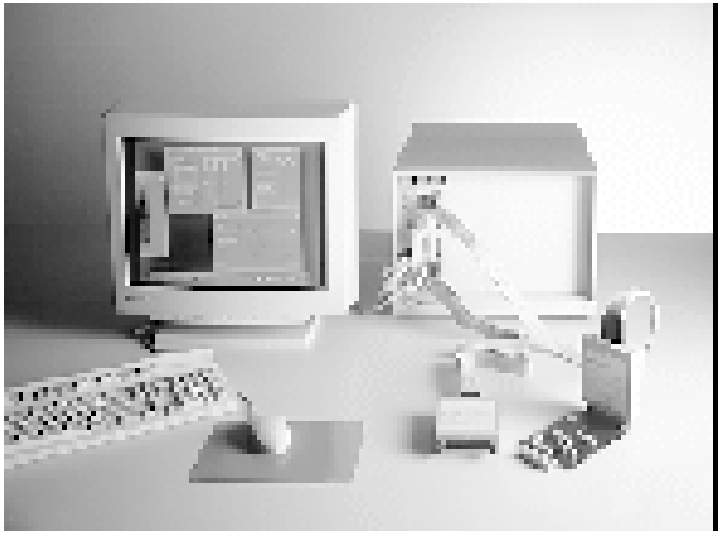
Parallel Cell & Traffic Generator and Analyzer E482xA/B



This presentation describes how to use the HP E482xA/B for generating and analyzing stream of cells according to AAL = ATM Adaptation Layer.

The examples show how to setup measurements for Cell Error Rate (CER), Cell Loss and Transit Delay Variation.

Cells according AAL

26 slides

HEWLETT PACKARD

AAL TEST Overview

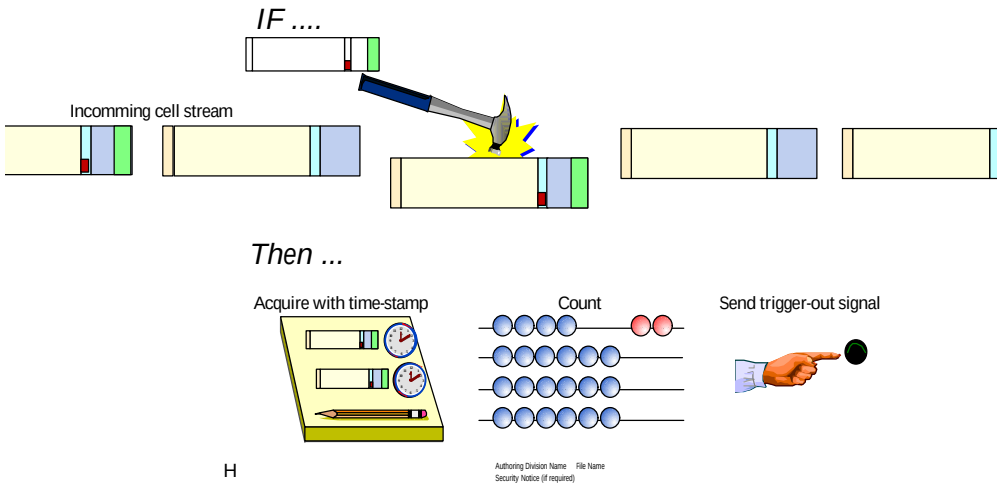
The presentation contains the following parts:

- How to setup measurements using Analyzer capabilities
- generating & analyzing a cell stream according to AAL1
  - ▸ AAL 1 is service for voice -> constant delay!
  - – how to setup transmitter of the E482xA/B system
  - – how to setup processing of the E482xA/B system

- generating & analyzing a cell stream according to AAL5
  - ▸ AAL 5 is service for data -> bursty!
  - – how to setup transmitter of the E482xA/B system
  - – how to setup processing of the E482xA/B system

Measurements on E482xA/B system, using Analyzer capabilities

Key Feature: Cell Analysis



H

Authoring Division Name File Name
Security Notice (if required)

three measurements are provided as examples:

- **Cell Error Ratio (CER)**

The capability to check the CRC-10 of incoming cells is used. For this the incoming cells must be provided with a CRC-10 securing the payload In the receiver the CRC-10 will be re-calculated over the payload and compared with the value received. A CRC error will be indicated and further processed, when re-calculated value does not match with received on one.

- **Cell Loss**

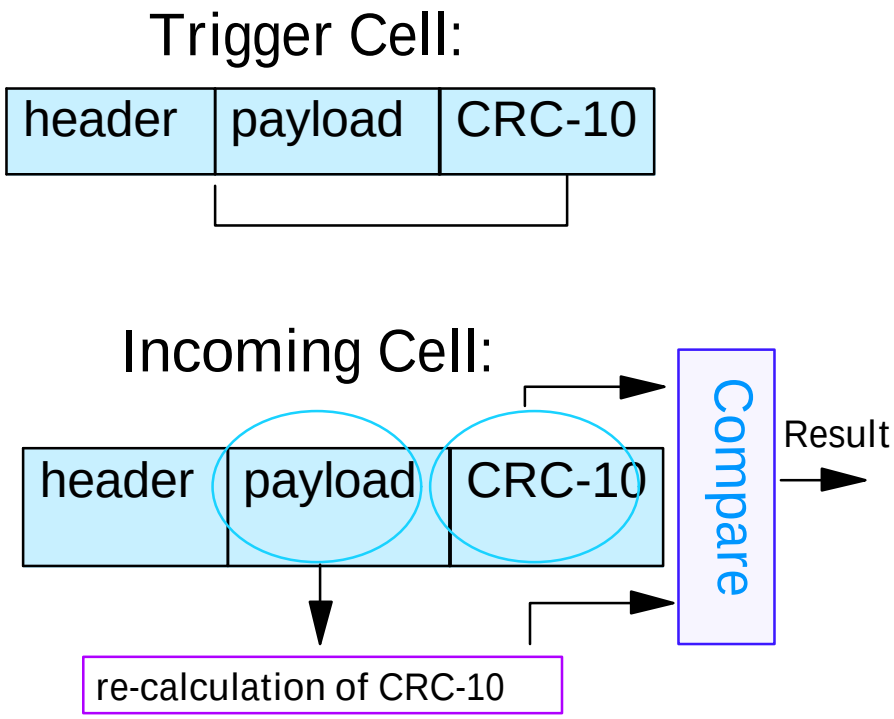
The capability to increment and reset the individual counters is used. It takes into account that in the stream of incoming cells the sequence will be maintained. So the task is to verify that a certain cell will occur after a fixed number of other cells. So the processing will be setup to count and acquire when the cell at a certain point in the stream does not match with expected one.

- **Cell transit delay variation**

The capability to record the arrival time in form of a time stamp is used The time stamp can be displayed in the acquisition. It can also be saved in a file for further processing.

H

Cell Error Rate Measurement on E482xA/B system



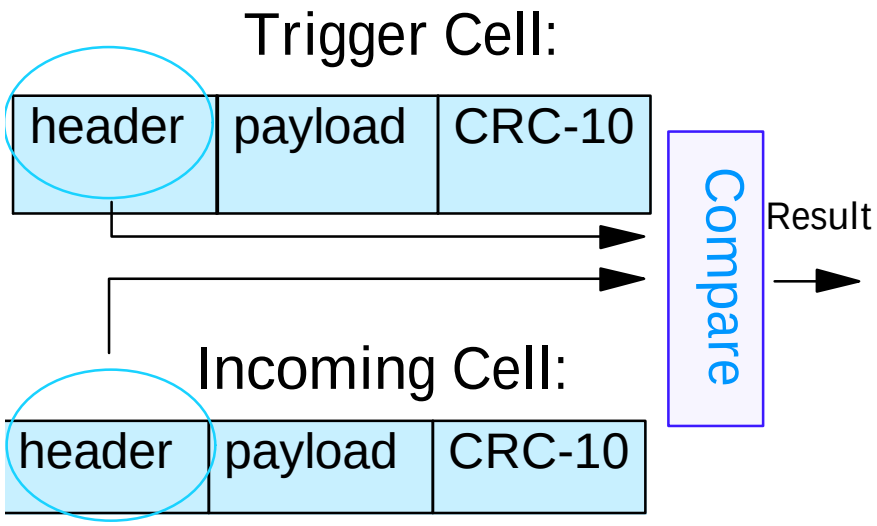
- CER Measurement is based on verifying CRC segment placed in the payload
- A Trigger Cell has to be setup with CRC-10 segment and specification of the range for calculation the CRC
- For all incoming cells a re-calculation of CRC-10 will be performed according the range specified in the trigger cell. This re-calculated CRC will be compared with the bits transferred in the CRC segment
- The result will be an Error if transferred and re-calculated values do not match for one or more bits.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

Cell Loss Measurement on E482xA/B system

Cell Loss Measurement is based on the reoccurrence of a 'critical cell' after a fixed number of cells in the stream.



- A Trigger Cell has to be setup with specification of the expected bits, here it's assumed it is VPI/VCI.
- All incoming cells will be compared against the expected bits specified in the trigger cell. The result can be inverted, so the result is: a certain cell does not match with the expected cell.
- The test for reoccurrence is done by a counter incrementing with each cell in the stream, being reset after the expected cell occurred.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

8bit vs. 16bit cell

The following slides use the example for ATM-8 (8bit wide data). ATM-16 will be only different according to the following cell structure:

bit	7 4 3 0
byte1	GFC | VPI
byte2	VPI | VCI
byte3	VCI
byte4	VCI | PT |CLP
byte5	HEC / UDF
byte6	payload byte1
byte7	'PRBS'
	or
	'memory'
byte52	| # #
byte53	# # CRC-10 # #

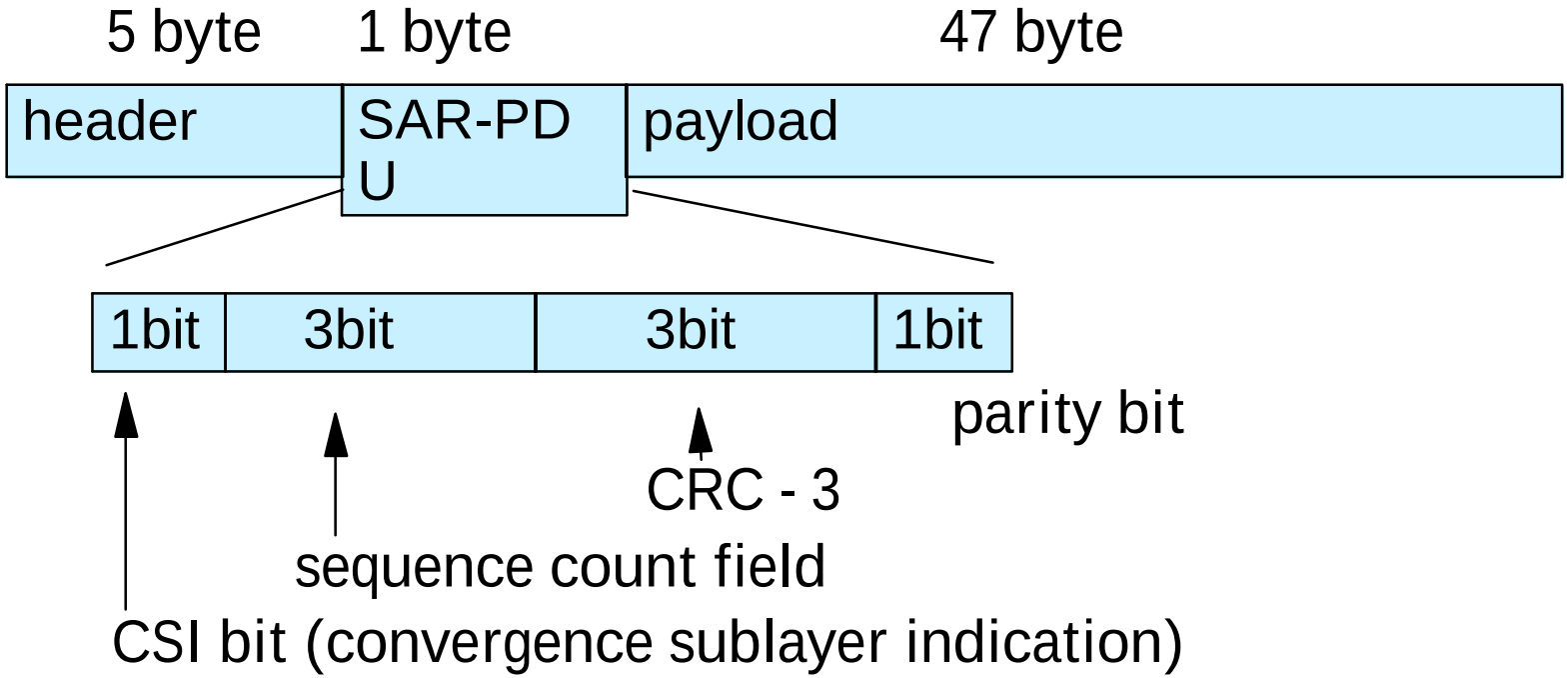
H

bit	15 12 11 8	7 4 3 0
word1	GFC | VPI	VPI | VCI
word2	VCI	VCI | PT
word3	HEC / UDF1	UDF2
word4	payload byte1	payload byte2
word5	'prws'	
word6	or	
word7		'memory'
....		
word26		
word27	| # #	# # CRC-10 # #

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

Cells according AAL 1 (1)

- The first byte in the payload is used for SAR-PDU (segmentation and reassemble - protocol data unit)
- The payload is therefore only 47 bytes



H

Cells according to AAL 1 (2)

CSI 1bit	sequence 3bit	CRC-3 3bit	parity 1bit

SAR-PDU consists of:

- CSI bit (convergence sublayer indication)
  default=0, if structured data=1, -> add. pointer byte 4
  (this is not further described here, but also possible: with copy command and edit of pointer byte these cells can be easily setup)
- sequence count field, range 0 to 7, same number for cells belonging together
- CRC - 3 : securing CSI bit & sequence number,
  polynome is: $x^3 + x + 1$
- parity bit: securing CRC-3 field, parity is even

H

Cells according to AAL 1 (3)

- the CRC-3 is not generated real-time yet. Due to the limited number of cells necessary, CRC-3 and parity is calculated manually the following way:

CSI bit 7	sequence bit 6,5,4	CRC-3 bit 3,2,1	parity bit 0

bit 4 x-or 5 x-or 7

bit 4 x-or 6 x-or 7

bit 4 x-or 5 x-or 6

bit 5 x-or 6 x-or 7

H

How to generate AAL 1 on E482xA/B system (1)

- To generate AAL1 cells on E482xA/B, cells with the following structure are defined:

5 bytes	ATM-8 UNI/NNI header	pre-defined
1 byte	SAR-PDU byte	memory
45 bytes	payload	PRBS
2 bytes	CRC	CRC-10 over PRBS

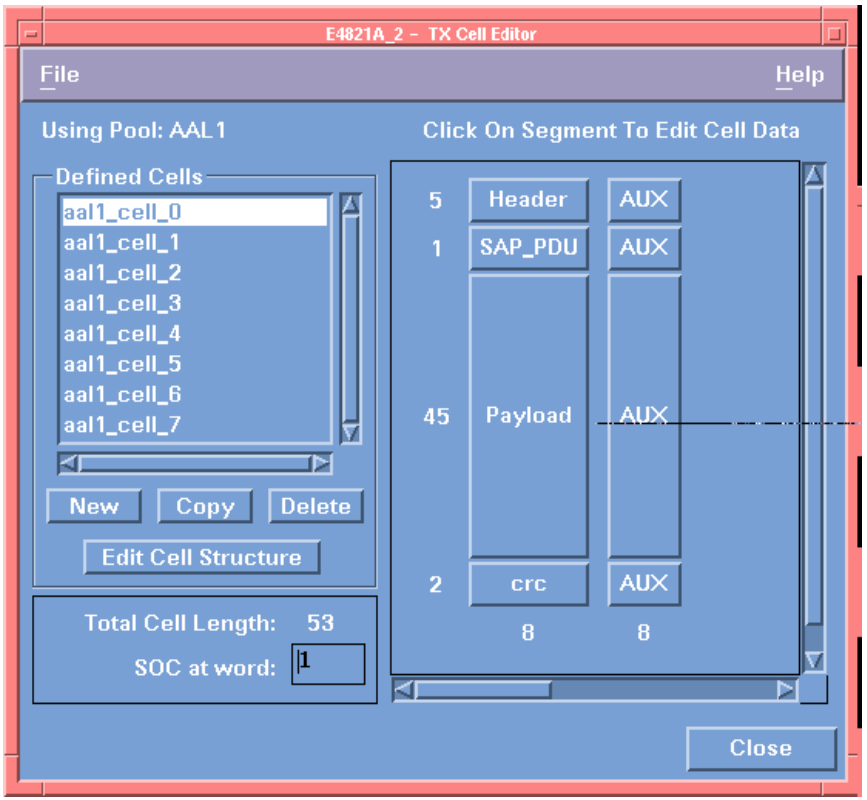
- The header parameters in the ATM8UNI/NNI fields are independent, as an example the following is used:

GFC	0000
VPI	255
VCI	100
PT & CLP	0000

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to generate AAL 1 on E482xA/B system (2)



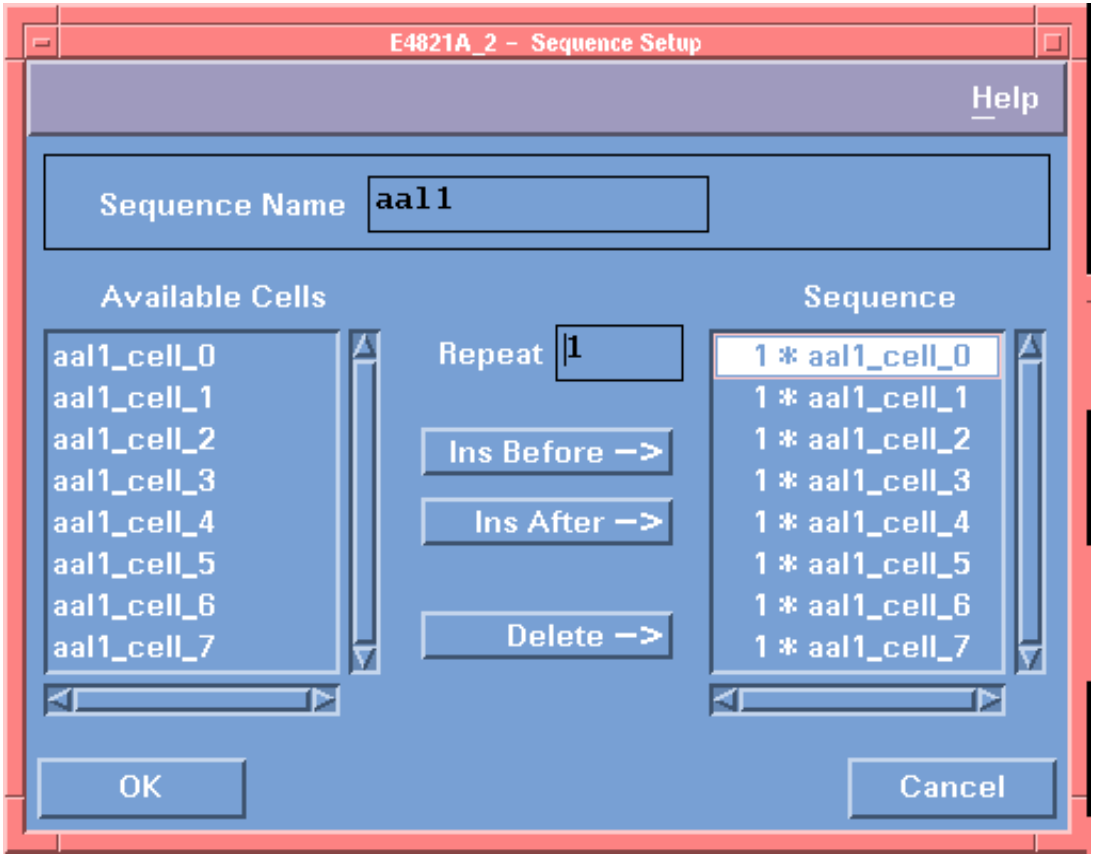
- to cover the range of 8 sequence numbers, the following 8 transmitter cells, with the following bits in the SAR-PDU byte are setup:

TX Cell		CSI	serial #	CRC-3 & parity in bin		all in hex
aal1_cell_0		0	0 0 0	0 0 0 0		00
aal1_cell_1		0	0 0 1	0 1 1 1		17
aal1_cell_2		0	0 1 0	1 1 0 1		2D
aal1_cell_3		0	0 1 1	1 0 1 0		3A
aal1_cell_4		0	1 0 0	1 1 1 0		4E
aal1_cell_5		0	1 0 1	1 0 0 1		59
aal1_cell_6		0	1 1 0	0 0 1 1		63
aal1_cell_7		0	1 1 1	0 1 0 0		74

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to generate AAL 1 on E482xA/B system (3)



- Traffic setup:

  aal1_cell_0 ->
  aal1_cell_1 -> .... ->
  aal1_cell_7

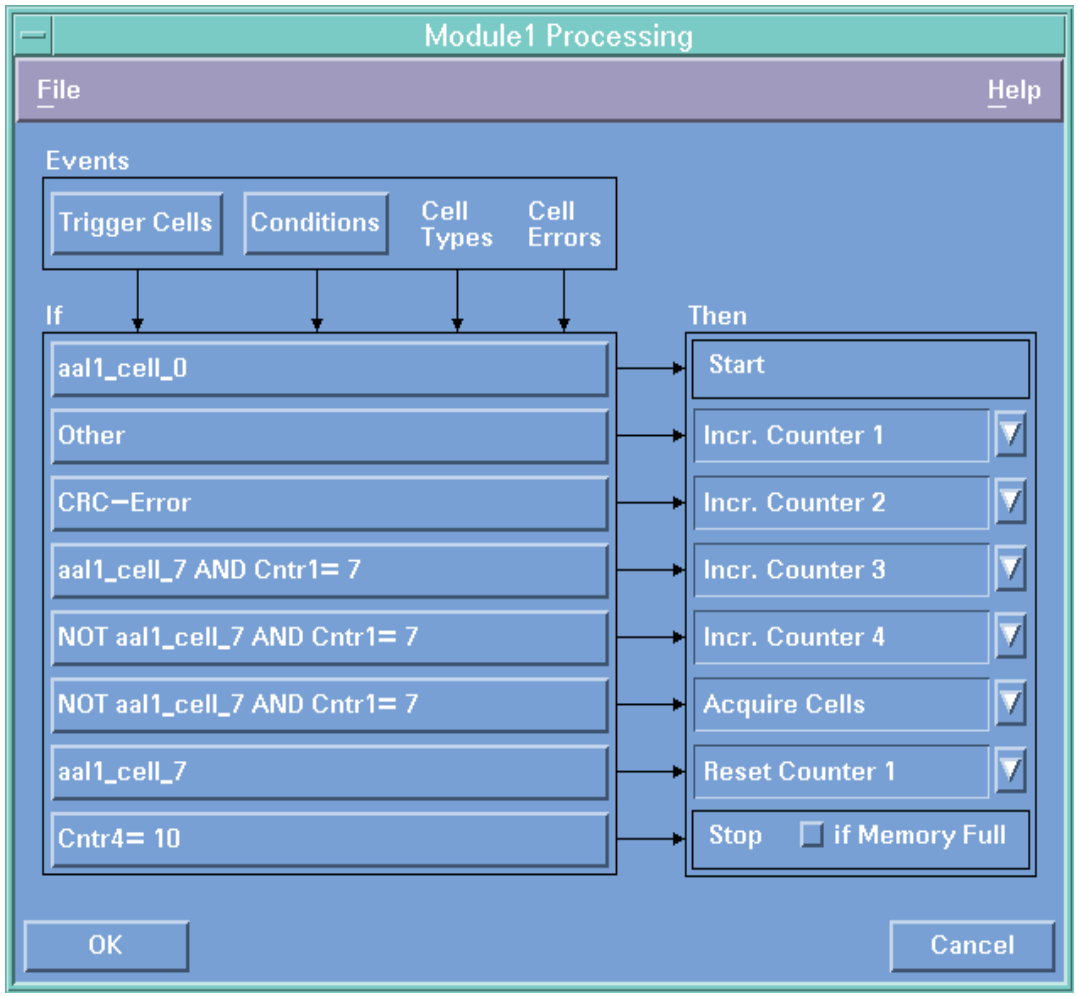
a sequence list with all the cells included is defined

- for generating a constant bit rate traffic (CBR), the traffic profile 'periodic cells' is used.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to analyze AAL 1 on E482xA/B system (1)

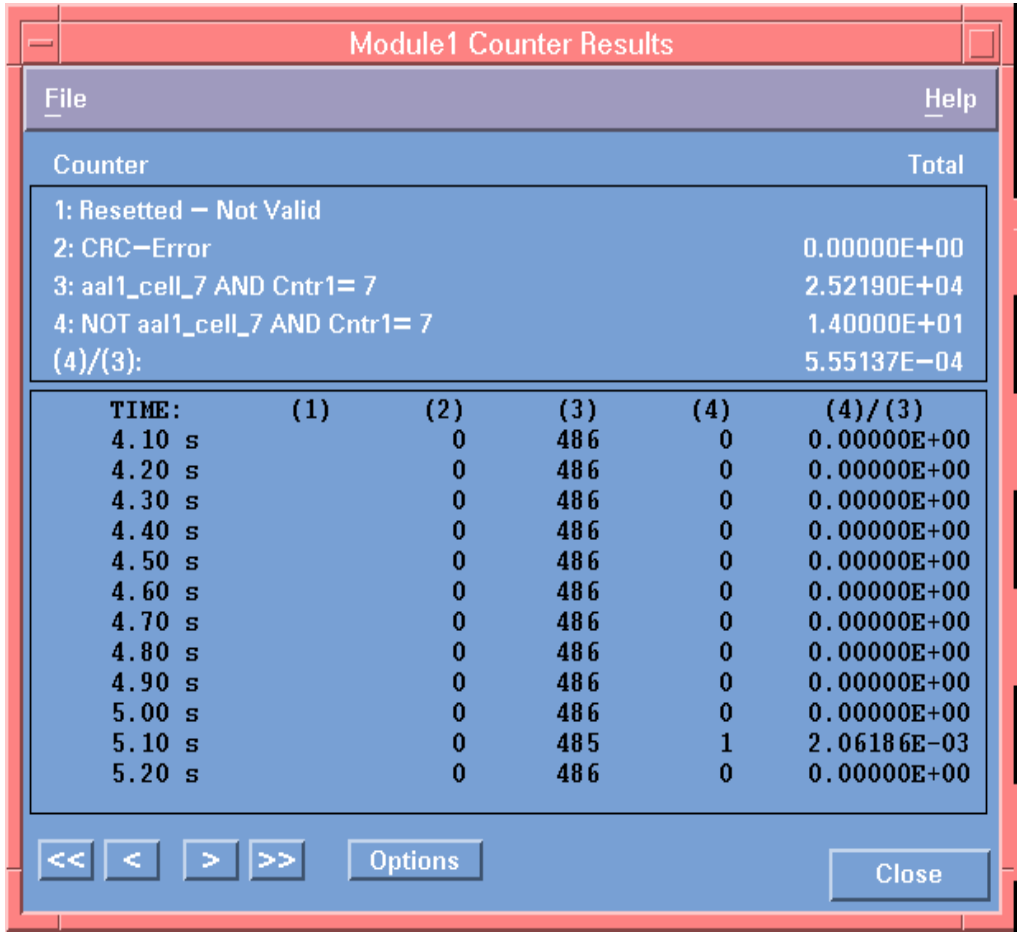


- Processing setup for cell error ratio and cell loss:
- copy TX cells to RX, define each cell to be a Trigger Cell
- counter 1 counts all cells, counter 2 counts cells with bad CRC, so: CER=cnt_2/cnt_1
- counter 3 counts all 'aal1_cell_7' cells, counter 4 counts whenever there is a different cell than 'aal1_cell_7' cell, so: Cell_Loss_Ratio=cnt_4/cnt_3. Whenever there is a different cell than expected, it will also be stored in the acquisition.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to analyze AAL 1 on E482xA/B system (2)

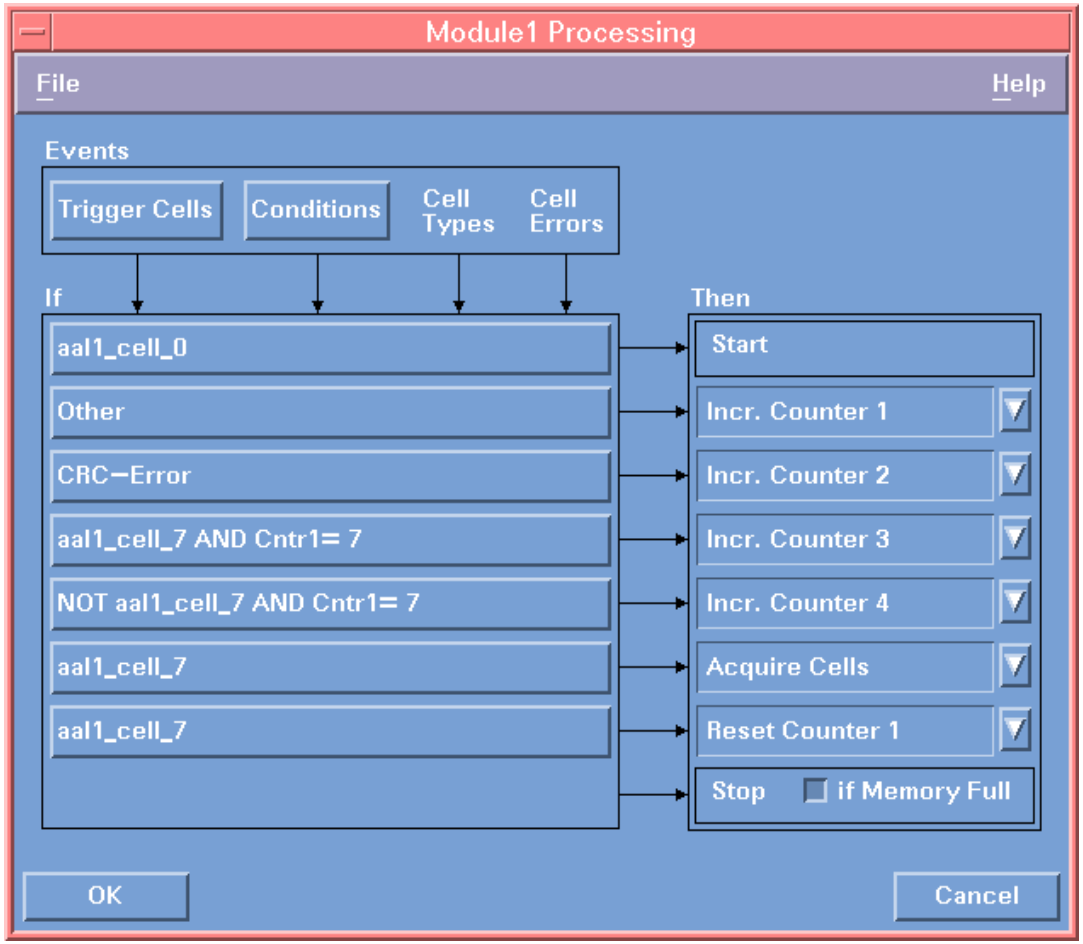


Results:

- Counter 1 is used to synchronize on cell sequence. It will be reset when the sequence is once completed. Due to the reset, the values will not be displayed.
- Counter 4 shows once a different cell than expected cell. The ratio cnt4/cnt3 gives a value for cell loss ratio.
- Note: a real-time sequence number processing is not yet implemented.

H

How to analyze AAL 1 on E482xA/B system (3)

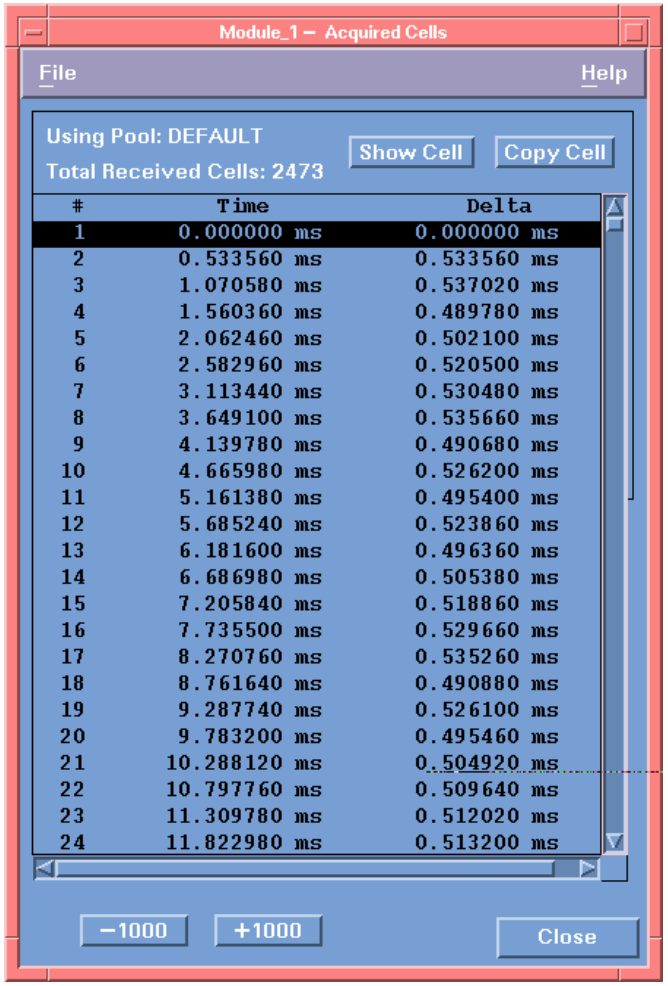


- Processing setup for cell transit delay measurement:
- The processing setup is slightly modified:
  the cell 'aal1_cell_7' is always acquired, for acquisition the total available acquisition memory will be used. Acquisition will stop, when memory will be full.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to analyze AAL 1 on E482xA/B system (4)

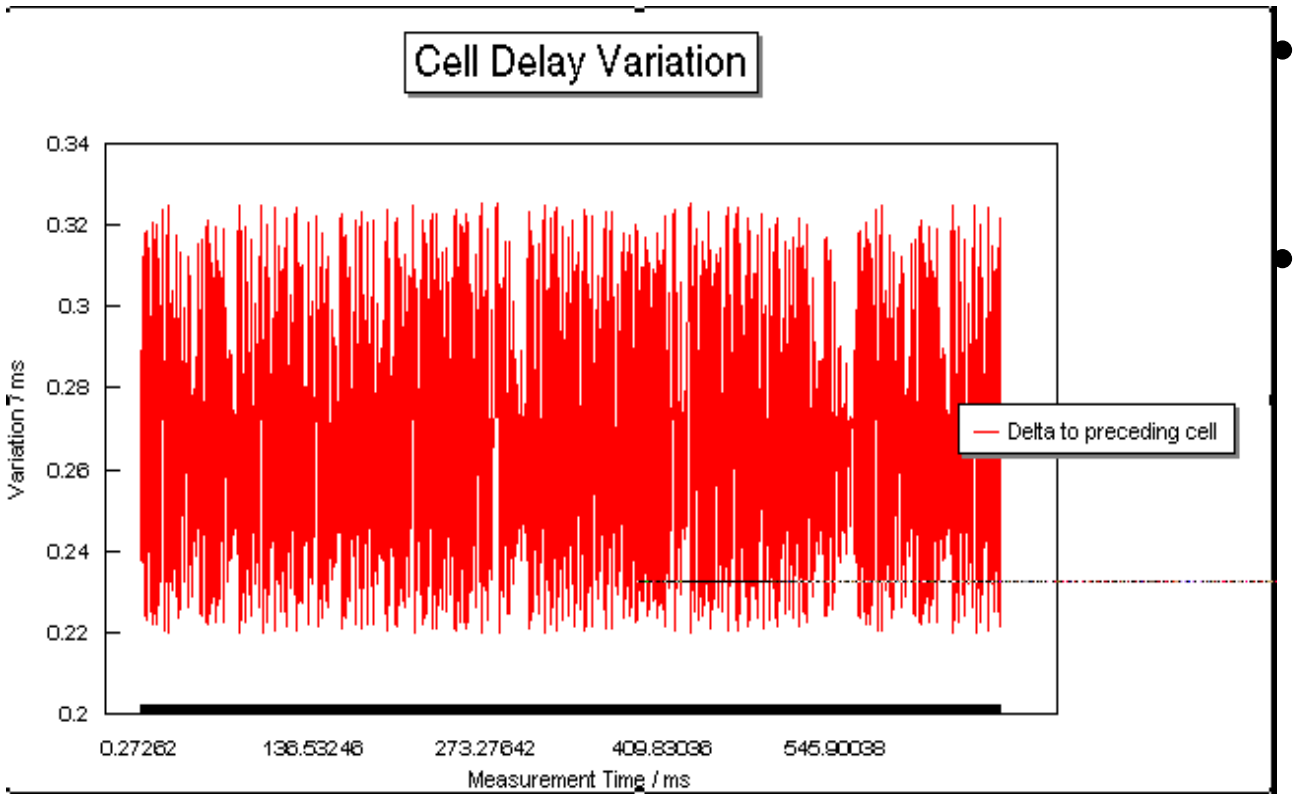


Results:

- When acquiring cells, the time stamp is stored together with cell content. The time stamp stored is used to show the time relative to the first received cell, and the delta time between two consecutive cells in the acquisition window.

H

How to analyze AAL 1 on E482xA/B system (5)



Results:

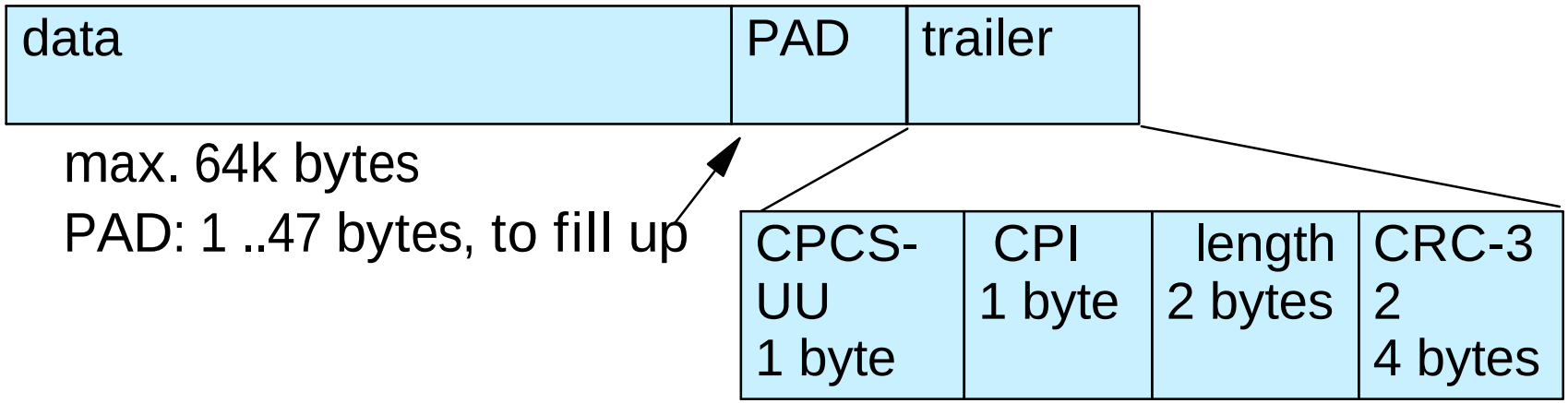
- The recorded list is saved on file, use the file save command in the GUI
- The list is transferred to spreadsheet software (e.g. LOTUS 1-2-3), where it is calculated and represented as the graph on the left.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

Cells according to AAL 5 (1)

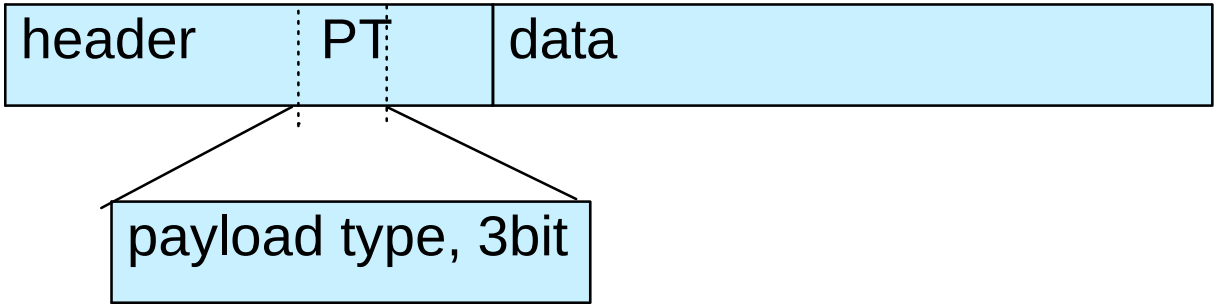
- A PAD and a trailer is added to a given block of data before it is broken into 48 byte pieces to be inserted into the payload of cells:



- CRC-32: CRC - 32 checksum calculated over all blocks
- length: number of total data bytes
- CPI: common part indicator, currently used only with 0
- CPCS-UU: CPCS (common part convergence sublayer) user to user indicator, error detection and indication, sequence integrity

Cells according to AAL 5 (2)

- AAL5 also indicates status of message in header:



PT=000 user data cell, begin or continuation, no congestion
PT=001 user data cell, message end, no congestion
PT=010 user data cell, begin or continuation, congestion
PT=011 user data cell, message end, congestion
PT=1xx non user data cell

Cells according to AAL 5 (3)

- Two cells have to be defined:
  - aal5_cell_0, this cell is used to represent the block of 64k of data. Data is represented by PRBS, secured with a CRC - 10 in each cell. For representing a block of 64k data, this cell has to be repeated 1365 times, while 16 bytes remain for the last cell in the stream:
  - aal5_cell_1: this cell carries last 16 bytes of the block of 64k data (PRBS), it also carries PAD (24 bytes to fill up) and the trailer .
- The structure of the cells are:

	aal5_cell_0		aal5_cell_1	
5 bytes	ATM-8 UNI/NNI header PT = 000		ATM-8 UNI/NNI header PT = 001	5 bytes
46 bytes	payload (PRBS)		payload (PRBS)	16 bytes
2 bytes	CRC - 10 vs. payload		PAD & trailer (memory)	32 bytes

Cells according to AAL 5 (4)

- The PAD and trailer segments have to be memory based, the typical values are:
  - PAD = 0 (24 bytes)
  - CPCS-UU = 0 (1byte)
  - CPI = 0 (1 byte)
  - length = FFFF (2 bytes)
  - CRC - 32 = 0 (4 bytes)

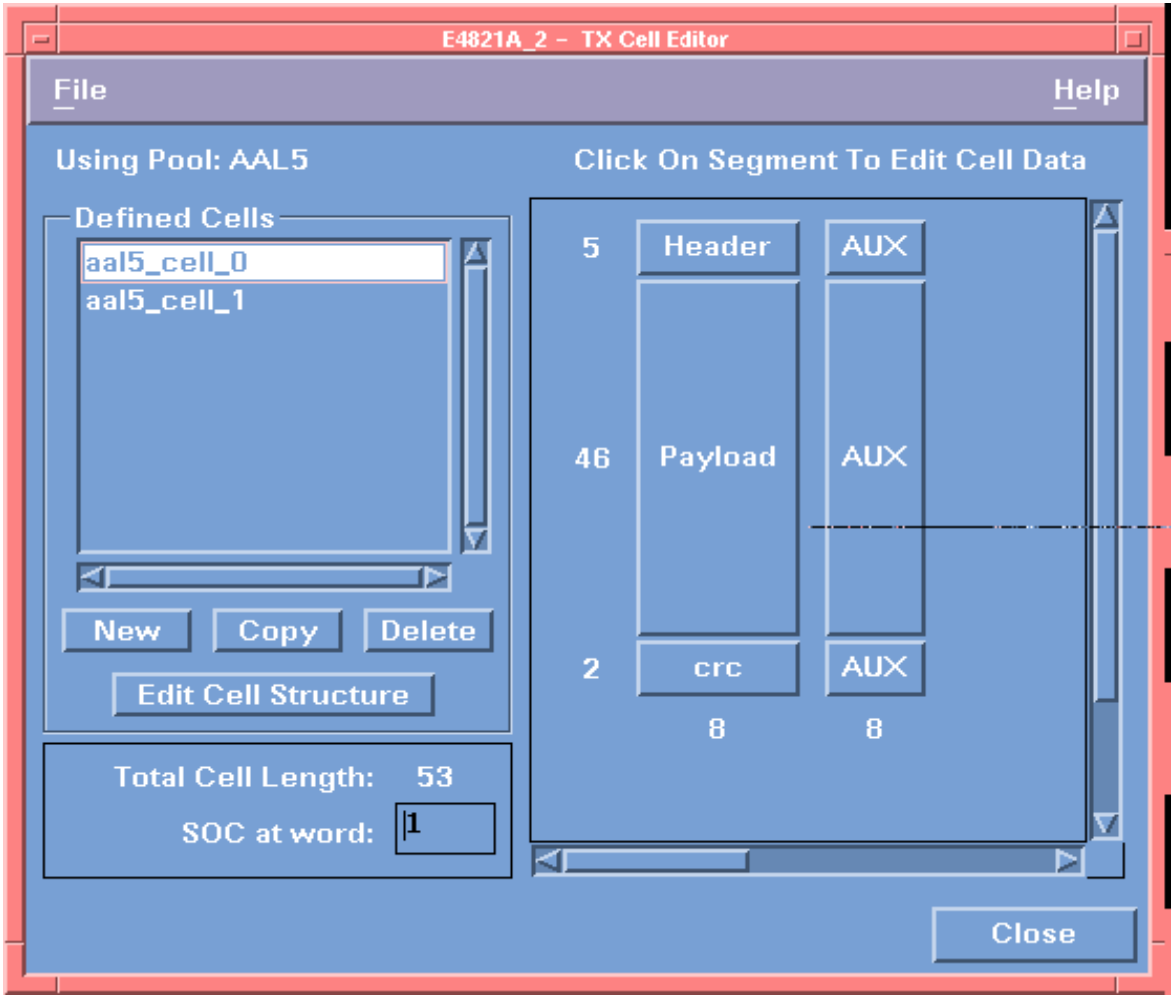
  currently real-time CRC - 32 generation is not implemented, it is replaced by a memory segment (2bytes) filled with 0 and a CRC-10 segment.
- The other header parameters except PT in the ATM8UNI/NNI fields are independent, as an example the following is used:

GFC	0000
VPI	255
VCI	100

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to generate AAL 5 on E482xA/B system (1)



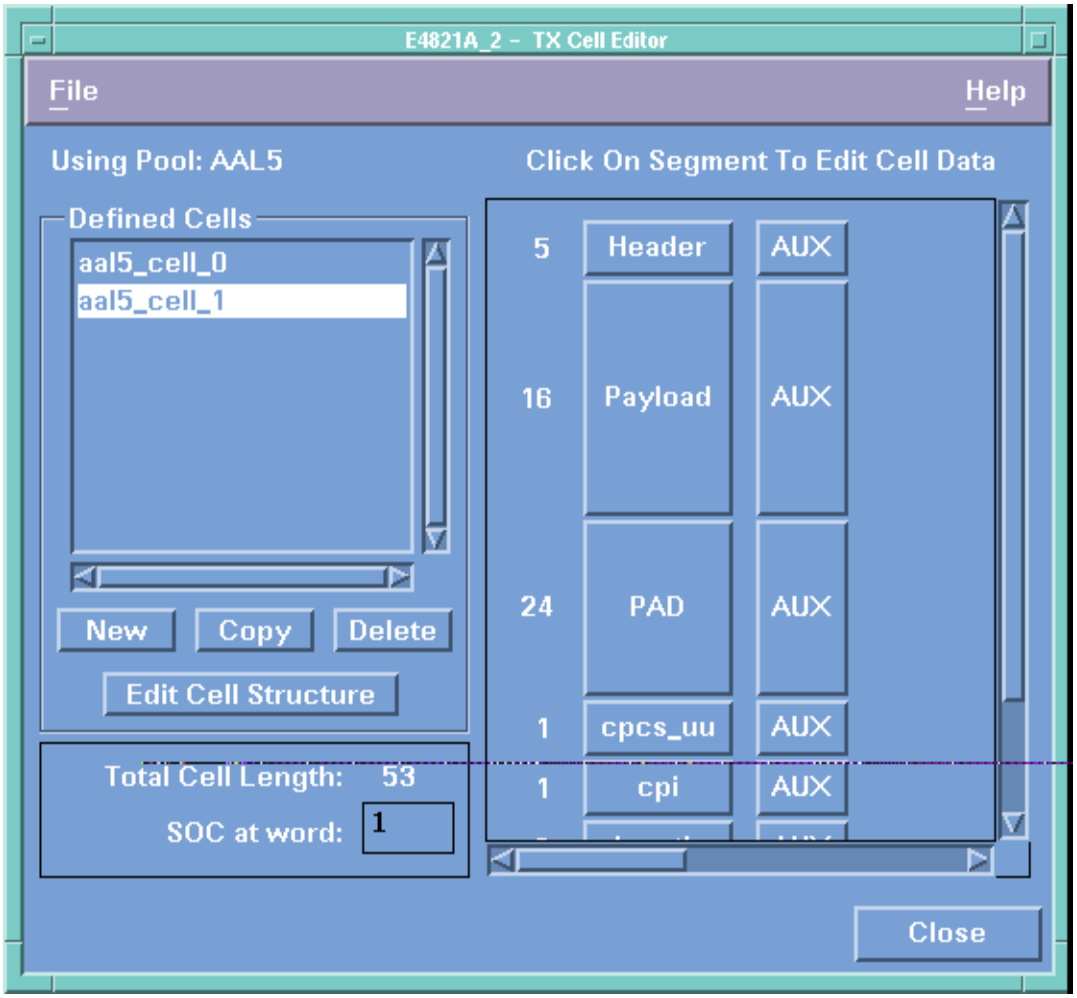
Cell Editor:

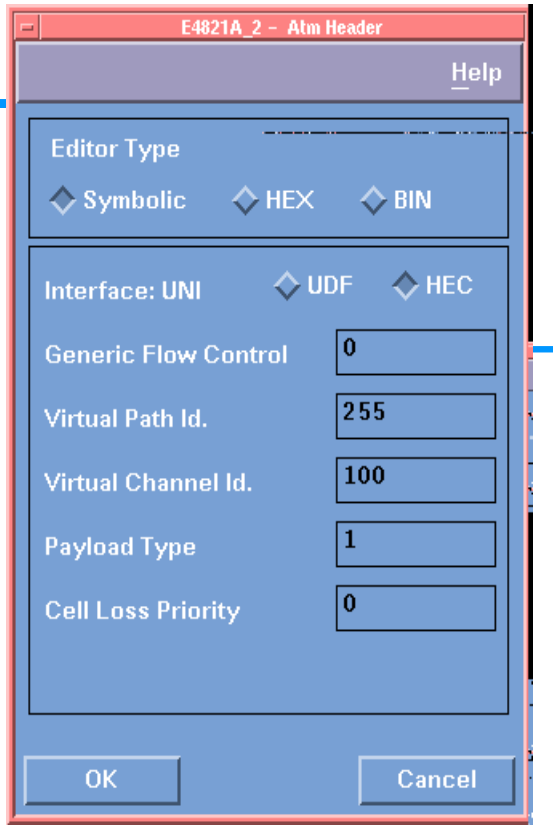
- aalL5_cell_0: this cell is used to represent the block of 64k of data (except the last 16 bytes). Data is represented by PRBS, secured with a CRC - 10 in each cell. For representing 64k data, this cell has to be repeated 1365 times.
- If a block size other than 64k is transferred, repeat factor, block of last bytes and PAD must be recalculated!

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to generate AAL 5 on E482xA/B system (2)





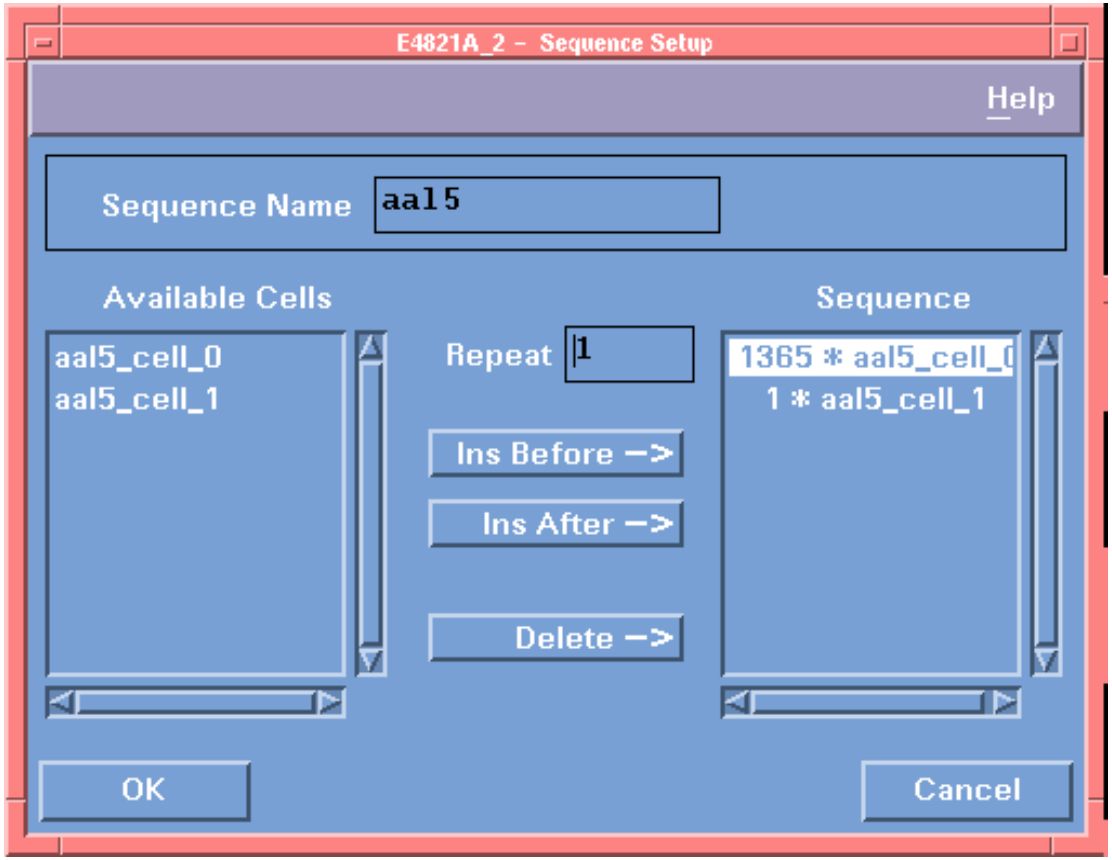
Cell Editor:

- aal5_cell_1: this cell is the last cell terminating a block of 64k data. It carries the last 16 bytes of data (PRBS), it also carries PAD field and trailer as described previously. The PT field in the header signals message end (PT=001).

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

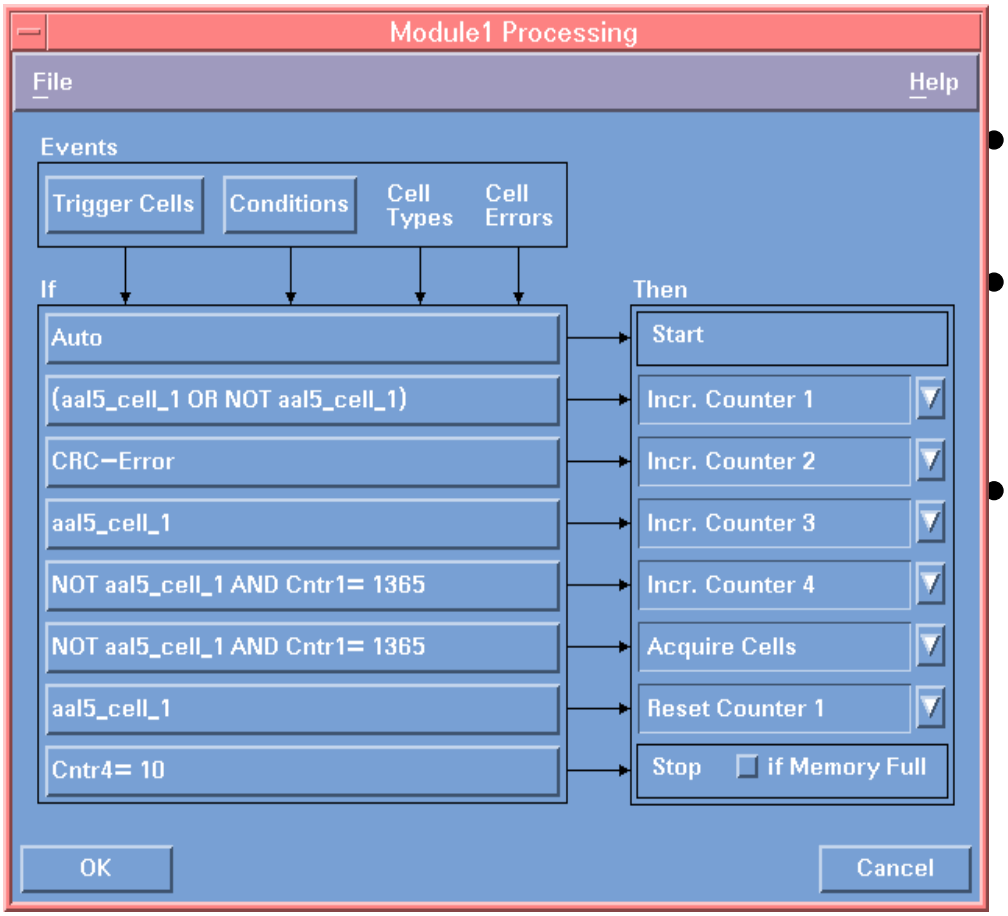
How to generate AAL 5 on E482xA/B system (3)



- Traffic:
  1365 x aal5_cell_0 -> 1x aal5_cell_1
- for generating traffic with variable bit rate (VBR), the traffic profile 'Periodic Burst' is used. This provides a constant time between bursts. A further traffic profile 'Random Burst' is available, for randomized time between bursts.

H

How to analyze AAL 5 on E482xA/B system (1)



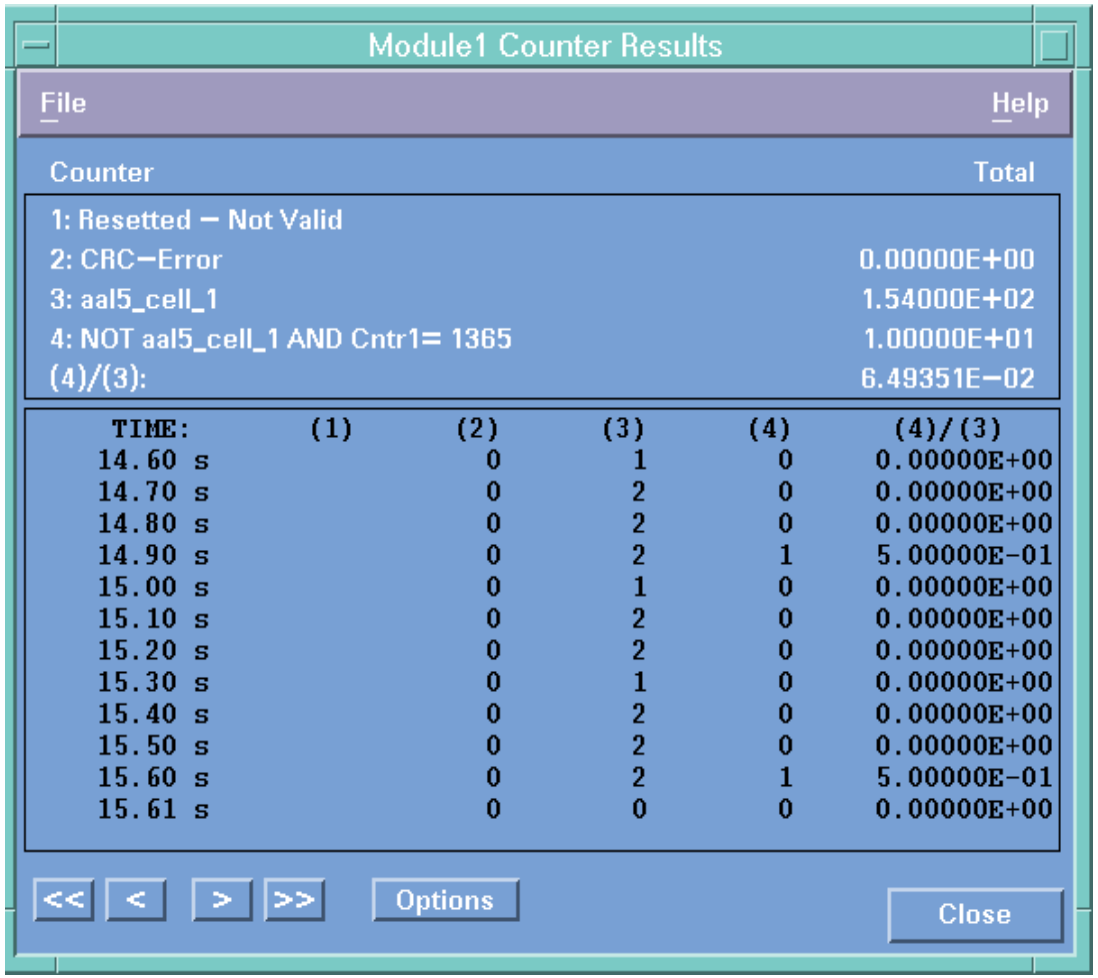
- Processing setup for Cell Error Measurement and Cell Loss:

- copy TX cells to RX, define both cells to be a Trigger Cell
- counter 1 counts all cells, counter 2 counts cells with bad CRC, so: CER=cnt_2/cnt_1
- counter 3 counts all 'aal5_cell_1' cells, counter 4 counts whenever there is a different cell than 'aal5_cell_1' cell, so: Cell_Loss_Ratio=cnt_4/cnt_3. Whenever there is a different cell than expected, it will also be stored in the acquisition.

H

BID PL24 AAL_TEST.pre
May96 rainer pl Rev. 2.3

How to analyze AAL 5 on E482xA/B system (2)



- Results:
- counter 2 counts any CRC Errors
- counter 4 counts whenever cell 'aal5_cell_1 is not in the cell sequence when expected
- counter 3 counts whenever cell 'aal5_cell_1' occurs
- cnt4/cnt3 gives a ratio for loss of cell 'aal5_cell_1'

H