

Cisco PGW 2200 SS7 Continuity Testing

Document ID: 48300

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Introduction

This document explains how Continuity Testing (COT) works for the Cisco PGW 2200 in configured signaling mode. COT is an automated diagnostic procedure performed in the Signaling System 7 (SS7) Public Switched Telephone Network (PSTN) between switches to ensure that circuits are in service and not experiencing excessive signal loss. This validation is performed by sending tones across the bearer channel. It is performed on a sampling basis. For instance, on 10 percent of the calls (in the Cisco PGW 2200, the sampling rate is defined by CotPercentage).

Prerequisites

Requirements

Readers of this document should have knowledge of these topics:

- Cisco Media Gateway Controller Release 7
- Cisco Media Gateway Controller Release 9
- Continuity Testing
- COT SS7 – ISUP timers (refer to ITU Q.704 – Section 16.8 for further explanation).
- COT testing – See ITU Q.784 – Section 1.4.x Continuity check test call and Section 6.1.x Continuity check call.
- COT SS7 – Application of the ISDN user part of CCITT Signalling System No. 7 for international ISDN interconnections (see Q.767).
- GR-246-CORE Annex B – Explains Tone Generation Accuracy, COT detection, Tone interruptions, Tone end recognition time, and Tone recognition time

Components Used

The information in this document is based on the Cisco PGW 2200 Softswitch.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

Background Information

Since the bearer path is distinct from the signaling path, SS7 requires specific means to validate the bearer channel before the call is established.

COT is requested by the Cisco PGW 2200 originating as an IAM request or as a separate SS7 ISUP message using the Continuity Check Request (CCR) or Circuit Reservation Message (CRM). Two types of COT are Loopback and Transponder (Tone check) methods (see the table). The destination Cisco PGW 2200 places the related circuit in either Loopback mode 2010 Hz or in Transponder mode 1780 Hz (see the table). The Loopback form of COT is used on 4-wire trunks. In the 2-wire case, when the originating switch sends a tone, the receiving switch sends a different frequency tone in response. This is the Transponder mode of COT. If the circuit testing fails during COT, alarm information is generated allowing diagnostic software to busy out the trunk, which can be checked with the man-machine language (MML) command **rtrv-alm**s. Calls are prevented from being routed to the circuit and are COT failed.

COT Type (Loop and/or Tone) NI2+	Tones Rx	Tones Tx
Loop	2010	2010
Tone	1780	2010

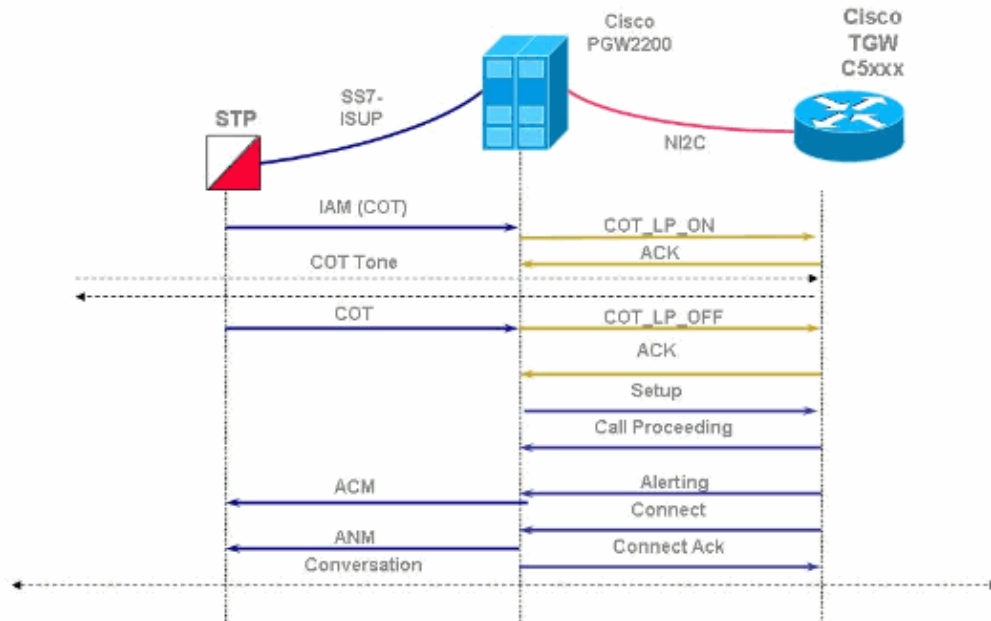
Cisco PGW 2200 – SS7 COT Configuration and Troubleshooting in Signaling Mode

The Cisco PGW2200 software application performs the signaling and/or call control tasks. This section will talk about the signaling mode. The Cisco PGW 2200 sends NI2+ commands to NAS to transmit and detect tones or loopback circuit.

- Termination – The Cisco PGW 2200 receives an IAM, CCR or CRM indicating that COT is required.

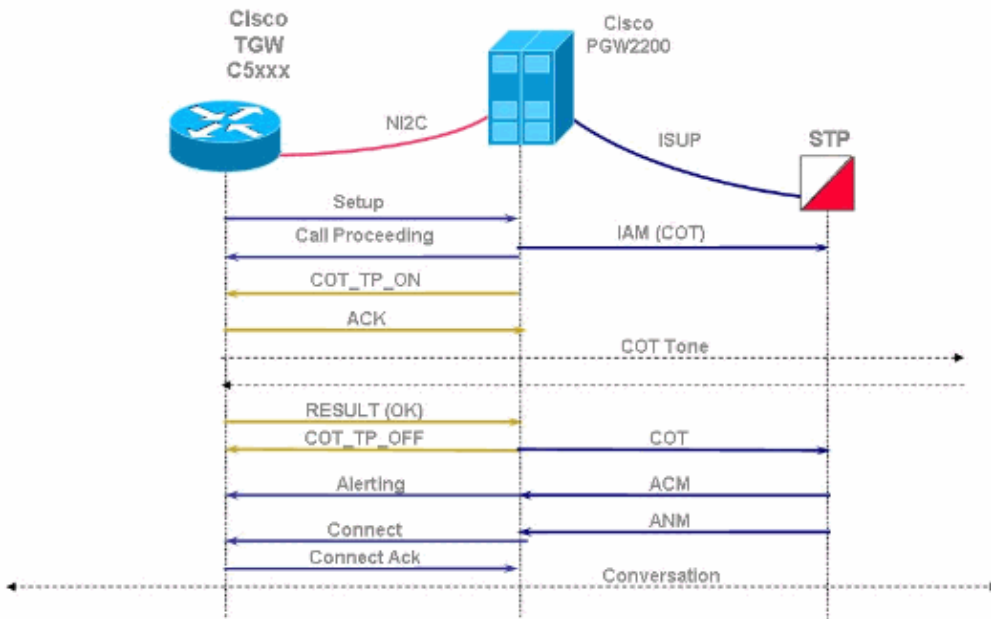
Single Tone (Loop)

Cisco PGW2200 Termination COT

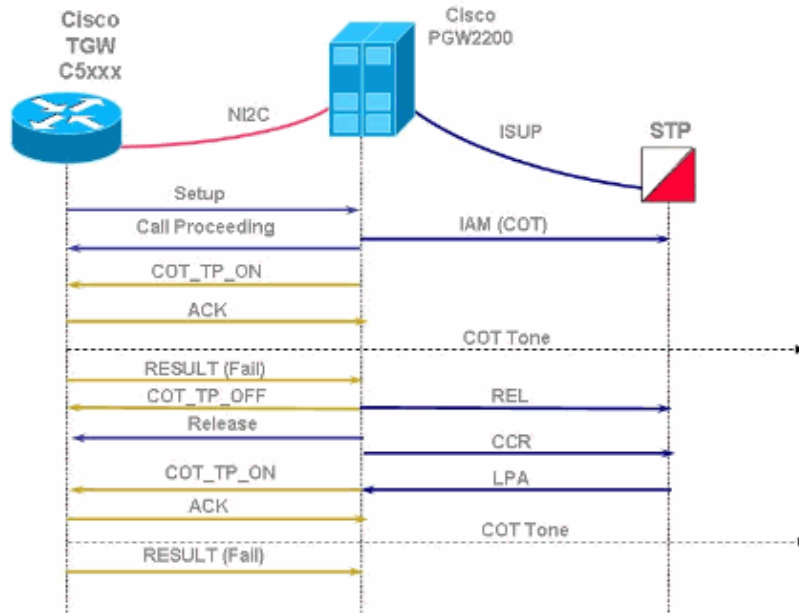


- Origination – The Cisco PGW 2200 sends an IAM, CCR, or CRM indicating that COT is required.
 - ◆ Single Tone (Loop)
 - ◆ Percentage Based (0 – 100%)

Cisco PGW2200 Origination COT



Cisco PGW2200 Origination COT - Failure



- The Cisco PGW 2200 MML `tst-cot` command.

SS7 COT Working

Look at an SS7 sniffer trace (Cisco Snooper PT-MTC) for an SS7 IAM message. This is used to check the message into the IAM on CONTINUITY CHECK IND which has a value equal to 1. This indicates that you need to do a CCR required on this circuit.

Note: No test is performed in case the value equals 0 (0 Continuity_check_not_required).

```

ISUP. -> IAM (01) CIC=0001
*****
*****  DETAIL  *****
CIC                                1
MESSAGE TYPE                       0x01 IAM - Initial_Address_Msg
NATURE_OF_CONNECTION               0x06
  LENGTH:                           0x01 FIXED DATA 0x08
  SATELLITE IND                      0 no_satellite_circuit_in_connection
  CONTINUITY CHECK IND               1 Continuity_check_required_on_this_circuit

<snip>

*****                                END_OF_MSG                                *****

14:37:21.854899  10.15.13.6:3001  10.15.13.132:3001
                    NMM..... -> NSCMD_REQ (03) PROT:43
                    OPER: COT_TP_IN (04)
                    IN_TONE: 218      OUT_TONE: 218
14:37:21.865164  10.15.13.132:3001  10.15.13.6:3001
                    NMM..... -> NSCMD_RES (02) PROT:43
                    OPER: COT_TP_IN (04) RESULT: SUCCESSFUL (02)
14:37:23.796451  214-110-005  214-110-035  ITU ISUP. -> COT (05) CIC=0001
                    SLS=123 Pr:2 Ni:NTL

*****
*****  DETAIL  *****
    
```

You can check the status on the network access server (NAS) ISDN interface channel using the command **show isdn service**. You can also check the status of the B-channel which is currently sending the COT testing into state 5 [Maintenance Pending].

```
nas#show isdn service 2
PRI Channel Statistics:
ISDN Se2:23 SC, Channel [1-24]
Configured Isdn Interface (dsl) 2
Channel State (0=Idle 1=Proposed 2=Busy 3=Reserved 4=Restart 5=Maint_Pend)
Channel : 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
State : 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Service State (0=Inservice 1=Maint 2=Outofservice)
Channel : 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
State : 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Channel blocked? (0=No 1=Yes)
Channel : 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

SS7 COT Configuration on the Cisco PGW 2200

If you want to check the configuration using MML, run the command **prov-rtrv:sigsvccprop** to find out the COT settings. You need to edit the properties.dat using MML commands to set-up the method (Loop or Tone) and tones (2010 and 1780) correctly.

```
PGW2200a mml>prov-rtrv:sigsvccprop:name="ss7path"
MGC-01 - Media Gateway Controller 2004-01-28 18:07:36.727 MET
M RTRV
"session=cot11:sigsvccprop"
/*
ACCRspCatName = default
ACCRspCntlInhibit = 0
ACLDur = 5
ADigitCCPrefix = 0
AInternationalPrefix = NULL
ANationalPrefix = NULL
<snip>

COLDefaultAllowed = 0
CotInTone = 2010
CotOutTone = 2010
CotPercentage = 0
EchoCanRequired = 0
ExtCOT = Loop

<snip>
Info: Percentage (0-100) is the percentage of the trunk group COT has passed
```

Note: In general, MML commands are not case sensitive (**ExtCOT** is an example of a case-sensitive command). However, property values are case sensitive.

To change the value:

```
PGW2200a mml>prov-sta::srcver="active",dstver="cot11"
MGC-01 - Media Gateway Controller 2004-01-28 18:05:49.681 MET
M COMPLD
"PROV-STA"
;
PGW2200a mml>prov-ed:sigsvccprop:name="ss7path",ExtCOT="Loop"
MGC-01 - Media Gateway Controller 2004-01-28 18:11:34.972 MET
M COMPLD
"sigsvccprop:
WARNING: Restart may be needed based on the property(s) added/modified.
```

```

    Refer to MGC Provisioning Guide."
;
PGW2200a mml>prov-ed:sigsvccprop:name="ss7path",CotInTone="2010"
MGC-01 - Media Gateway Controller 2004-02-03 16:51:50.233 MET
M COMPLD
"sigsvccprop:
WARNING: Restart may be needed based on the property(s) added/modified.
Refer to MGC Provisioning Guide."
;
PGW2200a mml>prov-cpy or prov-dply

```

Note: The two values that are provisionable are 1780 and 2010 for the COT tones. Table 4–4: Provisionable Properties lists the properties that can be provisioned and indicates if the modified property value takes effect without stopping and restarting the Media Gateway Controller software.

On the NAS, no COT configuration task is requested. Please be aware that for Nailed solution you are using ISDN switch-type **isdn switch-type primary-ni2c** between the PGW 2200 and NAS.

SS7 COT Troubleshooting on the Cisco PGW 2200 in Signaling Mode

If you run into a COT test failure, this can be viewed on the Cisco PGW 2200 in a variety of ways. The simplest is to use the MML utility and the MML command **rtrv-alm:cont** to receive continuous alarm updates.

```

PGW2200a mml>rtrv-alm:cont
Virtual Switch Controller 2003-12-20 091938
M RTRV
;
Virtual Switch Controller 2003-12-20 092041.308
A "dpc-ss7ALM=\ISUP COT FAILURE
;
Virtual Switch Controller 2003-12-20 092043.488
A "dpc-ss7ALM=\ISUP COT FAILURE
;

```

1. Clear alarms using the MML command **clr-alm:<comp>:"<alm cat>"**.

Note: From Cisco PGW 2200 release 9.4(1) **clr-alm** is removed from the MML command (refer to Cisco bug ID CSCdy63984 (registered customers only) for further information). You can first retrieve the current alarm status using **rtrv-alm**. Entering **help** at the mml> prompt provides you with a listing of all MML commands.

2. Attempt to put the Circuit Identification Code (CIC) back into service (the remote end may not comply).
 - a. On the Cisco PGW 2200, use the MML command **unblk-cic:<point code>:CIC=<number>**. You can then retrieve the CIC status by using the MML command **rtrv-cic:<point code>:CIC=<number>** or use the **rtrv-tc:all** command.
 - b. On the NAS, use the configuration command **isdn service dsl <dsl #> b_channel <channel #> state <0 = In service>** available under the **interface Serial0:15** interface command. You can then retrieve the B-channel status using the **show isdn service** command at the console log.

For example:

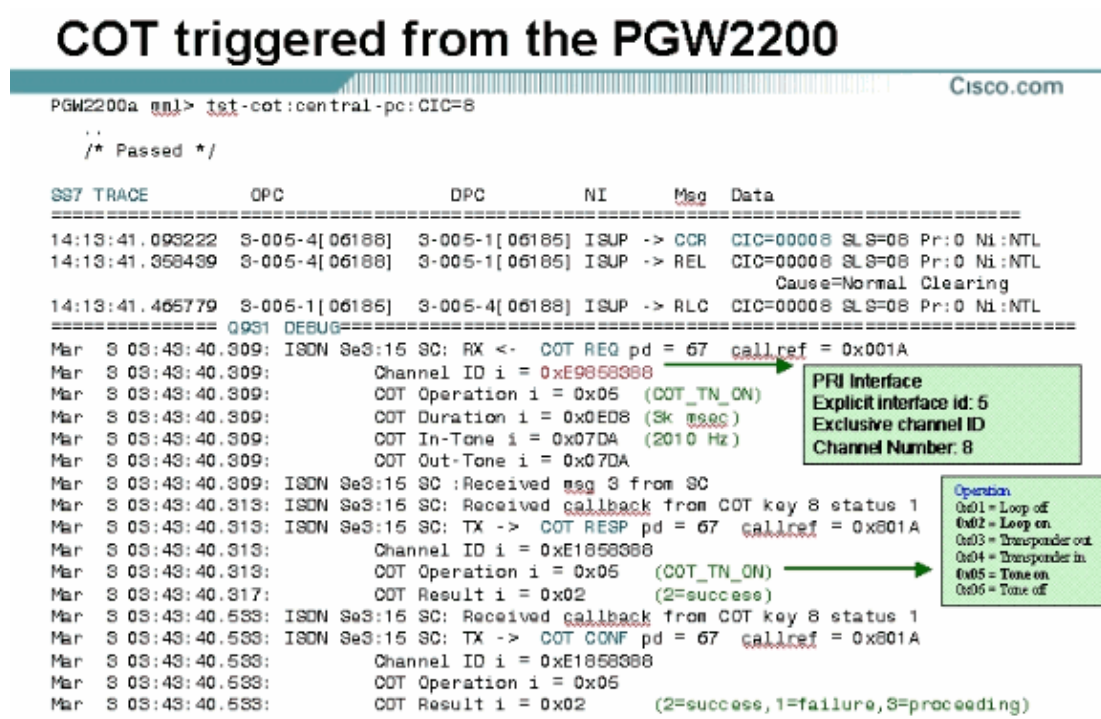
```
AS5300(config-if)#isdn service dsl 0 b_channel 1 state 0
```

3. Next, you can also run a manual COT testing again. Manual COT tests can be initiated on the Cisco PGW 2200 without requiring the SS7 network to initiate a COT test.

For example, on PGW2200a:

```
mml> tst-cot:<point code>:CIC=<number>
```

If you run into COT problems, issue the **debug isdn q931** command on the NAS, as shown in this figure.



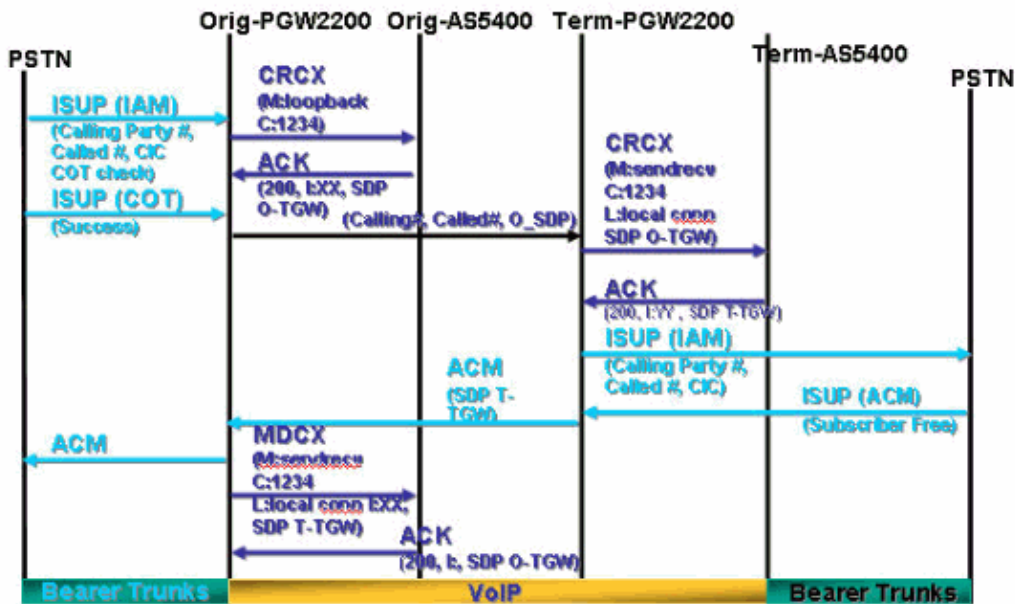
This figure explains the MML **tst-cot** command and the CCR sent out to the SS7, including the **debug isdn q931** command output.

SS7 COT Troubleshooting on the Cisco PGW 2200 in Call Control

This section contains the MGCP COT callflow for the PGW 2200 Call Control situation. The Media Gateway Control Protocol (MGCP) organizes the communication between a Media Gateway controller [Cisco PGW2200] and a Media Gateway [Cisco AS5xxx]. This section shows Cisco snoopers trace detail for a hairpinning call with loopback COT' and a manual MML cot test from the PGW 2200.

In this figure, COT is initiated by the PSTN switch that sends the IAM request. This PSTN switch reports the test result using a SS7 COT message if successful or a SS7 Release message if failed. The Cisco PGW 2200 puts the related circuit either in loopback mode or in transponder mode. The Cisco PGW 2200 that receives an IAM requesting COT (or a CCR message) first checks for the ExtCOT parameter in the /opt/CiscoMGC/etc/properties.dat file.

SS7 Continuity PGW2200 Call Flow



Hairpinning Call Example with Loopback COT

Upon receipt of the SS7 IAM message with the CONTINUITY CHECK IND = 1 which means `Continuity_check_required_on_this_circuit`, the PGW 2200 recognizes that a continuity test has been requested. It immediately sends a CRCX CreateConnection message to the Cisco Gateway with a M: loopback to put a loopback on the incoming trunk.

```
16:41:04.349197 1-021-1[02217] 1-003-1[02073] ITU ISUP. -> IAM (01) CIC=0009
SLS=11 Pr:0 Ni:NT
```

```
***** DETAIL *****
CIC 93
MESSAGE TYPE 0x01 IAM - Initial_Address_Msg
NATURE_OF_CONNECTION 0x06
  LENGTH: 0x01 FIXED DATA 0x04
  SATELLITE IND 0 no_satellite_circuit_in_connection
  CONTINUITY CHECK IND 1 Continuity_check_required_on_this_circuit
  ECHO SUPPRESSOR IND 0 outgoing_half_echo_suppressor_not_included
FORWARD CALL IND. 0x07
  LENGTH: 0x02 FIXED DATA 0x28 0x01
  NATL/INTL CALL IND 0 incoming_national_call
  END-TO-END METHOD IND 0 no_end_to_end_method_available
  INTERWORKING IND 1 interworking_encountered
  END-TO-END INFO IND 0 no_end_to_end_information_available
  ISUP IND. 1 ISUP_used_all_the_way
  ISDN PREFERENCE IND 0 isdn_up_pref_all_the_way
  ISDN ACCESS IND. 1 originating_access_ISDN
  SCCP Method 0 no_indication
CALLING PARTYS CATEGORY 0x09
  LENGTH: 0x01 FIXED DATA 0x00
  CALLING PARTYS CATEGORY 0 Partys_Category_unknown_default
TRANSMISSION MEDIUM REQUIRED 0x02
  LENGTH: 0x01 FIXED DATA 0x03
  TRANSMISSION MEDIUM REQUIRED 3 3_1_kHz_audio
INDEX TO CALLED PTY ADDRESS 0x02
INDEX TO OPTIONAL PART 0x08
CALLED PARTY NUMBER PARM 0x04
```

```

LENGTH:                0x06 VAR.  DATA 0x01 0x13 0x25 0x29 0x79 0x82
ODD/EVEN IND           0 even_number_of_digits
NATURE OF ADDRESS IND  0x01 subscriber_number
INTERNAL NETWORK PARM  0 routing to internal network number allowed
NUMBERING PLAN         1 ISDN_Telephony_Numbering_Plan
DIGITS:                52929728
OPTIONAL PARAMETERS:
CALLING PARTY ADDRESS  0x0A
LENGTH:                0x04 OPT.  DATA 0x03 0x17 0x63 0x00
ODD/EVEN IND           0 even_number_of_digits
NATURE OF ADDRESS IND  0x03 unique_national_number
NUMBER INCOMPLETE IND. 0 complete
PRESENTATION IND.      1 address_presentation_restricted
SCREENING IND.         3 network_provided
NUMBERING PLAN         1 ISDN_Telephony_Numbering_Plan
DIGITS:                3600
END OF OPTIONAL PARAMETERS 0x00
*****                END_OF_MSG                *****

```

```

16:41:04.380800  10.48.84.25:2427  10.48.84.26:2427  MGCP..... -> CRCX 411 s3/ds1-1
C: 39
L: e:off,fxr/fx:t
M: loopback
R:
S:
X: 19A

```

The Cisco gateway acknowledges [200 OK] the CRCX messages of the connection, and sends back the identification of the newly created connection and the session description used to receive audio data:

```

16:41:04.406307  10.48.84.26:2427  10.48.84.25:2427  MGCP..... -> 200 411 OK
I: 2
v=0
o=- 2 0 IN IP4 10
s=Cisco SDP 0
c=IN IP4 10.48.84
t=0 0
m=audio 17906 RTP
a=rtpmap:99 G.726
a=rtpmap:101 G.72
a=rtpmap:102 G.72
a=rtpmap:103 G.72
a=rtpmap:104 G.72
a=rtpmap:105 G.72
a=rtpmap:106 G.72
a=rtpmap:125 G.nX
a=rtpmap:100 X-NS
a=fmtp:100 200-20
a=X-sqn:0
a=X-cap: 1 audio 1
a=X-cpar: a=rtpmap
a=X-cpar: a=fmtp:
a=X-cap: 2 image 1
16:41:04.430601  10.48.84.25:2427  10.48.84.26:2427  MGCP..... -> CRCX 412 s3/ds1-0
C: 39
L: e:off,fxr/fx:t
M: sendrecv
16:41:04.433474  10.48.84.26:2427  10.48.84.25:2427  MGCP..... -> 200 412 OK
I: 3
v=0
o=- 3 0 LOCAL EPN
s=Cisco SDP 0
c=LOCAL EPN S3/DS
t=0 0

```



```

t=0 0
m=audio 0 LOCAL 0
16:41:05.642898 10.48.84.26:2427 10.48.84.25:2427 MGCP..... -> 200 416 OK
v=0
o=- 3 1 LOCAL EPN
s=Cisco SDP 0
c=LOCAL EPN S3/DS
t=0 0
m=audio 0 LOCAL 0
16:41:05.660510 1-003-1[02073] 1-021-1[02217] ITU ISUP. -> ACM (06) CIC=0009
SLS=11 Pr:0 Ni:NT:

```

***** DETAIL *****

```

CIC 93
MESSAGE TYPE 0x06 ACM - Address_Complete_Msg
BACKWARD CALL IND 0x11
  LENGTH: 0x02 FIXED DATA 0x02 0x14
  CHARGE IND 2 charge
  CALLED PTYS STATUS IND 0 no_indication_default
  CALLED PARTYS CATEGORY 0 no_indication_default
  END-TO-END METHOD IND 0 no_end_to_end_method_available
  INTERWORKING IND 0 no_interworking_encountered
  END-TO-END INFO IND 0 no_end_to_end_information_available
  ISUP IND. 1 ISUP_used_all_the_way
  REVERSE HOLDING IND 0 reverse_holding_not_required
  ISDN ACCESS IND. 1 terminating_access_ISDN
INDEX TO OPTIONAL PART 0x01
OPTIONAL PARAMETERS:
OPTIONAL BACKWARD CALL IND 0x29
  LENGTH: 0x01 OPT. DATA 0x01
  FORWARDING IND 0 no_indication
  INBAND INFO IND 1 inband_information
  SIMPLE SEGMENTATION 0 no additional information will be sent
  NET EXCESSIVE DELAY 0 no_indication
  USER NETWORK INTERACTION 0 no_indication
END OF OPTIONAL PARAMETERS 0x00
***** END_OF_MSG *****

```

```

16:41:15.384246 1-010-1[02129] 1-003-1[02073] ITU ISUP. -> ANM (09) CIC=0004
SLS=08 Pr:0 Ni:NT:

```

***** DETAIL *****

```

CIC 40
MESSAGE TYPE 0x09 ANM - Answer_Msg
INDEX TO OPTIONAL PART 0x01
OPTIONAL PARAMETERS:
BACKWARD CALL IND 0x11
  LENGTH: 0x02 OPT. DATA 0x02 0x04
  CHARGE IND 2 charge
  CALLED PTYS STATUS IND 0 no_indication_default
  CALLED PARTYS CATEGORY 0 no_indication_default
  END-TO-END METHOD IND 0 no_end_to_end_method_available
  INTERWORKING IND 0 no_interworking_encountered
  END-TO-END INFO IND 0 no_end_to_end_information_available
  ISUP IND. 1 ISUP_used_all_the_way
  REVERSE HOLDING IND 0 reverse_holding_not_required
  ISDN ACCESS IND. 0 terminating_access_non_ISDN
ACCESS TRANSPORT 0x03
  LENGTH: 0x04 OPT. DATA 0x1E 0x02 0x81 0x82
END OF OPTIONAL PARAMETERS 0x00
***** END_OF_MSG *****

```

```

16:41:15.492711 1-003-1[02073] 1-021-1[02217] ITU ISUP. -> ANM (09) CIC=0009
SLS=11 Pr:0 Ni:NT:

```

```

***** DETAIL *****
CIC 93
MESSAGE TYPE 0x09 ANM - Answer_Msg
INDEX TO OPTIONAL PART 0x01
OPTIONAL PARAMETERS:
BACKWARD CALL IND 0x11
LENGTH: 0x02 OPT. DATA 0x02 0x04
CHARGE IND 2 charge
CALLED PTYS STATUS IND 0 no_indication_default
CALLED PARTYS CATEGORY 0 no_indication_default
END-TO-END METHOD IND 0 no_end_to_end_method_available
INTERWORKING IND 0 no_interworking_encountered
END-TO-END INFO IND 0 no_end_to_end_information_available
ISUP IND. 1 ISUP_used_all_the_way
REVERSE HOLDING IND 0 reverse_holding_not_required
ISDN ACCESS IND. 0 terminating_access_non_ISDN
ACCESS TRANSPORT 0x03
LENGTH: 0x04 OPT. DATA 0x1E 0x02 0x81 0x82
END OF OPTIONAL PARAMETERS 0x00
***** END_OF_MSG *****

```

You also can run the MML `tst-cot` command to execute a continuity test on a specified remote switch circuit.

- **Format:** `tst-cot:<sig path>:CIC=<number>`
- **Description:**

- ◆ * sig path MML component name of a provisioning component signal path.
- ◆ * CIC=<number> A numeric value which identifies the ISUP circuit identification code number.

For example, this MML command executes a continuity test on `c7srv-bru7` for CIC-2:

```

PGW2200a mml>tst-cot:c7srv-bru7:cic=2
MGC-01 - Media Gateway Controller 2002-09-19 13:26:51.530 WET
M RTRV
SCNF
"c7srv-bru7"
/* Passed */
;
PGW2200a mml>

```

From the MGCP CRCX message, you can see the `co1` of 2010 Hz or [`co2` of 1780 Hz].

```

-----
MESSAGES DISPLAY
-----

```

Time stamp	Orig IP address	Dest IP address	Prot	Msg Data
13:26:48.590752	10.48.84.128:2427	10.48.84.110:2427	MGCP.....	-> CRCX 12587 s6/ds1 C: 1AF L: e:off M: recvonly R: T/co1(N) S: T/co1 X: 312A
13:26:51.050405	10.48.84.128:2427	10.48.84.110:2427	MGCP.....	-> CRCX 12587 s6/ds1 C: 1AF L: e:off M: recvonly

```

R: T/col(N)
S: T/col
X: 312A
13:26:51.096961 10.48.84.110:2427 10.48.84.128:2427 MGCP..... -> 200 12587 OK
I: D
v=0
o=- 13 0 IN IP4 1
s=Cisco SDP 0
c=IN IP4 10.48.84
t=0 0
m=audio 19198 RTP

99

a=rtpmap:101 G726
a=rtpmap:102 G726
a=rtpmap:103 G723
a=rtpmap:104 G723
a=rtpmap:105 G729
a=rtpmap:106 G723
a=rtpmap:107 G723
a=rtpmap:125 GnX6
a=rtpmap:99 teleph
a=fmtp:99 0-15
a=X-sqn:0
a=X-cap: 1 image 1
13:26:51.120463 3-005-2[06186] 3-005-1[06185] ITU ISUP. -> CCR (11) CIC=0000
SLS=02 Pr:0 Ni:NT
13:26:51.517150 10.48.84.110:2427 10.48.84.128:2427 MGCP..... -> NTFY 4 s6/ds1-2/2
X: 312A
O: T/col
13:26:51.531608 3-005-2[06186] 3-005-1[06185] ITU ISUP. -> REL (0c) CIC=0000
SLS=02 Pr:0 Ni:NT
13:26:51.531939 10.48.84.128:2427 10.48.84.110:2427 MGCP..... -> 200 4 OK
C: 1AF
13:26:51.532220 10.48.84.128:2427 10.48.84.110:2427 MGCP..... -> DLCX 12589 s6/ds1
C: 1AF
I: D
R:
S:
X: 312C
13:26:51.577503 10.48.84.110:2427 10.48.84.128:2427 MGCP..... -> 250 12589 OK
P: PS=0, OS=0, PR
13:26:51.652675 3-005-1[06185] 3-005-2[06186] ITU ISUP. -> RLC (10) CIC=0000
SLS=02 Pr:0 Ni:NT

```

Note: Continuity test is not part of the UK ISUP V3 and COT message is not a valid message for this protocol.

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Related Information

- **Tech Notes for the PGW 2200**
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