Teldat

ATM over E1

Teldat-Dm 756-I

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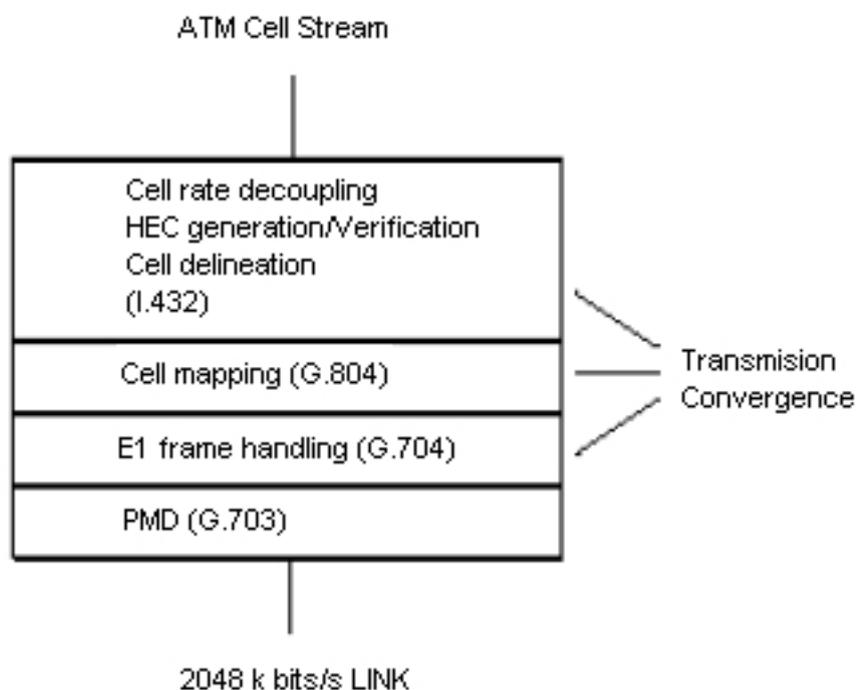
Table of Contents

Chapter 1 ATM over E1

1.1 ATM over E1

This interface permits you to transport ATM over a serial interface (E1/G703) complying with the ATM Forum af-phy-0064.000 (E1 Physical Interface Specification) specifications.

The ITU-T recommendations, which the ATM Forum specifications are based on, can be seen in the following figure:

PMD (G.703):

G.703 is an ITU (formally CCITT) standard which describes a physical layer i.e. the physical and electrical signal characteristics transmitted between both ends of the communication. Two pairs of cables are usually used in the interface: one to transmit data and the other to receive it. These cables are generally either coaxial or twisted pair.

The standard defines three methods to transmit synchronism between the ends:

• **Codirectional**: This is the most common. This delivers the clocks in the same direction as the data. The clock information is recovered from the received data and forwarded with the sent data. As this information is included together with the data signal, additional cables are not required. The device cable is used.
• **Counterdirectional**: The clock information and the data are transmitted in opposite directions. This implies two additional pairs to transmit the clocks independently from the data.
• **Centralized clock**: The clock, both transmission as well as reception at both ends is received from a central clock generator. In the same way as the above case, this implies the use of two additional pairs to transmit the clocks independently from the data.

G.704:

The G.704 defines the structure of the frame used to transmit data. In our case, the frame structure for 2048 Mbps will be used.

The frame comprises of 256 bits (8,000 frames per second). These bits are grouped in 32 time divisions of 8 bits each.

In the first of these (channel 0) a word for frame synchronization is introduced in one out of every two frames, to recover the 8 KHz synchronization at reception. The frame not carrying this information contains signaling and alarm bits.

The rest of the timeslots are used for data transmission although channel 16 is recommended to transmit channel-signaling information (Primary, R2, etc.).

	1 frame = 32 * 8 bits = 256 bits in 125 microsec.								
0	1 ←			timeslots				→	31
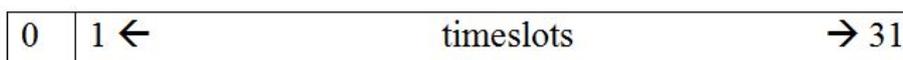
Timeslot 0

	1	2	3	4	5	6	7	8
Even Frames FAS	1	0	0	1	1	0	1	1
Odd Frames NFAS	S_i	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}

FAS	*Frame Alignment Signal*
NFAS	*Not Frame Alignment Signal*
A	*Alarm indication bit (RAI)*
Si	*International Signaling Bit*
SaX	*End-to-end Signaling Bits*

G.704 also defines an optional procedure CRC-4 (Cyclic Redundancy Check) to check the integrity of the data being received. In this case this forms a multiframe over timeslot 0 which consists of 16 frames over those inserted by the CRC complying with the following table.

SubFrame	Frame		1	2	3	4	5	6	7	8
I	0	FAS	C_1	0	0	1	1	0	1	1
	1	NFAS	0	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	2	FAS	C_2	0	0	1	1	0	1	1
	3	NFAS	0	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	4	FAS	C_3	0	0	1	1	0	1	1
	5	NFAS	1	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	6	FAS	C_4	0	0	1	1	0	1	1
	7	NFAS	0	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
II	8	FAS	C_1	0	0	1	1	0	1	1
	9	NFAS	1	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	10	FAS	C_2	0	0	1	1	0	1	1
	11	NFAS	1	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	12	FAS	C_3	0	0	1	1	0	1	1
	13	NFAS	E	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	14	FAS	C_4	0	0	1	1	0	1	1
	15	NFAS	E	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}

FAS	*Frame Alignment Signal*
NFAS	*Not Frame Alignment Signal*
C1 a C4	*CRC4 Bits*
E	*Received CRC4 with error indication*
A	*Remote alarm indicator (RAI)*
SaX	*Signaling Bits end-to-end*

Level ATM:

This is independent to the physical layer and common to all higher layer services; this manages cell multiplexation and routing through the VPI/VCI and handles cell sequencing.

This does not execute any retransmission task for lost or erroneous cells. This task falls to the higher layers.

Given that the service is orientated to an inherent ATM connection, the end-to-end connections must be established before initializing the cell stream between both entities.

The ATM layer has a management layer associated to it whose information unit is made up of **OAM cells** grouped in streams; this provides fault management (alarms, connection verification, detection of cells with incorrect VPI/VCI) and traffic monitoring (guaranteeing proficient use of the resources and protecting them from abuse from a connection).

ATM Cell:

An ATM cell is made up of a header and a payload, both fixed-size. The following table shows the ATM cell format.

GFC (Generic Flow Control)

This is used for flow control between the user and network; therefore this is only implemented in the UNI [1].

VPI (Virtual Path Identifier)

This is an 8 bits identifier (or 12 bits if it is not UNI). Together with the VCI, this provides routing information. This is only significant locally as it has no end-to-end value.

The ITU defines a "**virtual path**" as **unidirectional** transport of cells between two nodes pertaining to "**virtual channels**" associated to the same VPI.

There is a predefined route associated to each VPI in the physical network and each "virtual path" has a determined bandwidth available divided between its different "virtual channels."

[1] User Network Interface

Various interfaces are defined in ATM: UNI, NNI, PNNI, … whose characteristics vary according to their different locations and functions within the ATM network; the UNI is the interface specification for the ATM network in terminal or user devices.

VCI (Virtual Channel Identifier)

The ITU defines a "**virtual channel**" as the unidirectional transport of cells between two nodes associated to a common VCI; i.e. each VCI identifies a distinct connection between two ends.

This only has local significance but no end-to-end value.
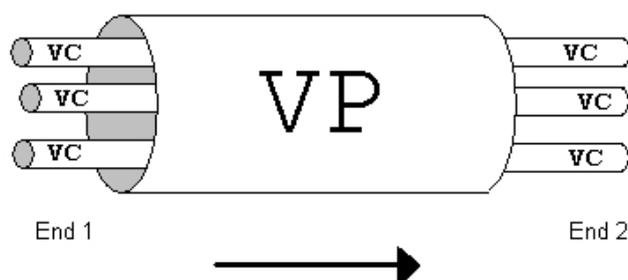
Fig. 2: Grouping of VCs in a VP
VPI/VCI in the UNI

Type	VPI	VCI
Inactive	0	0
Invalid	>0	0
Reserved	Any	1 al 31
User	Any	>31

The real number of VPI and VCI bits used for routing is negotiated between the user device and the network.

However these are always, within the VPI and the VCI, the least significant contiguous bits.

PTI (Payload Type Indicator)

This field indicates the type of information transported by the cell.
Meaning of the PTI field

Codification	Cell content
000	User data
	The cell has not experienced congestion
	Without user-user indication
001	User data
	The cell has not experienced congestion
	With user-user indication
010	User data
	The cell has experienced congestion
	Without user-user indication
011	User data
	The cell has experienced congestion
	With user-user indication
100	OAM F5 Cell segment [1]
101	OAM F5 Cell end-to-end [1]
110	Resource Management Cell
111	Reserved

[1] The OAM flows (**Operation And Maintenance**) consist of a special type of information used to detect errors in the ATM network, monitoring etc.

CLP (Cell Loss Priority)

This bit indicates whether the nodes processing the cell can discard the cell when the congestion conditions require this (the nodes must discard marked cells before unmarked cells).

HEC (Header Error Control)

This byte represents a cell header CRC-8 (x^8+x^2+x+1) and has two important functions:

- detection of erroneous cells (permits bit error correction and reduces the possibility of accepting erroneous cells i.e. it is a powerful tool for detecting errors).
- simplifies cell synchronization in the receptors or "cell delineation" (this can be made available by applying the so called "**coset rules**". This consists of adding an eight bit format ("0101 0101" is recommended) to the calculated test bits). We need to bear in mind that ATM is characterized by a **continuous** cell stream be they data or idle cells in such a way that there is always activity on the line.

To increase the robustness of the system, there is an option of randomizing the cell thus avoiding excessively long 0 or 1 sequences.
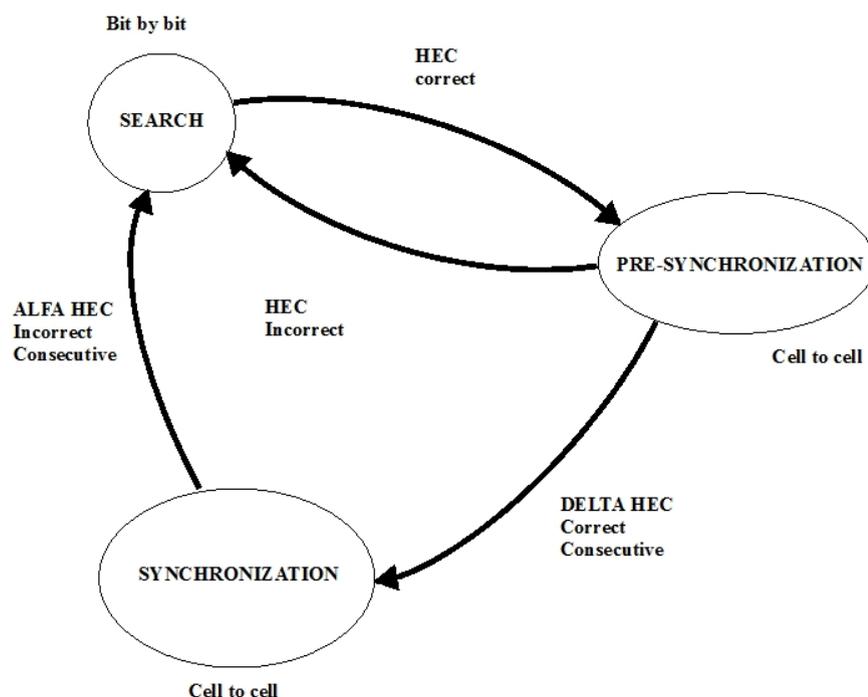
Fig. 3: Cell synchronization process complying with the ITU-T 1.432 recommendation

Data

This field is made up of 48 octets and does not have, at the cell layer, any type of error protection /detection. (The current transmission methods offer very low error rates therefore permitting you to save in information for detection / correction of errors and avoid the confirmation between intermediate nodes making the protocols more agile and less redundant).

In the specific case of an OAM cell, the payload portion has the following structure:

Octet	8	7	6	5	4	3	2	1
6	OAM Type				Function			
7	Depends on the							
	function							
52	Reserved						CRC-10	
53	CRC-10							

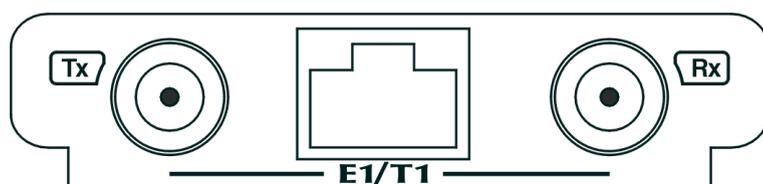**OAM cell format**

1.2 Installation

The board format is PMC Standard with 1 slot (card for 1 interface) or 2 slots (card for 4 interfaces).

The board is inserted in one of the free PCI slots in the device.
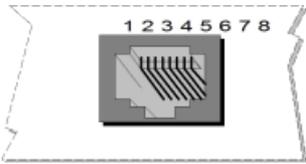
The board has connections for the physical connection as described below.

1.2.1 RJ45 Connector

This is normally used on non-balanced connections with an impedance of 120 Ohms.

The pins are as follows:

RJ45	RJ45	Signal
	4	Tx+
	1	Rx+
	2	Rx-
	5	Tx-

RJ45 connector contact numeration

The TX signals are considered outgoing and the RX incoming for the device.

1.2.2 Coaxial connector

This is normally used in balanced connections with an impedance of 75 Ohm.

The transmission connector is located on the left and the reception on the right when looking at the rear of the board.

Chapter 2 Configuring ATM over E1

2.1 Accessing the interface configuration

Carry out the following steps to access the configuration environment:

(1)   At the OPCON (*) prompt, enter PROCESS 4.

(2)   At the configuration (Config>) prompt, enter NETWORK xxx where xxx is the ATM interface whose G.703 physical layer is the one we want to configure .

(3)   At the ATM interface configuration prompt (atmx/y config>), enter PHY.

(4)   Once you have completed the above steps, you will be in the G.703 physical layer configuration menu for this ATM interface (atmx/y G703 config>).

Example:

You can check the interfaces present in the device through the **LIST DEVICES** command from the configuration prompt.

```
*P 4
Config>LIST DEVICES

Interface      Con    Type of interface           CSR      CSR2   int
ethernet0/0    LAN1   Fast Ethernet interface   fa200e00          27
serial0/0      WAN1   X25                       fa200a00 fa203c00  5e
serial0/1      WAN2   X25                       fa200a20 fa203d00  5d
serial0/2      WAN3   X25                       fa200a60 fa203f00  5b
bri0/0         ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00  5c
x25-node       ---    Router->Node                     0          0
atm1/0         SLOT 1 Generic ATM              f0200000          22
Config>
```

The ATM interface whose physical layer we wish to configure is the atm1/0 (ATM daughter over E1 installed in slot 1):

```
Config>NETWORK atm1/0
-- ATM interface configuration --
atm1/0 config>
```

The following commands can be found:

```
atm1/0 config>?
aal-connection Configures an AAL connection
description Enter interface description
line-rate Sets the line rate to work with
list List configuration
max-circuit-rate Sets maximum allowed circuit tx rate
max-number-of-circuits Sets max number of circuits to handle
max-to-min-rate-ratio Sets max allowed/min allowed ratio
min-circuit-rate Sets minimum allowed circuit tx rate
mtu Sets the maximum transmit unit
no Negates a command or sets its defaults
oam-to-data-coefficient Sets the OAM to DATA coefficient
phy Provides access to physical configuration
priority-levels Sets number of traffic priority levels
pvc Configures a PVC
shutdown Change state to administratively down
utopia-clock-frequency Sets the UTOPIA clock frequency
utopia-level Sets the UTOPIA level
exit
atm1/0 config>
```

Once in the "ATM config", enter " **PHY**" in order to access the physical layer configuration menu, in this case G.703.

```
atm1/0 config>phy
--- G703 CONFIGURATION ---
atm1/0 G703 config>
```

2.2 Interface configuration commands

The G.703 physical layer configuration commands are numerated and described in this section. All the configuration commands must be entered from the G.703 prompt (G703 config>).

There are certain commands that are common to all the device interfaces. These commands are described in the interfaces common configuration manual (**Dm772-I "Common Configuration Interfaces"**).

Command	Function
? (HELP)	Lists the available commands or their options.
ADVANCED	Configures the interface advanced parameters.
CRC4	Configures the E1 frame format (with or without CRC4).
LINE-INTERFACE	Permits you to configure the line interface in long-haul or short-haul for clock and data recovery.
LIST-CONFIG	Displays all the current G.703 physical layer configuration.
TERMINATION	Configures the line termination both in reception and transmission (75 Ohms – 120 Ohms).
TRANSMIT-CLOCK	Configures the transmission clock, this can be internally generated or recovered from the line.
EXIT	Returns to the *ATM Config>* prompt.

> **Note**
>
> The configuration must be saved and the router rebooted in order for the new configuration to take effect.

2.2.1 ? (HELP)

Displays a list of the available commands or their options.

Syntax:

```
atm1/0 G703 config>?
```

Example:

```
atm1/0 G703 config>?
advanced Configures advanced options
crc4 enable or disable CRC4
line-interface Long-Haul and Short-Haul Line Interface for Clock/Data
                 Recovery and Waveshaping
list-configuration list-interface
termination set internal tx and rx termination
transmit-clock set transmit clock (recovered or internal
exit
atm1/0 G703 config>
```

2.2.2 ADVANCED

Configures the interface advanced options. These configuration options are for advanced users.

Example:

```
atm1/0 G703 config>advanced ?
scrambling Configures scrambling options
atm1/0 G703 config>advanced
```

2.2.2.1 ADVANCED SCRAMBLING

Permits you to enable (or not) the ATM cells scrambling option over the interface.

Example:

```
atm1/0 G703 config>advanced scrambling ?
```

```
   disable    Disable atm cell payload scrambling
   enable     Enable atm cell payload scrambling
atm1/0 G703 config>advanced scrambling enable
```

2.2.3 CRC4

Permits you to configure the E1 frame format with or without CRC4. With CRC4 enabled, a multiframe is created (16 frames) over channel 0 where the synchronization, alarms and the CRC4 are transmitted. This mode is also known as PCM31C. When CRC4 is not enabled, the error corrector code is not transmitted through the E1 channel 0.

Default is disabled.

Example:

```
atm3/0 G703 config>crc4 ?
  disable disable CRC4
  enable enable CRC4
atm3/0 G703 config>
```

2.2.4 LINE-INTERFACE

Permits you to configure the line interface in long-haul or short-haul for clock and data recovery. This parameter permits us to act over the receive equalizer sensitivity:

Short-haul: Receive Equalizer Gain Limit (EGL) = -10dB

Long-haul: Receive Equalizer Gain Limit (EGL) = -43dB

Default is Short-haul.

Example:

```
atm1/0 G703 config>line-interface ?
  long-haul set line interface long haul
  short-haul set line interface short haul
atm1/0 G703 config>
```

2.2.5 LIST-CONFIGURATION

Displays the current configuration of the G.703 physical interface.

Example:

```
atm1/0 G703 config>list-configuration
physical configuration:
 ----------------------
Transmit clock: recovered
E1 termination: 120 Ohms
CRC4: enabled
Line interface: short haul
ATM scrambling: enable
atm1/0 G703 config>
```

2.2.6 TERMINATION

Permits you to configure the termination both for the input as well as the output. The possible values are:

120 Ohms: E1 twisted pair

75 Ohms: E1 coaxial

By default this is configured to 120 Ohms.

Example:

```
atm1/0 G703 config>termination ?
  120-ohms 120 Ohms
  75-ohms 75 Ohms
atm1/0 G703 config>
```

2.2.7 TRANSMIT-CLOCK

Permits you to configure the transmission clock:

>   Internal: internally generates the clock for transmission.

>   Recovered: recovers the clock from the G.703 line.

By default this is configured as recovered.

Example:

```
atm1/0 G703 config>transmit-clock ?
 internal transmit clock internal generated
 recovered transmit clock recovered from E1
atm1/0 G703 config>
```

2.2.8 EXIT

Accesses the previous menu.

Example:

```
atm1/0 G703 config>EXIT
atm1/0 config>
```

Chapter 3   Monitoring ATM over E1

3.1 Accessing the interface monitoring

To access the monitoring environment, carry out the following steps:

(1)   At the OPCON (*) prompt, enter PROCESS 3.

(2)   At the monitoring (+) prompt, enter NETWORK xxx where xxx is the ATM interface whose physical layer we want to monitor.

(3)   At the ATM interface monitoring prompt (atmx/y monitor+), enter PHY

(4)   Once you have completed the above steps, you will be in the G.703 physical layer monitoring menu for this ATM interface (atmx/y:g703 monitor+).

Example:

You can check the interfaces present in the device through the gateway CONFIGURATION command from the monitoring prompt.

```
*PROCESS 3
+CONFIGURATION


Teldat's Router, XXXXX 2 8  S/N: 403/00222
Boot ROM release:
BIOS CODE VERSION: 01.06.00B  Oct 21 2002 08:36:43
  gzip  Oct 11 2002 11:35:27
  io1  Oct 21 2002 08:36:22
  io2  Oct 18 2002 16:41:48
  io3  Oct 21 2002 08:36:22
START FROM FLASH    Watchdog timer Enabled
Software release: 10.0.0 Oct 21 2002 13:56:31
Compiled by    smolina on    SMOLINA2
Hostname:                   Active user:
Date:    Monday, 10/21/02    Time: 18:45:23


Num  Name     Protocol
3    ARP      Address Resolution Protocol
11   SNMP     SNMP


7 interfaces:
Conn    Interface       MAC/Data-Link          Hardware              Status
LAN1    ethernet0/0     Ethernet/IEEE 802.3    Fast Ethernet Interface Up
WAN1    serial0/0       X25                    SCC Serial Line- X25   Down
WAN2    serial0/1       X25                    SCC Serial Line- X25   Down
WAN3    serial0/2       X25                    SCC Serial Line- X25   Down
ISDN1   bri0/0          BRI Net                ISDN Basic Rate Int    Up
---     x25-node        internal               Router->Node           Up
SLOT 1  atm1/0          ATM                    FireStream             Down
+
```

The ATM interface whose physical layer we wish to monitor is the atm1/0 (ATM daughter over E1 installed in slot 1):

```
+NETWORK atm1/0
-- ATM/0 Console --
atm1/0 monitor+
```

The following commands can be found:

```
atm1/0 monitor+?
ATM-PING
CLEAR
LIST
PHY
EXIT
atm1/0 monitor+
```

Once in the "atm1/0 monitor", enter " **PHY**" in order to access the physical layer monitoring menu, in this case G.703:

```
atm1/0 monitor+phy
--- G703 MONITORIZATION ---
atm1/0:g703 monitor+
```

3.2 Interface monitoring commands

The G.703 physical layer monitoring commands are numerated and described in this section. All the G.703 interface monitoring commands must be entered from the G.703 prompt (atm1/0:g703 monitor+).

Command	Function
? (HELP)	Displays the available commands or their options.
CLEAR	Deletes the statistics.
CLOSE	Disconnects the ATM interface.
LIST	Displays the different aspects of the interface.
LOOP	Implements loops over the physical interface.
OPEN	Connects ATM interface.
PRBS	Pseudo-random binary sequence transmission/reception over the interface.
EXIT	Returns to the previous menu.

3.2.1 ?(HELP)

Lists the available commands.

Example:

```
atm1/0:g703 monitor+?
  clear Clear statistics
  close Deactivate interface
  list List statistics
  loop Loopback control
  open Reactivate interface
  prbs Pseudo Random Binary Sequence control
  exit
```

3.2.2 CLEAR

Deletes the stored statistics for the interface.

Syntax:

```
atm1/0:g703 monitor+CLEAR ?
 all Clear all
 atm Clear ATM
 interface Clear interface
```

3.2.2.1 CLEAR ALL

Deletes the ATM and interface statistics content.

3.2.2.2 CLEAR ATM

Deletes the ATM statistics content.

3.2.2.3 CLEAR INTERFACE

Deletes the interface statistics content.

3.2.3 CLOSE

Disconnects the ATM daughter transmitter over E1, making the line drop. This means that the atm interface this is associated to will consequently also pass to down. The interface will continue in this state until the **OPEN** command is applied or the device rebooted.

Example:

```
atm1/0:g703 monitor+CLOSE
```

3.2.4 LIST

Displays information on the interface parameters. This command has the following options:

Syntax:

```
atm1/0:g703 monitor+LIST ?
  all List all
  atm List ATM
  interface List interface
  physical List physical
```

3.2.4.1 LIST ALL

Displays the content of the LIST ATM and LIST INTERFACE commands.

3.2.4.2 LIST ATM

Displays information on the status of the E1 chip Utopia interface.

Example:

```
atm1/0:g703 monitor+list-status atm
Utopia status:
----------------
Line Cell Delineation Status (LCDS): in-cell delineation
Receiver Mode Status (RMS): correction
Cell Delination Status (CDS): sync
Receive FIFO overrun counter (RFIFOV): 0
Receive correctable HEC counter (RCHEC): 0
Receive uncorrectable HEC counter (RUHEC): 0
Receive assigned cell counter (RAC): 3653001
Transmit assigned cell counter (TAC): 3652988
EPLD Revision: 2 (Calendar Enabled/FS50 Tx Shaping Patch OK)
```

3.2.4.3 LIST INTERFACE

Displays information on the G703 link status at the physical layer and displays statistics and histories for device connections.

Example:

```
atm1/0:g703 monitor+list interface
Physical device statistics
-------------------------
Loss of Signal .......... ON
RAI Reception ........... ON
AIS Reception ........... OFF
Code Violations ......... 102
CRC4 Errors ............. 0
E-Bit Errors ............ 0
FAS Word Errors ......... 0
Slip Event .............. CLEAR
Errored Second .......... SET
Current status ...................... Down
Current status last (days/hh:mm:ss) .. 0/00:28:46
Status Changes ...................... 2 (Up 1 / Down 1)
Physical loop ....................... None
Time measured in the last interval ... 856 sc
Valid stored intervals ............. 1
Statistics measured current previous total
-------------------------------------- ---------- ---------- ------------
(ES) Errored seconds = 0 0 0
(SES) Severely errored seconds = 0 0 0
```

```
(SEFS) Severely errored framing seconds = 630 0 630
(UAS) Unavailable seconds = 856 869 1725
(CSS) Controlled slip seconds = 0 0 0
(PCV) Path coding violations (CRC4) = 0 0 0
(FEBE) Far End Block Errors = 0 0 0
(LES) Line errored seconds = 0 0 0
(BES) Bursty errored seconds = 0 1 1
(DM) Degraded minutes = 0 0 0
(LCV) Line code violations (HDB3) = 0 102 102
```

Loss of Signal	Indicates the presence or absence of the signal in the physical interface (Red Alarm).
Out of Frame	Indicates the presence or absence of frame alignment over the physical interface.
RAI Reception	Indicates the presence or absence of the "Remote Alarm Indication Yellow Alarm" signal sent from the remote end.
AIS Reception	Indicates the presence or absence of the Alarm Indication Signal – Blue Alarm", also known as All Ones ("All unframed ones") sent from the remote end.
Code Violations	Error counter for code violations on the line (HDB3 or AMI). Also known as LVC-Line Code Violations.
CRC-4 Errors	When the selected frame mode is CRC-4, this indicates the number of CRC-4 errors in the detected multiframes. Also known as PCV- Pulse code violations.
E-Bit Errors	When the selected frame mode is CRC-4, this indicates the number of E bit errors in the multiframe. The E Bit is activated by the remote end when, in reception, it has an error rate above the threshold and consequently informs the remote end. This is also known as FEBE- Far End Block Errors.
FAS Word Errors	Error counter in the alignment word.
SLIP Event	The line clock varies due to jitter. However the internally generated clock towards the device is always fixed.
	When the difference surpasses the threshold, the frames are repeated in reception (negative slip) or frames are lost (positive slip). Indicates if the interface is receiving with the adequate clock (CLEAR) or is above the tolerance threshold level (SET). The tolerance threshold is a mask that appears in the ITU-T G.728 recommendations.
Errored Second	Indicates if the last statistics second for an active connection has an error. This does not increase if there is no physical connection in the interface.

Information on the status of the connections is provided as indicated below:

Current status	Indicates if the physical interface is active (UP) or inactive (DOWN).
Current status last	Indicates how long the interface has been in the indicated status.
Status Changes	Status changes counters from the point of device start up.
Physical Loop	Indicates if the device has some type of loop activated.

In the same way, stored statistics for time intervals, complying with the RFC 1406, are displayed. Statistics are stored for 24 hours and saved in periods of 15 minutes.

Time measured	Indicates the time stored for the last period of time, i.e. the real duration of the current interval.
Valid Stored	Number of 15 minute periods stored.

The displayed statistics are indicated in the following table:

NM	Name	Meaning
ES	Errored Seconds	For an E1-CRC link: Where there is one or more Path Code Violations (PCV), one or more Out of Frame (OOF, FAS), one or more Slips (CS) or more or more Alarm Indication Signal (AIS) in a one second period. This value does not increase during unavailable periods (UnAvailable Seconds – UAS).
SES	Severely Errored Seconds	For an E1-CRC link: Second during which there are more than 832 Path Code Viol-

		ations (PCV) or one or more Out of Frame (OOF-FAS). This value does not increase during unavailable periods UAS).
SEFS	Severely Errored Framing Seconds	Seconds during which one or more Out of Frame (OOF-FAS) have been detected or Alarm Indication Signal (AIS) has been detected.
UAS	Unavailable Seconds	Seconds during which the E1 interface is not available.
CSS	Controlled Slip Seconds	Seconds during which one or more Slips have been detected.
PCV	Pulse Code Violations	Code violation error counter. For an E1-CRC link, this corresponds to the CRC4 number of errors.
FEBE	Far End Block Errors	Counter for the number of E Bits (CRC4 error indication bit) which have been received.
LES	Line Errored Seconds	Seconds during which one or more code violations (LCV) have been detected.
BES	Bursty Errored Seconds	Seconds during which between 1 and 320 PCVs have been detected, without SES existing and without AIS being detected. The CS parameter is not included in this time.
DM	Degraded Minutes	Degraded minutes, where the error rate is estimated as greater than 10^{-3}. The available seconds are calculated, eliminating the SES and grouping them in periods of 60 seconds.
LCV	Line Code Violations	For an E1-CRC LCV interface, this consists in the detection of bipolar code violation errors (BPV-HDB3) or an excessive number of zeros (EXZ).

3.2.4.4 LIST PHYSICAL

Displays information on the status of the G703 link at a physical layer, reading all the device registers.

Example:

```
atm1/0:g703 monitor+list physical
Physical status:
----------------
Link status: UP
Resync Criteria Met Event (CASRC): no
Resync Criteria Met Event (FASRC): no
Resync Criteria Met Event (CRCRC): no
Transmit Open-Circuit Detect Condition (TOCD): no
Line Interface Receive Carrier-Loss Condition (LRCL): no
Framer Receive Carrier-Loss Condition (FRCL): no
Receive Unframed All-Ones Condition (RUA1): no
Receive Yellow Alarm Condition (RYEL): no
Receive Loss-of-Sync Clear Event (RLOSC): no
Framer Receive Carrier-Loss Clear Event (FRCLC): no
Receive Unframed All-Ones Clear Event (RUA1C): no
Receive Remote Alarm Condition (RRA): no
Loss-of-Receive Clock Condition (LORC): no
Loss-of-Transmit Clock Condition (LOTC): no
```

The general link status, UP or DOWN, is presented in the Link Status. The criteria to follow for the alarms is when they are inactive, a "no" value is given, contrariwise i.e. active, a "yes" value appears, these values remaining while events provoking them continue to occur.

Equivalents with the ANSI specifications:

> Blue Alarm (AIS) # RUA1

> Yellow Alarm (RAI) # RYEL

3.2.5 LOOP

Use the **LOOP** command to activate or deactivate loops in the physical interface.

Syntax:

```
atm1/0:g703 monitor+loop ?
  local Local loopback
  remote Remote loopback
atm1/0:g703 monitor+loop <local | remote> ?
  disable Disable local loopback
  enable Enable local loopback
atm1/0:g703 monitor+loop <local | remote> enable ?
  <0..65534> Loopback last in seconds (0->Continuous)
```

3.2.5.1 LOOP LOCAL

Activates or deactivates the local loop. All the locally sent data is received.

This loop is executed at the ATM layer.

The AIS signal is sent to the remote end.

In order to prevent loss of accessibility to the device, loop duration can be configured in seconds.

Example:

```
atm1/0:g703 monitor+LOOP LOCAL ENABLE 0
Local Loop Activated
atm1/0:g703 monitor+LOOP LOCAL DISABLE
Local Loop Deactivated
```

3.2.5.2 LOOP REMOTE

Activates or deactivates the remote loop. All data received by the interface is returned to the remote end.

All data received from the remote end is not sent to the local interface. An AIS signal is internally generated.

In order to prevent loss of accessibility to the device, loop duration can be configured in seconds.

Example:

```
atm1/0:g703 monitor+LOOP REMOTE ENABLE 0
Remote Loop Activated
atm1/0:g703 monitor+LOOP REMOTE DISABLE
Remote Loop Deactivated
```

3.2.6 OPEN

Enables the ATM daughter transmitter over E1. If this is disabled, the link begins to operate again in accordance with its configuration and the ATM interface over which this is configured passes to an UP state.

Example:

```
atm1/0:g703 monitor+OPEN
```

3.2.7 PRBS

Use the **PRBS** command *(Pseudo-random binary sequence)* to activate or deactivate pseudo-random binary sequence transmission/reception in the physical interface.

Both for reception and transmission, time-slots 1-15, 17-31 are used, i.e. all the interface excluding time-slot 1 (synchronization) and 16 (reserved).

Syntax:

```
atm1/0:g703 monitor+PRBS ?
  receive PRBS reception
  status PRBS Status
  transmit PBRS transmission
atm1/0:g703 monitor+prbs receive ?
  disable Disable PRBS reception
  enable Enable PRBS reception
atm1/0:g703 monitor+prbs transmit ?
  a Transmit PRBS 2^15 - 1
  b Transmit QRSS 2^20 - 1 with 14 0's restrictions
```

```
   disable Disable transmission of PRBS
```

3.2.7.1 PRBS RECEIVE

Activates or deactivates the reception of pseudo-random binary sequence in the interface.

In cases where detection of the data received from the remote end is activated, this is not sent to the local interface. An AIS signal is internally generated.

Example:

```
atm1/0:g703 monitor+PRBS RECEIVE ENABLE
Pseudo-Random Binary Sequence Receive Activated
atm1/0:g703 monitor+PRBS RECEIVE DISABLE
Pseudo-Random Binary Sequence Receive Deactivated
```

> **Note**
>
> The PRBS detector monitors the incoming data sequence complying with the ITU-T O.151 norm. Synchronization is reached in 400 milliseconds from the detection of the signal with a probability of 99.9% with an error rate less than 10^{-1}. A signal comprising of all 1's or all 0's in framed or unframed format can provoke synchronization activity.

3.2.7.2 PRBS TRANSMIT

Activates or deactivates transmission of the pseudo-random binary sequence in the interface.

There are 2 types of transmitted sequences:

A-(2exp15-1) The sequence sent here is $2^{15}-1$ with a restriction of a maximum of 14 zeros, complying with ITU-T O.151.

B-(QRSS 2exp20-1 with 14 0's restrictions) The sequence sent here is $2^{20}-1$ with a restriction of a maximum of 14 zeros, complying with ITU-T O.151. This is also known as QRSS.

Example1:

```
atm1/0:g703 monitor+PRBS TRANSMIT A
Pseudo-Random Binary Sequence Transmit Activated
atm1/0:g703 monitor+PRBS TRANSMIT B
Pseudo-Random Binary Sequence Transmit Activated
atm1/0:g703 monitor+PRBS TRANSMIT DISABLE
Pseudo-Random Binary Sequence Transmit Deactivated
```

3.2.7.3 PRBS STATUS

Displays information on the pseudo-random binary sequence measurements in the interface.

Example:

```
atm1/0:g703 monitor+PRBS STATUS
Transmit .......... Enabled
Receive .......... Enabled
Synchronized ...... Yes
Bit received ...... 2100045838
Bit errors ........ 28 (1460 sc.)
```

> **Note**
>
> The error bits counter starts from 0 in each sequence activation petition and is updated every second. The counter can be reset once the sequence has initiated through 2 commands, re-requesting reception activation (PRBS RECEIVE ENABLE), or by deleting the physical layer statistics (CLEAR INTERFACE).

3.2.8 EXIT

Returns to the previous menu.

```
atm1/0:g703 monitor+EXIT
```

```
atm1/0 monitor+
```