-40-01 |            |     |        | H'000000000000 |
| 1   | 001-2  | 001-1-40-02 |            |     |        | H'000000000000 |
| 1   | 001-3  | 001-1-40-03 |            |     |        | H'000000000000 |
| 1   | 001-4  | 001-1-40-04 |            |     |        | H'000000000000 |
| 1   | 001-5  | 001-1-40-05 |            |     |        | H'000000000000 |
| 1   | 001-6  | 001-1-40-06 |            |     |        | H'000000000000 |
| 1   | 001-7  | 001-1-40-07 |            |     |        | H'000000000000 |
| 1   | 001-8  | 001-1-40-08 |            |     |        | H'000000000000 |
| 1   | 001-9  | 001-1-40-09 |            |     |        | H'000000000000 |
| 1   | 001-10 | 001-1-40-10 |            |     |        | H'000000000000 |
| 1   | 001-11 | 001-1-40-11 |            |     |        | H'000000000000 |
| 1   | 001-12 | 001-1-40-12 |            |     |        | H'000000000000 |
| 1   | 001-13 | 001-1-40-13 |            |     |        | H'000000000000 |
| 1   | 001-14 | 001-1-40-14 |            |     |        | H'000000000000 |
| 1   | 001-15 | 001-1-40-15 |            |     |        | H'000000000000 |



```
1 001-16 001-1-40-17      H'000000000000
1 001-17 001-1-40-18      H'000000000000
1 001-18 001-1-40-19      H'000000000000
1 001-19 001-1-40-20      H'000000000000
1 001-20 001-1-40-21      H'000000000000
1 001-21 001-1-40-22      H'000000000000
1 001-22 001-1-40-23      H'000000000000
1 001-23 001-1-40-24      H'000000000000
1 001-24 001-1-40-25      H'000000000000
1 001-25 001-1-40-26      H'000000000000
1 001-26 001-1-40-27      H'000000000000
1 001-27 001-1-40-28      H'000000000000
1 001-28 001-1-40-29      H'000000000000
1 001-29 001-1-40-30      H'000000000000
1 001-30 001-1-40-31      H'000000000000
```

END

<KSCAP:dir=4204&4205;  
KEY SYSTEM CATEGORY PRINT

| DIR  | TRAF     | SERV       | CDIV      | ROC    | ITYPE | TRM | ADC            | LANG |
|------|----------|------------|-----------|--------|-------|-----|----------------|------|
| 4204 | 03151515 | 0211120700 | 011151111 | 720004 | 20    | 0   | 00100013011000 | F    |
|      | 0        |            |           |        |       |     |                |      |
| 4205 | 03151515 | 0211120700 | 011151111 | 720004 | 20    | 0   | 00100013011000 | F    |
|      | 0        |            |           |        |       |     |                |      |

<NIINP:dir=4204&4205;  
EXTENSION NAMES

| DIR  | NAME1  | NAME2 | PRES | INFO |
|------|--------|-------|------|------|
| 4204 | BC12-3 | FOUR  |      | 20   |
| 4205 | BC12-3 | FIVE: |      | 20   |

Ericsson MD-110 Software Version

<CADAP;  
CALENDAR DATA

IDENTITY=DANDS-EURO  
VERSION=CXP1010001/5/BC12SP5/R3A

CALENDAR TIME NOT VALID  
17:23:44  
MON 13 DEC 2004  
END



## Cisco IOS gateway 'A' (2651XM) Configuration

2651XM\_West# **show version**

Cisco IOS Software, C2600 Software (C2600-IPVOICE-M), Version 12.4(2.10), INTERI  
M SOFTWARE

Technical Support: <http://www.cisco.com/techsupport>

Copyright (c) 1986-2005 by Cisco Systems, Inc.

Compiled Mon 13-Jun-05 02:01 by hqluong

ROM: System Bootstrap, Version 12.2(8r) [cmong 8r], RELEASE SOFTWARE (fc1)

2651XM\_West uptime is 2 weeks, 5 days, 28 minutes

System returned to ROM by reload

System image file is "flash:c2600-ipvoice-mz.124-2.10"

Cisco 2651XM (MPC860P) processor (revision 0x300) with 125770K/5302K bytes of me  
mory.

Processor board ID JAE0817EK5Z (1672255744)

M860 processor: part number 5, mask 2

2 FastEthernet interfaces

31 Serial interfaces

2 Channelized E1/PRI ports

32K bytes of NVRAM.

49152K bytes of processor board System flash (Read/Write)

Configuration register is 0x2102

2651XM\_West#

2651XM\_West# **show running-config**

Building configuration...

Current configuration : 1705 bytes

!

version 12.4

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname 2651XM\_West

!

boot-start-marker

boot system flash

boot-end-marker

!

!

no aaa new-model

!

resource policy

!

no network-clock-participate slot 1

no network-clock-participate wic 0

voice-card 1

!

ip subnet-zero

ip cef

!

!



```
!  
!  
no ip domain lookup  
isdn switch-type primary-qsig  
!  
!  
!  
voice service voip  
h323  
!  
!  
voice class codec 1  
codec preference 1 g729r8  
codec preference 2 g711ulaw  
codec preference 3 g711alaw  
!  
!  
!  
!  
controller E1 1/0  
pri-group timeslots 1-31  
description ECN-4  
!  
controller E1 1/1  
!  
!  
!  
interface FastEthernet0/0  
ip address 172.20.4.7 255.255.255.0  
duplex auto  
speed auto  
!  
interface FastEthernet0/1  
no ip address  
shutdown  
duplex auto  
speed auto  
!  
interface Serial1/0:15  
description D-channel for ECN-4  
no ip address  
no logging event link-status  
isdn switch-type primary-qsig  
isdn overlap-receiving  
isdn incoming-voice voice  
isdn contiguous-bchan  
isdn bchan-number-order ascending  
no cdp enable  
!  
ip classless  
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0  
!  
ip http server  
!  
!  
!  
control-plane  
!
```



```
!  
!  
voice-port 1/0:15  
description voice port for ECN-4  
!  
!  
!  
dial-peer voice 323 voip  
destination-pattern 4...  
session target ipv4:172.20.4.9  
!  
dial-peer voice 1015 pots  
destination-pattern 1...  
direct-inward-dial  
port 1/0:15  
forward-digits all  
!  
dial-peer voice 519 voip  
shutdown  
destination-pattern 6...  
session protocol sipv2  
session target ipv4:172.20.4.9  
supplementary-service pass-through  
!  
!  
line con 0  
line aux 0  
line vty 0 4  
exec-timeout 0 0  
password cisco  
login  
transport input telnet  
!  
!  
end
```

```
2651XM_West#  
2651XM_West# show isdn stat  
Global ISDN Switchtype = primary-qsig  
ISDN Serial1/0:15 interface  
    dsl 0, interface ISDN Switchtype = primary-qsig  
    **** Slave side configuration ****  
Layer 1 Status:  
    ACTIVE  
Layer 2 Status:  
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED  
Layer 3 Status:  
    0 Active Layer 3 Call(s)  
Active dsl 0 CCBs = 0  
The Free Channel Mask: 0xFFFF7FFF  
Number of L2 Discards = 0, L2 Session ID = 156  
Total Allocated ISDN CCBs = 0  
2651XM_West#
```



## Cisco IOS gateway 'B' (3745) Configuration

3745\_West# **show version**

Cisco IOS Software, 3700 Software (C3745-IPVOICE-M), Version 12.4(2.10), INTERIM SOFTWARE

Technical Support: <http://www.cisco.com/techsupport>

Copyright (c) 1986-2005 by Cisco Systems, Inc.

Compiled Mon 13-Jun-05 00:06 by hqluong

ROM: System Bootstrap, Version 12.2(8r)T2, RELEASE SOFTWARE (fc1)

3745\_West uptime is 2 weeks, 4 days, 23 hours, 6 minutes

System returned to ROM by reload

System image file is "flash:c3745-ipvoice-mz.124-2.10"

Cisco 3745 (R7000) processor (revision 2.0) with 110592K/20480K bytes of memory.

Processor board ID JMX0813L0Z3

R7000 CPU at 350MHz, Implementation 39, Rev 3.3, 256KB L2, 2048KB L3 Cache

2 FastEthernet interfaces

31 Serial interfaces

4 Channelized E1/PRI ports

2 Voice FXS interfaces

DRAM configuration is 64 bits wide with parity disabled.

151K bytes of NVRAM.

31168K bytes of ATA System CompactFlash (Read/Write)

Configuration register is 0x2102

3745\_West#

3745\_West#

3745\_West# **show running-config**

Building configuration...

Current configuration : 1934 bytes

!

version 12.4

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname 3745\_West

!

boot-start-marker

boot system flash:c3745-ipvoice-mz.124-2.10

boot-end-marker

!

card type e1 1 1

logging buffered 5000000 debugging

!

no aaa new-model

!

resource policy

!

no network-clock-participate slot 1



```
ip subnet-zero
ip cef
!
!
!
no ip domain lookup
isdn switch-type primary-qsig
voice-card 1
dspfarm
!
!
!
voice call carrier capacity active
!
voice service voip
h323
!
!
voice class codec 1
codec preference 2 g711ulaw
codec preference 3 g711alaw
!
!
!
controller E1 1/0
pri-group timeslots 1-31
description ECN10
!
controller E1 1/1
!
controller E1 1/2
!
controller E1 1/3
!
!
!
interface FastEthernet0/0
ip address 172.20.4.9 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/1
no ip address
shutdown
duplex auto
speed auto
!
interface Serial1/0:15
description D-channel for ECN10
no ip address
no logging event link-status
isdn switch-type primary-qsig
isdn overlap-receiving
isdn protocol-emulate network
isdn incoming-voice voice
isdn T310 120000
isdn contiguous-bchan
```



```
no cdp enable
!
router eigrp 10
network 172.20.0.0
no auto-summary
!
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
!
ip http server
!
!
control-plane
!
!
!
voice-port 1/0:15
description voice port for ECN10
!
voice-port 3/0/0
!
voice-port 3/0/1
!
!
dial-peer cor custom
!
!
!
dial-peer voice 323 voip
destination-pattern 1...
session target ipv4:172.20.4.7
!
dial-peer voice 1015 pots
destination-pattern 4...
direct-inward-dial
port 1/0:15
forward-digits all
!
dial-peer voice 519 voip
shutdown
destination-pattern 3...
session protocol sipv2
session target ipv4:172.20.4.7
supplementary-service pass-through
!
!
line con 0
line aux 0
line vty 0 4
exec-timeout 0 0
password cisco
login
transport input telnet
!
!
end

3745_West#
3745_West#
```





```
3745_West# show isdn stat
Global ISDN Switchtype = primary-qsig
ISDN Serial1/0:15 interface
***** Network side configuration *****
dsl 0, interface ISDN Switchtype = primary-qsig
**** Master side configuration ****
Layer 1 Status:
ACTIVE
Layer 2 Status:
TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
Layer 3 Status:
0 Active Layer 3 Call(s)
Active dsl 0 CCBs = 0
The Free Channel Mask: 0xFFFF7FFF
Number of L2 Discards = 0, L2 Session ID = 243
Total Allocated ISDN CCBs = 0
3745_West#
```



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