ANT-20SE
Advanced Network Tester

Extended Overhead Analysis STM-1 Mappings

BN 3060/90.01

Extended Overhead Analysis STS-1 Mappings

BN 3060/90.02

Drop&Insert

BN 3060/90.10
in combination with
STM-1/STS-1 Mappings

Software Version 7.20

Operating Manual

BN 3060/98.39

WAVETEK
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Communications Test Solutions

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Contents

Notes:

Introduction

1 Functions

The “Extended Overhead Analysis” option provides further useful functions for your ANT-20SE:

- Recording of selected Section Overhead (SDH) or Transport Overhead (SONET) bytes.
- Recording of selected Low or High Path Overhead (POH) bytes.
- Recording of TCM protocols (Tandem Connection Monitoring) in the N1 / Z6 byte (SONET) or N1 / N2 byte (SDH).
- Monitoring of TCM alarms in a separate display window.
- Error count of TCM measured values:
  - TC-IEC
  - TC-Diff (B3-IEC or BIP2-IEC)
  - TC-REI
  - TC-OEI
- Measurement of the circuit switching or dead time when Automatic Protection Switching (APS) is used.

This allows you to check simply if the APS protocol is adhered to and that the maximum permitted switching time is not exceeded.

To simplify this task, the APS codes are output in plain text when bytes K1 and K2 of the overhead are recorded.

You can also specify maximum value for the APS switching time, to provide a simple PASSED or FAILED result immediately after the measurement.

The TCM function allows you to investigate the TCM protocols received and carry out an error count and alarm monitoring.

The settings required are made using the optional dialog windows of the following virtual instruments:

- Signal Structure (APS)
- Overhead Analyzer (recording overhead bytes)

Notes:

Operation

1 Recording selected bytes (Overhead Capture)

1.1 Function

The “Capture” function is opened from the “Overhead Analyzer” window. After the byte has been selected using the cursor, the “Capture” dialog is opened using the Capture menu command.

The “Capture” function can record a single byte or two bytes simultaneously if bytes K1 and K2 are recorded.

A trigger condition is set to start the recording. When this trigger condition occurs, the instrument records all changes in the selected byte. The record includes timestamps and the contents of the byte.

If you set N1/N2 or N1/Z6 as the trigger condition, the function will look for the TCM FAS word. When it is detected, all bytes will be captured (not just the change). This allows you to capture and display complete 76 byte protocols.

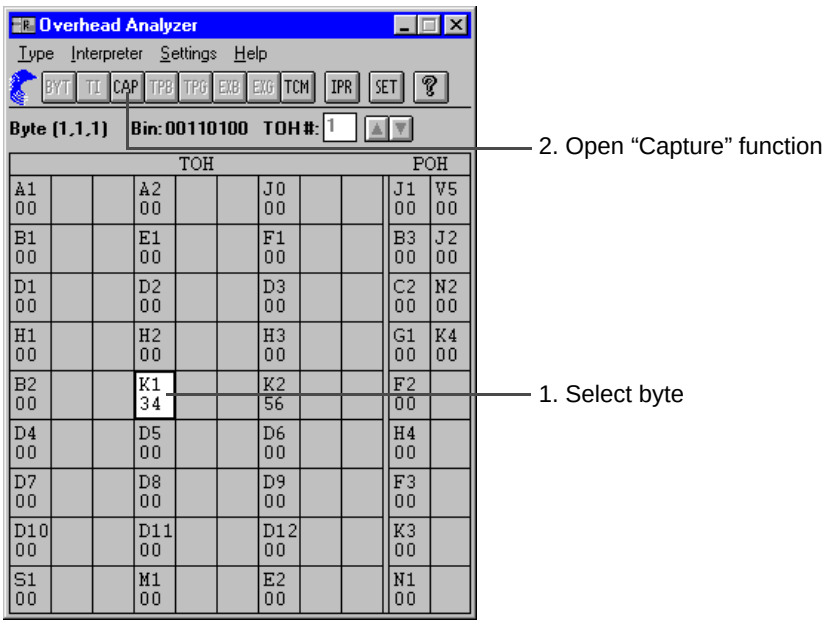

Fig. O-1 “Overhead Analyzer” window with “CAP” action button (option BN 3035/90.15)

Basic procedure

✓ Open the “Overhead Analyzer” window.
✓ Set a SDH or SONET signal structure.

1. Mark the required overhead byte, e.g. K1.
2. Click on the “CAP” button.
   The “Byte Capture” dialog opens.

1.2 The “Byte Capture” dialog

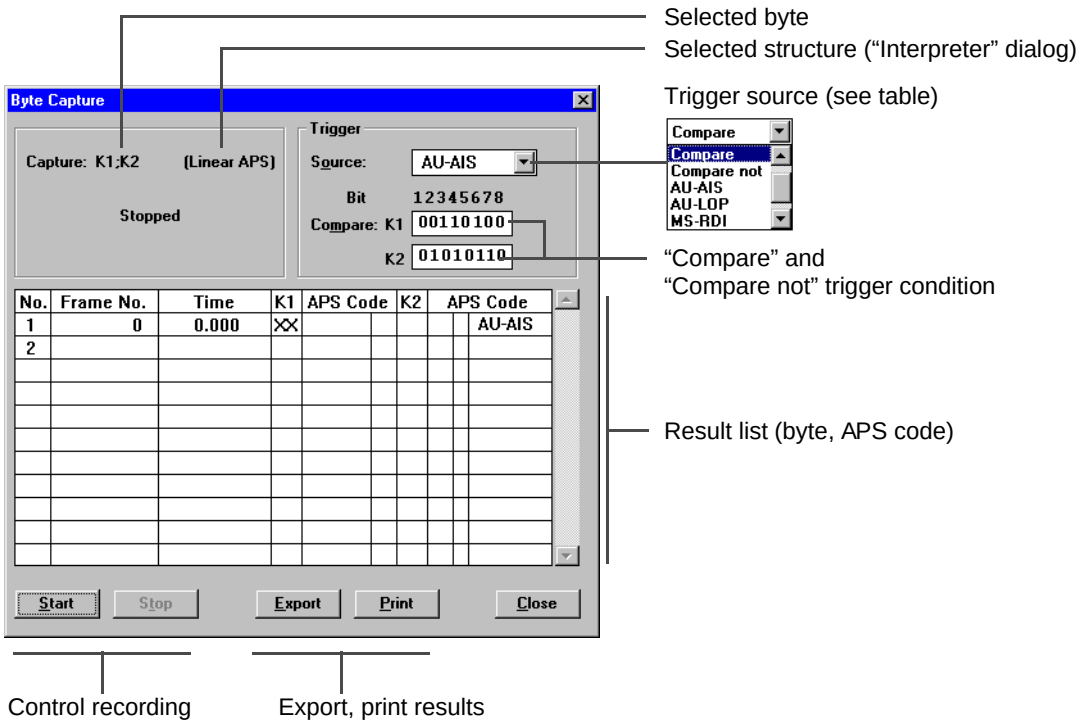

Fig. O-2 “Byte Capture” dialog of the “Overhead Analyzer” window

1.2.1 Setting the trigger conditions

The event that triggers the recording is set from the ‘Source’ list box:

Setting		Start condition
Manual		Immediately after START.
Compare		The content of the selected byte must agree with the compare value. Don’t care values can be set with ‘X’.
Compare not		Inverse of the Compare condition. The record starts when the value no longer agrees with the compare value.
AU-AIS	AIS-P	Start when AU-AIS or AIS-P occurs.
AU-LOP	LOP-P	Start when AU-LOP or LOP-P occurs.
MS-RDI	RDI-L	Start when MS-RDI or RDI-L occurs.
MS-AIS	AIS-L	Start when MS-AIS or AIS-L occurs.
N1/N2-TCM	N1/Z6-TCM	Starts recording TCM frames when the TCM FAS word has occurred (Tandem Connection Monitoring). Requirement: The N1/N2 or N1/Z6 byte is activated for Tandem Connection Monitoring.

Table O-1 Events available from the “Source” list box

1.3 Recording results

1.3.1 Recording K1, K2 bytes, APS channel

⇒ Click the “START” button to prepare to start the recording.
The record starts as soon as the pre-set trigger condition occurs.
The changes in the selected byte are recorded frame by frame with timestamp.

Ending the recording

⇒ Recording stops automatically when the buffer is full (max. 200 items)
– or –
⇒ Click the “STOP” button.

Result display

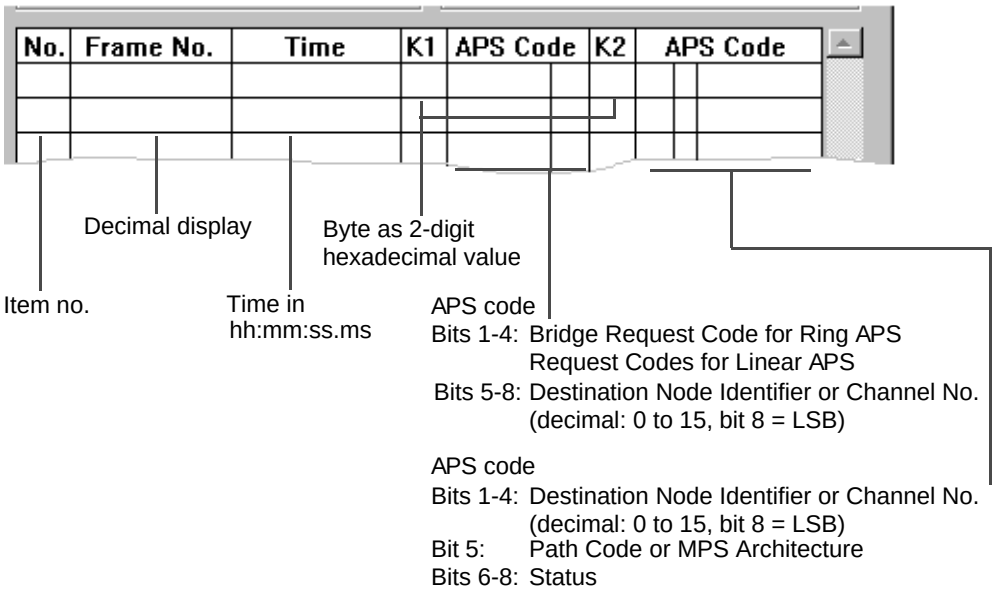

Fig. O-3 APS channel results display in “Byte Capture” dialog window

Example

No.	Frame No.	Time	K1	APS Code		K2	APS Code		
1	0	00:00:00.000		SD-R	0	00	0	0	Idle
2	16000	00:00:02.000	82	SD-R	2	00	0	0	Idle

Fig. O-4 Example result

If alarms occur that prevent further byte capture (e.g. LOF) an additional message is output as follows:

- ALARM BEGIN
- ALARM END

1.3.2 Recording TCM frames

⇒ Click the “START” button to prepare for recording.
Recording starts as soon as the TCM FAS word is detected. Complete TCM frames are captured and displayed. The first eight bytes, which contain the TCM FAS word, are also output.

Ending the recording

⇒ The recording ends automatically when the buffer is full (max. 3.5 complete frames)
– or –
⇒ Click the “STOP” button.

Result display

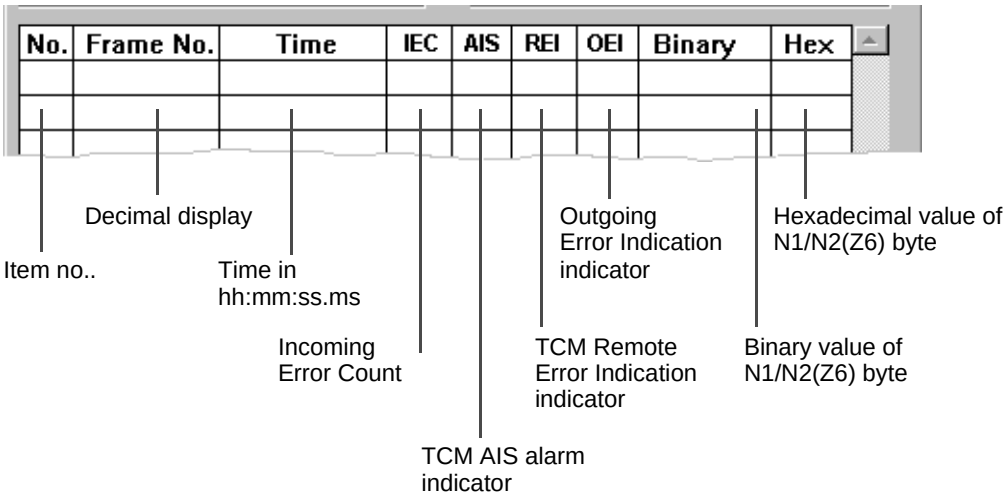

Fig. O-5 TCM frame result display in the “Byte Capture” dialog window

Example

No.	Frame No.	Time	IEC	AIS	REI	OEI	Binary	Hex
1	1	00:00:00.000	0				00000011	03
2	2	00:00:00.000	0		X		00001011	0B
3	3	00:00:00.000	0			X	00000111	07

Fig. O-6 Example result

1.3.3 Recording further SOH/TOH or POH bytes

⇒ Click the “START” button to prepare to start the recording.
The record starts as soon as the pre-set trigger condition occurs.
The changes in the selected byte are recorded frame by frame with timestamp.

Ending the recording

⇒ Recording stops automatically when the buffer is full (max. 265 items)
– or –
⇒ Click the “STOP” button.

Result display

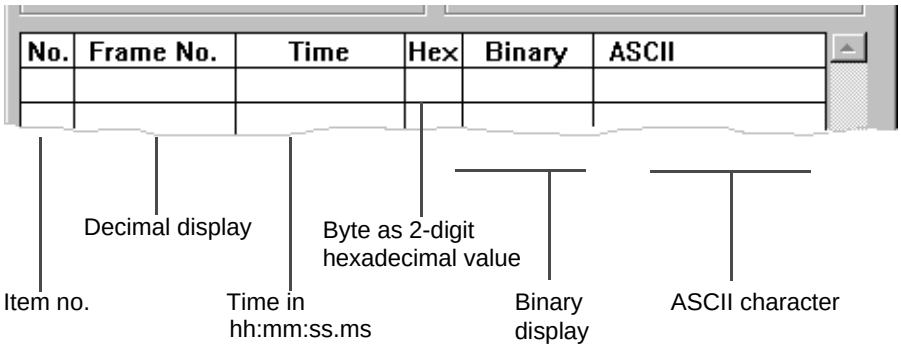

Fig. O-7 Byte capture results in “Byte Capture” dialog window

Example

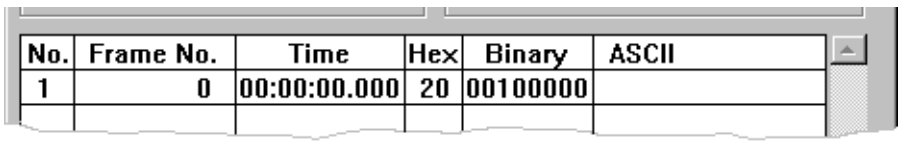

Fig. O-8 Example result

1.3.4 Recording when defects are present

If the defects LOF, LOS and OOF occur, recording is interrupted.

When the defects disappear, recording resumes. The duration of the LOS defect is not measured with frame accuracy.

2 Measuring the APS switching or dead time

2.1 Function

APS stands for Automatic Protection Switching. This is a SDH network function which prevents connections from being interrupted for long periods if a line fails. If a problem occurs on the line, the circuit is automatically switched to a back-up line. The switching time must meet certain criteria. The ANT-20SE checks these criteria by measuring the length of time that a certain event persists (e.g. AIS or loss of test pattern) after APS is triggered. The measured time is compared with a pre-set threshold value. This provides the basis for a simple PASSED / FAILED assessment.

“APS” measurement is invoked from the “Signal Structure” window.

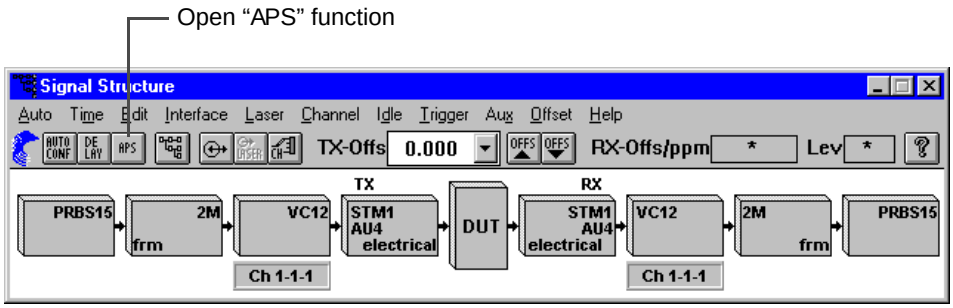

Fig. O-9 “Signal Structure” window with “APS” button (option BN 3035/90.15)

Basic procedure

✓ Open the “Signal Structure” window.

⇒ Click on the “APS” button.
The “APS Tester” dialog opens.

2.2 The “APS Time Measurement” dialog

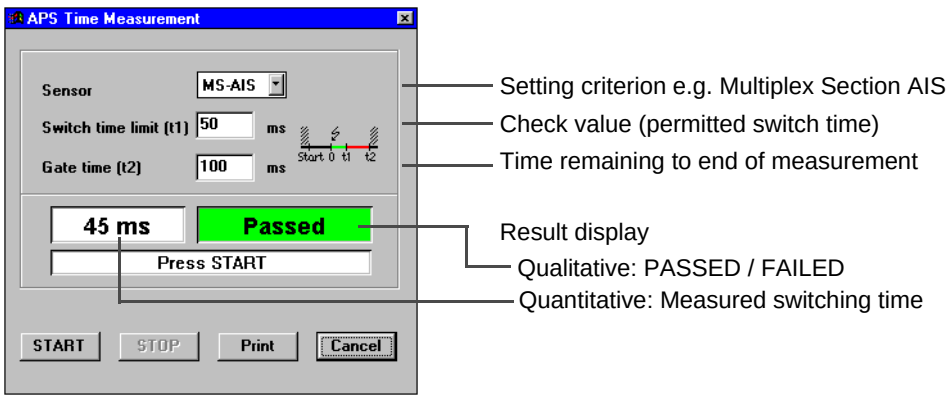

Fig. O-10 “APS Time Measurement” dialog

2.2.1 Setting the switch event

The event to be used to trigger switching and to be measured is set from the “Sensor” list box.

- MS-AIS measures the duration of a Multiplex Section Alarm.
- TSE measures the duration of loss of test pattern (PRBS).

Tip: If the sensor criterion is already present at the start of the measurement, the switching time cannot be measured. To correctly detect loss of test pattern (Sensor = TSE) the base error rate of the path should not exceed $2*10^{-4}$.

Switch time limit (t1): Setting the check value

The measured switching time is compared with the ‘Switch Time Limit’ value on completion of the measurement. If the measured value is lees than or equal to the limit, the result is PASSED. Otherwise the result is FAILED.

Gate time (t2): Setting the measurement time

The measurement begins when the sensor event first occurs. It ends when the pre-set measurement time has elapsed. This allows multiple switching to be detected.

Result and status display

The following are displayed after the end of the measurement:

- Switching time
- Status message

Display	Meaning
PASSED	Measured value ≤ Switch Time Limit
FAILED (Time)	Measured value > Switch Time Limit
FAILED (Signal)	A non-permitted defect occurred during the measurement which blocked the sensor (e.g. LOS or LOF when Sensor = MS-AIS)

Table O-2 Display of test result after evaluation

2.3 Performing an APS measurement

Test setup and description

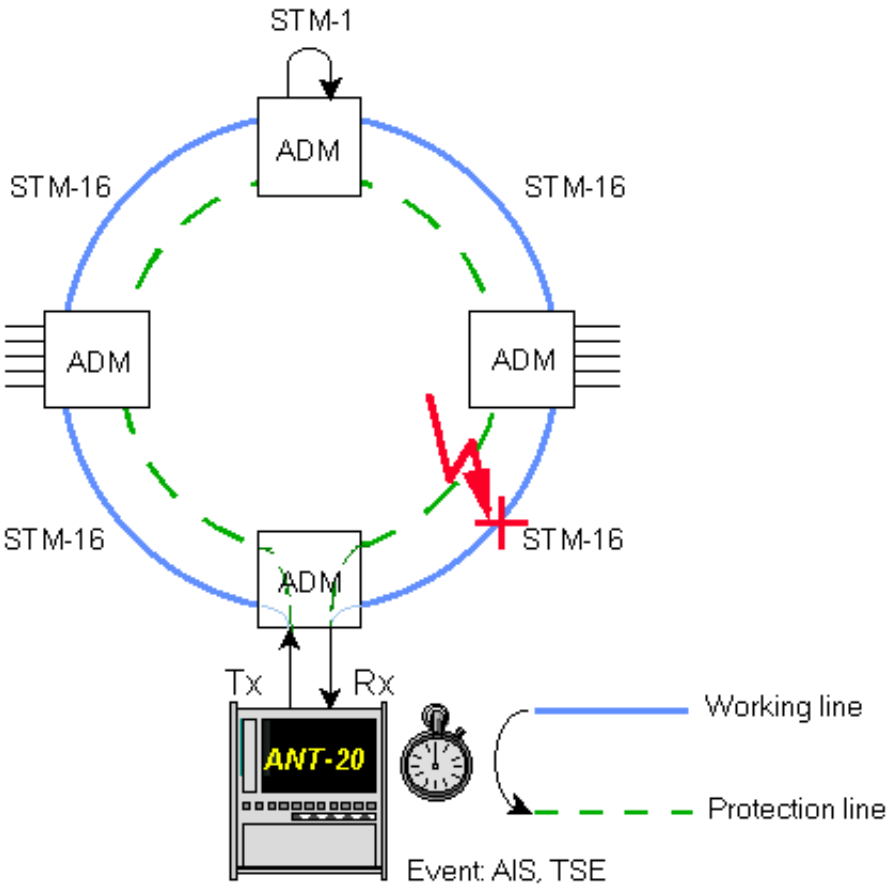

Fig. O-11 APS measurement setup

Interfaces

- Electrical balanced Rx : [12] Tx : [13]
- Electrical unbalanced Rx : [14] Tx : [15]
- Optical 52, 155, 622 Mbit/s Rx : [17] Tx : [18]

VIs required

- Signal Structure

Application settings

⇒ Add the VIs required to the list of VIs used in the Application Manager. The Application Manager should include at least the following instruments:

Fig. O-12 Application Manager after selecting the “Signal Structure” VI

Measurement

Settings

1. Click on the APS icon in the toolbar of the “Signal Structure” VI.
   The “APS Time Measurement” dialog opens.

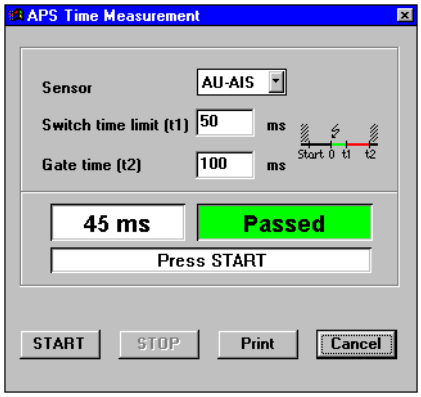

Fig. O-13 “APS Time Measurement” dialog

2. Select an event for triggering the switch operation from the “Sensor” list box.
3. Set the threshold value for the maximum switching time in the “Switch time limit (t1)” entry box.
4. Enter the overall measurement time required in the “Gate time (t2)” entry box. This is greater than the threshold value to allow detection of multiple switching.
5. Start the measurement by clicking on the “START” button.
6. Induce the switching condition, e.g. by interrupting the working line.
7. The measurement stops automatically.

Analysis

Two results are displayed after the measurement ends:

- The overall duration of the event selected from the “Sensor” list box.
- Interpretation of the measured value (see Tab. 2).

Notes:

Specifications Extended Overhead Analysis

1 Overhead Capture

Function

The Capture function is used to record one byte of the SOH/TOH (or two bytes simultaneously when recording K1, K2) or one byte of the low/high path POH.

Capture bytes

STS-1,STM-0,STM-1,STS3,STS3c . . . . . all SOH/TOH/POH bytes
STM-4, STM-16[1] . . . . . all SOH #1 bytes
except A1, A2, B1
all POH bytes

OC-12, OC-48[1] . . . . . all TOH #1 bytes
except A1, A2, B1
all POH bytes

Buffer length . . . . . 265 bytes for single byte recording
200 bytes for double byte recording
Triggering . . . . . recording starts manually or
when trigger condition occurs

1 STM-16, OC-48: ANT-20SE

Trigger events

Alarms . . . . . .MS-AIS (AIS-L),
AU-AIS (AIS-P),
MS-RDI (RDI-L)
AU-LOP (LOP-P)
Compare/Compare not . . . . . occurrence of a certain value in the capture byte or
non-occurrence of this value
(don't care values also possible)
N1/N2 - TCM (N1/Z6 - TCM) . . . . . all bytes including the detected FAS bytes are
recorded when the TCM FAS word is detected

Resolution . . . . . frame
Time display . . . . . frame number,
hh:mm:ss.ms
Maximum recording time . . . . . 99 h
Result display . . . . . number, frames since trigger,
time elapsed since trigger,
byte value in hexadecimal,
binary and ASCII codes,
plain text for K1, K2 (APS)

2 APS switching time measurement

Sensor selection . . . . . MS-AIS, AU-AIS, TU-AIS, TSE, AIS-L, AIS-P, AIS-V
Resolution . . . . . 1 ms
Measurement error . . . . . (see Tab. S-1)
Minimum detectable switching time . . . . . 125 µs
Maximum measurable switching time . . . . . 2 s
Maximum permitted base BER for TSE sensor 2 E-4

Hierarchy	**Sensor**	**Maximum error**
SDH	MS-AIS, AU-AIS, TU-AIS	± 1 ms
SONET	AIS-L, AIS-P, AIS-V	± 1 ms
PDH unframed	BE	± 2 ms
PDH framed	TSE	± 2 ms + T_{sync} [1]
DSn unframed	TSE	± 2 ms
DSn framed	TSE	± 2 ms + T_{sync} [1]

1 T_{sync} is the frame synchronization time included in the measurement

Table S-1 Maximum measurement error

Hierarchy	**T_{sync} (typ.)**
E4 (140 Mbit/s)	0.1 ms
E3 (34 Mbit/s)	0.1 ms
E2 (8 Mbit/s)	1 ms
E1 (2 Mbit/s)	2 ms
DS3 (45 Mbit/s)	6 ms
DS1 SF (1.5 Mbit/s)	3 ms
DS1 ESF (1.5 Mbit/s)	6 ms

Table S-2 Typical values of T_{sync}

Specifications STM-1 Mappings

These specifications apply to the options:

STM-1 Mapping

for ETSI tributaries

C-12 (2 Mbit/s in STM-1, AU-3/AU-4). . . . . .BN 3035/90.01
C-3 (34 Mbit/s in STM-1, AU-3/AU-4). . . . . .BN 3035/90.02
C-4 (140 Mbit/s in STM-1) . . . . . .BN 3035/90.03
C-2 (6 Mbit/s, unframed, in STM-1, AU-3/AU-4). . . . . .BN 3035/90.06

for ANSI tributaries

C-11 (1,5 Mbit/s in STM-1, AU-3/AU-4, TU-11/TU-12) . . . . . .BN 3035/90.04
C-3 (45 Mbit/s in STM-1, AU-3/AU-4). . . . . .BN 3035/90.05

Drop & Insert . . . . . .BN 3035/90.20

1 STM-1 Mapping

1.1 General information

Mapping/Demapping

The PDH tributaries are mapped into a STM-1 signal via the AU-4 or the AU-3 layer.

Container contents for all mapping options:

- Framed or unframed PDH test signal in one selected container
  (6 Mbit/s, unframed only)
- PDH multiplex signal in one selected container
  (together with Mux/Demux Chain 64k/140M or M13 option)
- Filling one selected container with a test pattern without justification bits
  (Bulk Signal to O.181)

Drop & Insert

An additional Drop & Insert Option (BN 3035/90.20) for dropping or inserting tributary signals (via sockets) is available in conjunction with the mapping options.

1.2 Tributary channel numbering

TU-3	TU-2	TU-12	TU-11	TS #
100	110	111	111	1
		112	112	22
		113	113	43
			114	64
	120	121	121	4
		122	122	25
		123	123	46
			124	67
	130	131	131	7
		132	132	28
		133	133	49
			134	70
	140	141	141	10
		142	142	31
		143	143	52
			144	73
	150	151	151	13
		152	152	34
		153	153	55
			154	76
	160	161	161	16
		162	162	37
		163	163	58
			164	79
	170	171	171	19
		172	172	40
		173	173	61
			174	82

TU-3	TU-2	TU-12	TU-11	TS #
200	210	211	211	2
		212	212	23
		213	213	44
			214	65
	220	221	221	5
		222	222	26
		223	223	47
			224	68
	230	231	231	8
		232	232	29
		233	233	50
			234	71
	240	241	241	11
		242	242	32
		243	243	53
			244	74
	250	251	251	14
		252	252	35
		253	253	56
			254	77
	260	261	261	17
		262	262	38
		263	263	59
			264	80
	270	271	271	20
		272	272	41
		273	273	62
			274	83

TU-3	TU-2	TU-12	TU-11	TS #
300	310	311	311	3
		312	312	24
		313	313	45
			314	66
	320	321	321	6
		322	322	27
		323	323	48
			324	69
	330	331	331	9
		332	332	30
		333	333	51
			334	72
	340	341	341	12
		342	342	33
		343	343	54
			344	75
	350	351	351	15
		352	352	36
		353	353	57
			354	78
	360	361	361	18
		362	362	39
		363	363	60
			364	81
	370	371	371	21
		372	372	42
		373	373	63
			374	84

Table S-3 Channel numbers to G.707 (relationship between TU and time slot TS #)

1.3 Scrambling/Descrambling

The STS-N signal is scrambled/descrambled as described in ITU-T G.707.

1.4 Overhead generation

1.4.1 Section Overhead (SOH)

Standard Overhead, STM-1 (hex)

SOH										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
1	A1 F6	A1 F6	A1 F6	A2 28	A2 28	A2 28	J0 01	— AA	— AA	
2	B1 XX	— 00	— 00	E1 00	— 00	— 00	F1 00	— 00	— 00	
3	D1 00	— 00	— 00	D2 00	— 00	— 00	D3 00	— 00	— 00	
4a	H1 68	Y 9B	Y 9B	H2 00	— FF	— FF	H3 00	H3 00	H3 00	for AU-4
4b	H1 68	H1 68	H1 68	H2 00	H2 00	H2 00	H3 00	H3 00	H3 00	for AU-3
5	B2 XX	B2 XX	B2 XX	K1 00	— 00	— 00	K2 00	— 00	— 00	
6	D4 00	— 00	— 00	D5 00	— 00	— 00	D6 00	— 00	— 00	
7	D7 00	— 00	— 00	D8 00	— 00	— 00	D9 00	— 00	— 00	
8	D10 00	— 00	— 00	D11 00	— 00	— 00	D12 00	— 00	— 00	
9	S1 00	Z1 00	Z1 00	Z2 00	Z2 00	M1 00	E2 00	— 00	— 00	

Table S-4 SOH contents

XX: Inserted by parity formation (B1, B2)

H1 and H2 depend on the pointer address setting (pointer address = 0 is shown), H3 depends on whether or not a pointer action takes place.

SOH byte contents

- Static bytes: all except B1, B2, H1, H2, H3
- Overhead sequence m, n, p: all except B1, B2, H1, H2, H3
- Trace Identifier (Length = 16 frames with CRC7 formation): J0
- Dynamic bytes filled using PRBS 11: E1, F1, E2
- Dynamic byte groups filled using PRBS 11: D1 to D3, D4 to D12
- Dynamic bytes filled via DCC/ECC interface (V.11): E1, F1, E2
- Dynamic byte groups filled via DCC/ECC interface (V.11): D1 to D3, D4 to D12, K1 to K2

1.4.2 STM-1 error insertion (anomalies)

Error insertion (anomalies) . . . . . B1, B2, B3 parity errors, FAS word errors, MS-REI, HP-REI, bit errors in test pattern (TSE), code errors (single errors only)

Trigger types . . . . . Single or Rate

When Rate triggering is selected a bit error rate is inserted.

Anomaly	**Single**	**Rate[1]**	**Burst m, n (frames)**
FAS	yes	2E-3 to 1E-10	m = 1 to 196000
B1	yes	2E-4 to 1E-10	m = 1 to 196000
B2	yes	2E-3 to 1E-10	m = 1 to 196000
MS-REI	yes	2E-3 to 1E-10	m = 1 to 196000
B3[2]	yes	2E-4 to 1E-10	m = 1 to 196000
HP-REI	yes	2E-4 to 1E-10	m = 1 to 196000
TSE	yes	1E-2 to 1E-8	-
CODE	yes	-	-

1 Mantissa: 1 to 9 (only 1 for TSE), exponent: -1 to -10 (whole numbers)
2 Static error insertion, can be edited using an 8-bit mask (x = don't care, 1 = insert error)

Table S-5 Available anomalies (STM-1) and trigger modes

The insertion of **errors** (anomalies) **and alarms** (defects) are mutually exclusive. The first action selected is active. The second action is rejected.

1.4.3 STM-1 alarm generation (defects)

Defect	Test sensor function	Test sensor thresholds	
	On/Off	M in N	|----t1----| |------t2------|
LOS[1]	yes	M = 800 bis 7200 N = 1600 bis 8000	t1 = 0.1 bis 60.0 s t2 = 0.2 bis 600 s
LOF	yes	M = 1 to N - 1 N = 1 to 8000[2]	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
RS-TIM	yes	-	-
MS-AIS	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
MS-RDI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
AU-LOP	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
AU-AIS	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
HP-UNEQ	yes	M = 1N to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
HP-PLM	yes	M = 1N to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
HP-RDI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
HP-TIM	yes	-	-

1 Only in conjunction with an optical interface
2 Included in mainframe (no option required)

Table S-6 Available defects (STM-1)

The insertion of **alarms** (defects) **and errors** (anomalies) are mutually exclusive. The first action selected is active. The second action is rejected.

1.4.4 Pointer action generation

Stimulation

Pointer sequences

On all pointer levels to ITU-T G.783

T1, T4: 0.25 ms to 600 s . . . . . (2 to 4800000 frames)

T2, T3: 0.25 ms to 10 s . . . . . (2 to 80000 frames)

T5: 0 ms to 600 s. . . . . (0 to 4800000 frames)

n: 1 to 2000

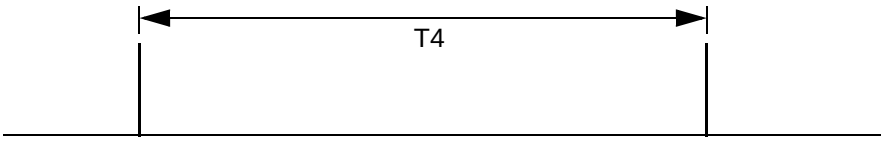

Fig. S-1 Perodic (single/multiple) pointers with identical polarity

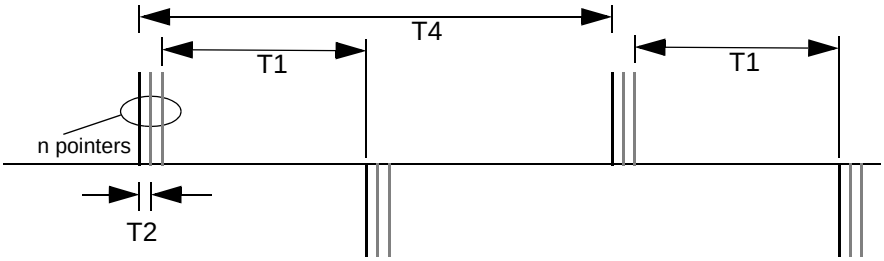

Fig. S-2 Periodic (single/multiple) pointers with different polarity

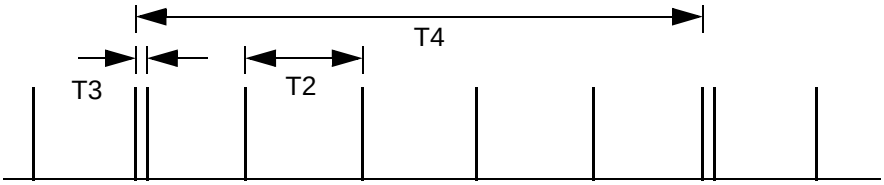

Fig. S-3 Periodic pointers with one double pointer

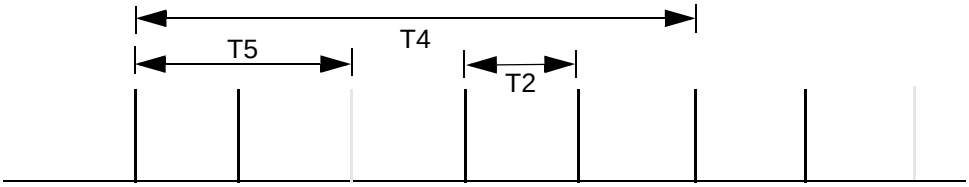

Fig. S-4 Periodic pointers with one missing pointer

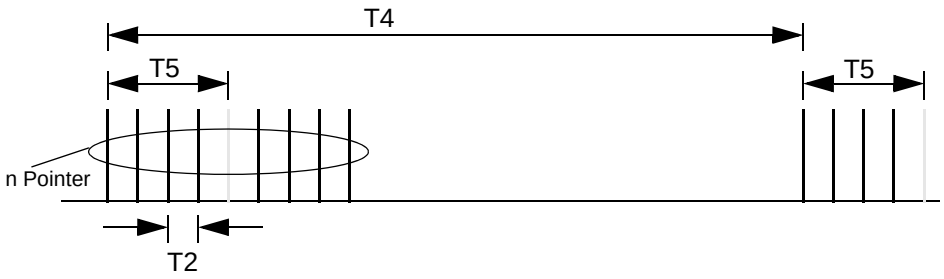

Fig. S-5 Pointer burst with missing pointers

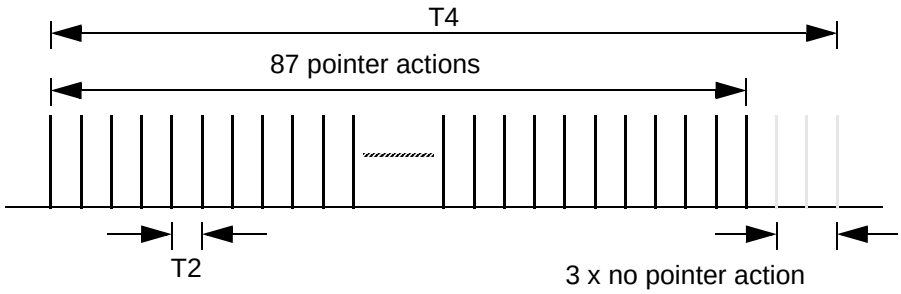

Fig. S-6 ”87-3” sequence

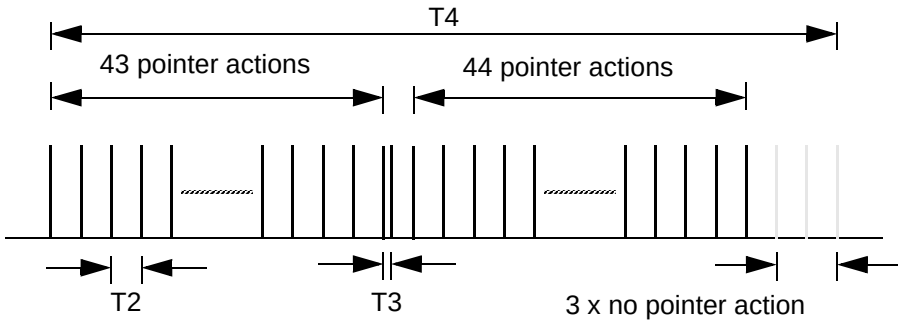

Fig. S-7 ”43-44” sequence with double pointer

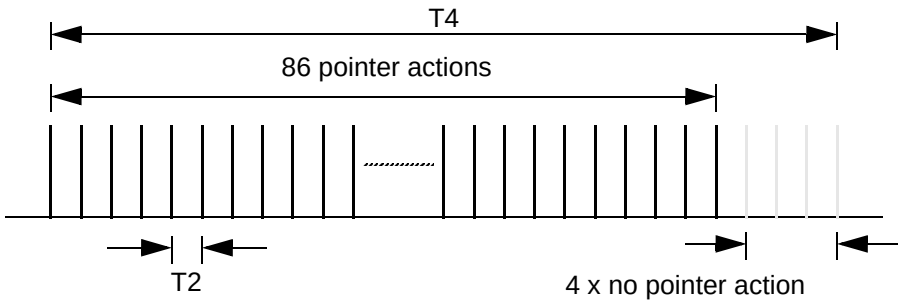

Fig. S-8 ”86-4” sequence with missing pointer

Pointer jumps

Pointer jump from pointer value A to pointer value B (also setting a new pointer).

Pointer jumps are executed with NDF.
Pointer range A + B:

AU-4/AU-3 pointer	0 to 782
TU-3 pointer	0 to 764
TU-2 pointer	0 to 427
TU-12 pointer	0 to 139
TU-11 pointer	0 to 103

1.4.5 STM-1 error measurements (anomalies)

Evaluation

All errors (anomalies) are counted simultaneously and stored.

Gate times . . . . . 1 to 99 seconds
or 1 to 99 minutes
or 1 to 99 hours
or 1 to 99 days

Intermediate results . . . . . 1 to 99 seconds
or 1 to 99 minutes

Display

of anomalies via LEDs:

CURRENT LED (red) is on when the anomaly is present

HISTORY LED (yellow) is on if the anomaly has occurred at least once during the current measurement interval.

Display of errors as count or ratio values (equivalent bit error ratio): When calculating the ratio value, correction formulae are used for the anomalies B1, B2, B3 and BIP-2 as well as MS-REI, HP-REI and LP-REI. These take into account that a multiple error in the same bit can lead to clearance of the error.

Anomaly	**LED**
OOF -155	LOF/OOF
FAS-155	-
B1	B1/B2
B2	B1/B2
MS-REI	-
B3	B3
HP-REI	-
CRC-4	FAS/CRC
E-Bit	-
TSE	TSE
CODE	-

Table S-7 LED display of possible anomalies (STM-1)

1.4.6 STM-1 alarm detection (defects)

Evaluation

All alarms (defects) which occur are evaluated simultaneously where possible and stored. Storage takes place only within a started measurement interval.

Time resolution of defects . . . . . 100 ms

Display

of defects via LEDs:

CURRENT LED (red) is on when the defect is present

HISTORY LED (yellow) is on if the defect has occurred at least once during the current measurement interval.

Defect	**LED**
LOS	LOS
LOF-155	LOF/OOF
RS-TIM	-
MS-AIS	MS-AIS
MS-RDI	MS-RDI
AU-LOP	AU-LOP
AU-AIS	AU-AIS
HP-UNEQ	HP-UNEQ
HP-PLM	HP-PLM
HP-RDI	HP-RDI
HP-TIM	-
LSS	LSS

Table S-8 LED display of possible defects (STM-1)

1.4.7 Measurement of AU and TU pointer actions

Evaluation

All pointers in the selected path are shown as absolute values and the direction and number of pointer movements is detected and counted.

NDF (New Data Flag) is recorded and counted.

Display

of:

- Number of pointer operationsseparated for AU and TU pointer:
  Increments, decrements, sum of increments + decrements,
  difference of increments - decrements
- Pointer address
- Number of NDF events
- Corresponding clock deviation
- AU-NDF and TU-NDF can be indicated by the LED display (front panel)
  (Application Manager - “Configuration” menu - LED Display ...):
  – the “AU-LOP/LOP-P” LED indicates “AU-NDF” in addition to “AU-LOP”
  – the “TU-LOP/LOP-V” LED indicates “TU-NDF” in addition to “TU-LOP”

Absolute pointer values, increments, decrements, sum of increments + decrements and NDF are displayed as a histogram with selectable time resolution in seconds, minutes, hours or days.

Printout

Absolute pointer values, increments, decrements, sum of increments + decrements and NDF are printed out as a table with 1 second time resolution.

1.4.8 VC-4 Path Overhead (POH), High Order

Standard overhead

POH byte	Option 3035/90.01, Option 3035/90.04, Option 3035/90.06	Option 3035/90.02 and Option 3035/90.05	Option 3035/90.03
J1 (ASCII)	“WG HP-TRACE”		“VC-4 MAPPING” “VC-4 BULK”
B3 (hex)	Inserted by parity formation		
C2 (hex)	“02”	“04”	“12” for MAPPING “FE” for BULK
G1 (hex)	“00”		
F2 (hex)	“00”		
H4 (hex)	“FC”, ”FD”, ”FE”, ”FF” sequence across 4 frames	“FF”	
	48-byte-sequence as G.709		
F3 (hex)	“00”		
K3 (hex)	“00”		
N1 (hex)	“00”		

Table S-9 POH contents

VC-4 POH byte contents

- Static bytes: all except B3, H4
- Overhead sequence m, n, p: J1, C2, G1, F2, F3, K3, N1
- Trace Identifier (Length = 16 frames with CRC7 formation): J1
- Dynamic byte filled using PRBS 11: F2
- Dynamic bytes filled via DCC/ECC interface (V.11): F2, K3, N1
- H4 sequence, switchable, 4/48 byte

1.4.9 VC-3 Path Overhead (POH), High Order

Standard overhead

POH byte	Option 3035/90.01, Option 3035/90.04 and Option 3035/90.06		Option 3035/90.02 and Option 3035/90.05	
	Measured channels	**Fill channels**	**Measured channels**	**Fill channels**
J1 (ASCII)	“WG HP-TRACE”	“WG IDLE”	“VC-3 Mapping” “VC-3 Bulk”	“WG IDLE”
B3 (hex)	Inserted by parity formation			
C2 (hex)	“02”	“02”	“04” for mapping “FE” for bulk	“04”
G1 (hex)	“00”			
F2 (hex)	“00”			
H4 (hex)	“FC”, “FD”, “FE”, “FF” sequence across 4 frames		“FF”	
	48-byte-sequence asG.709			
F3 (hex)	“00”			
K3 (hex)	“00”			
N1 (hex)	“00”			

Table S-10 POH contents

VC-3 POH byte contents

- Static bytes: all except B3, H4
- Overhead sequence m, n, p: J1, C2, G1, F2, F3, K3, N1
- Trace Identifier (Length = 16 frames with CRC7 formation): J1
- Dynamic byte filled using a pseudo-random sequence: F2
- Dynamic bytes filled by DCC/ECC interface (V.11): F2, K3, N1
- H4 sequence, switchable, 4/48 byte

1.4.10 Evaluation of Section Overhead (SOH) and VC-4/VC-3 Path Overhead (POH)

Display

of complete SOH and POH . . . . . hexadecimal
of Trace Identifier J0, J1 . . . . . ASCII, plain text

Evaluation

Bit error measurement

using PRBS 11 (bytes). E1, F1, E2, F2
using PRBS 11 (byte groups) . . . . . D1 to D3, D4 to D12

Output

as bytes via DCC/ECC interface (V.11) E1, F1, E2, F2, K3, N1
as byte groups via DCC/ECC interface (V.11). . . . . D1 to D3, D4 to D12, K1 to K2

1.5 C-12 mapping (2 Mbit/s in STM-1, AU-3/AU-4)

Option: BN 3035/90.01

Mapping structure: AU-4

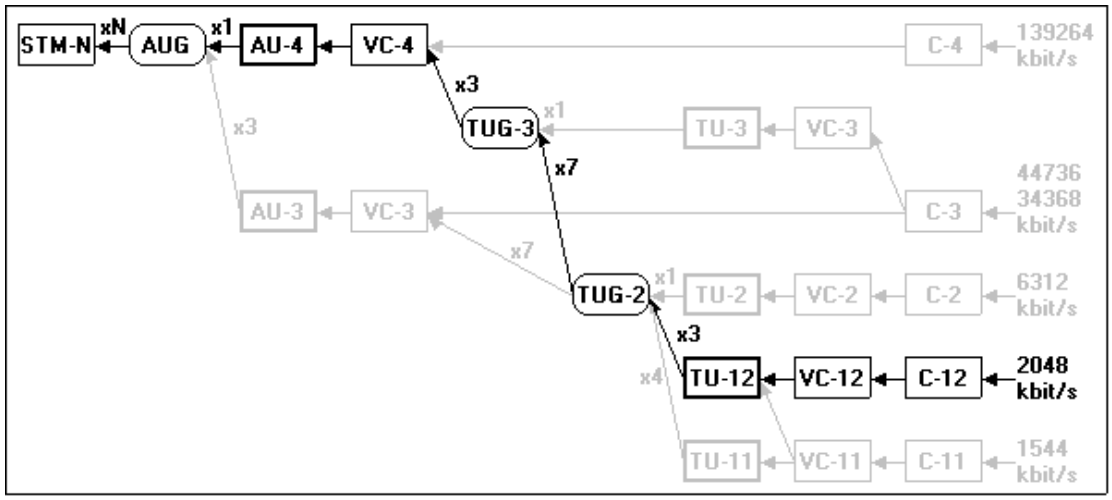

Fig. S-9 Mapping structure: 2 Mbit/s → C-12 → AU-4 → STM-1

Mapping structure: AU-3

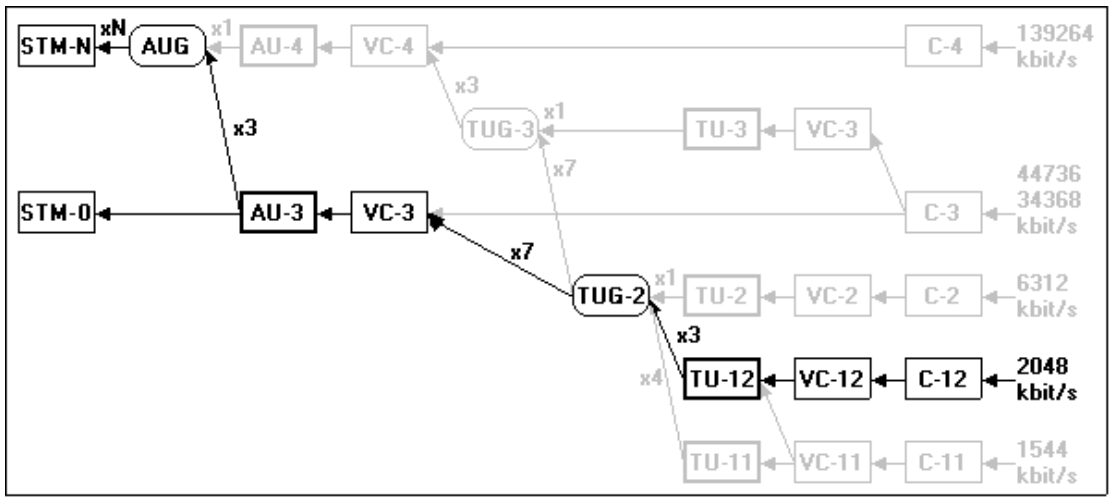

Fig. S-10 Mapping structure: 2 Mbit/s → C-12 → AU-3 → STM-1
Mapping structure: 2 Mbit/s → C-12 → AU-3 → STM-0; option 3035/98.13 required

Mapping method

The following modes are available:

- Asynchronous mode
- Byte-synchronous mode (floating)

1.5.1 VC-12 Path Overhead contents

POH byte	Measurement channel	Filler channels
V5 (binary)		
LP-BIP (bits 1-2)	Inserted by parity formation	Inserted by parity formation
LP-REI (bit 3)	“0”	“0”
LP-RFI (bit 4)	“0”	“0”
Path Label (bit 5-7)	“010” for asynchronous mode “100” for byte-synchronous mode “110” for bulk signal	“010” for asynchronous mode “100” for byte-synchronous mode
LP-RDI (bit 8)	“0”	“0”
J2 (ASCII)	“WG LP-TRACE”	“WG IDLE”
N2 (hex)	“00”	“00”
K4 (hex)	“00”	“00”

Table S-11 VC-12 POH (Standard Overhead) contents

Measurement channel byte contents (VC-12)

- Static bytes: all except bits 1-2 of V5
- Overhead sequence m, n, p: J2, N2, K4
- Trace Identifier (Length = 16 frames with CRC7 formation): J2
- Dynamic bytes filled by DCC/ECC interface (V.11): N2

Filler channel byte contents (VC-12)

Fixed, non-editable as in (see Tab. S-11).

1.5.2 VC-12 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in Sec. 1.4.2, Page S-6:

Anomaly	Single	Rate
BIP-2[1]	yes	2E-4 to 1E-10
LP-REI	yes	2E-4 to 1E-10

1 Static error insertion, can be edited using a 2-bit mask (x = don’t care, 1 = insert error)

Table S-12 Additional available anomalies (VC-12)

Error insertion refers to the selected measurement channel.

1.5.3 VC-12 alarm generation (defects)

The following defects can be generated in addition to the alarm types specified in Sec. 1.4.3, Page S-7:

Defect	**Test sensor function**	**Sensor thresholds**	
	On/Off	M in N	I----t1----I I------t2------I
TU-LOM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-LOP	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-AIS	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-UNEQ	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-PLM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-RDI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-TIM	yes	-	-
LP-RFI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s

Table S-13 Addition available defects (VC-12)

Alarm generation refers to the selected measurement channel.

1.5.4 VC-12 error measurements (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-11:

Anomaly	**LED**
LP-BIP	LP-BIP
LP-REI	-

Table S-14 LED display of additional anomalies (VC-12)

Evaluation and display refer to the selected measurement channel.

1.5.5 VC-12 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in Sec. 1.4.6, Page S-12:

Defect	LED
TU-LOM	TU-LOM
TU-LOP	TU-LOP
TU-AIS	TU-AIS
LP-UNEQ	LP-UNEQ
LP-PLM	LP-PLM
LP-RDI	LP-RDI
LP-TIM	-
LP-RFI	-

Table S-15 LED display of additional alarms (VC-12)

Evaluation and display refer to the selected measurement channel.

1.5.6 VC-12 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J2

Output

- via DCC/ECC interface (V.11): N2

1.6 C-3 mapping (34/45 Mbit/s in STM-1, AU-3/AU-4)

Option: BN 3035/90.02 for 34 Mbit/s
Option: BN 3035/90.05 for 45 Mbit/s

Mapping structure: AU-4

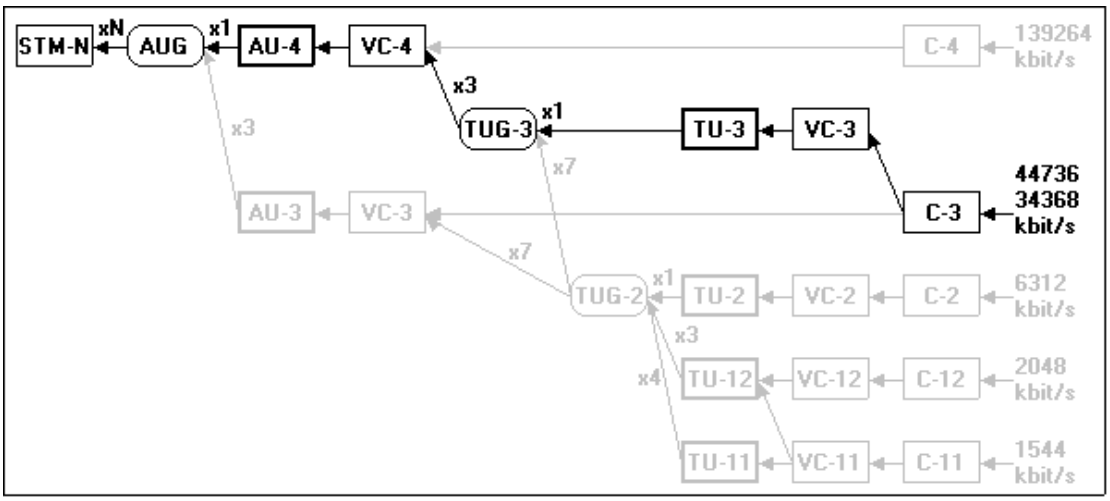

Fig. S-11 Mapping structure: 34/45 Mbit/s → C-3 → AU-4 → STM-1

Mapping structure: AU-3

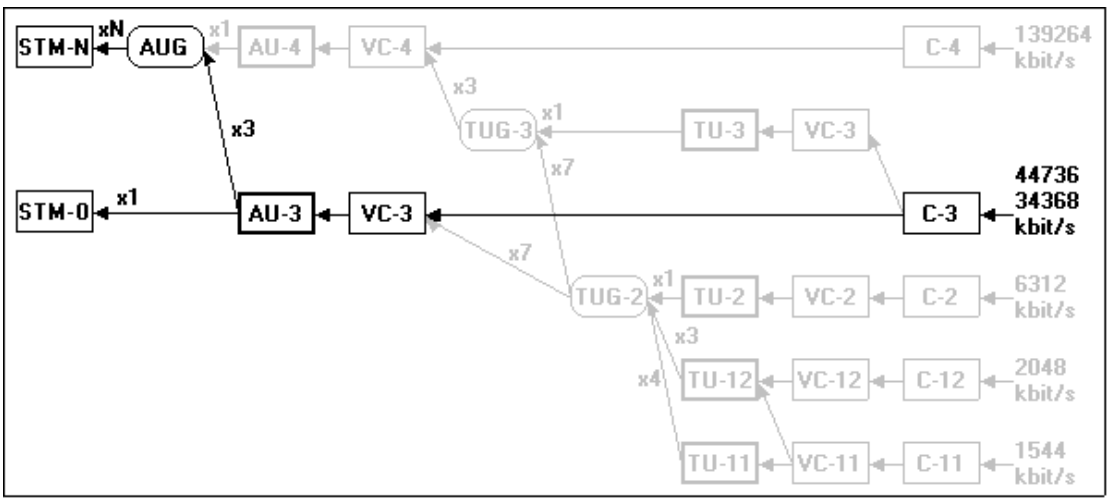

Fig. S-12 Mapping structure: 34/45 Mbit/s → C-3 → AU-3 → STM-1
Mapping structure: 34/45 Mbit/s → C-3 → AU-3 → STM-0;
option 3035/90.12 required

1.6.1 VC-3 Path Overhead contents (Low Order)

POH byte	Measurement channel	Filler channels
J1 (ASCII)	“WG TRACE”	“WG IDLE”
B3 (hex)	Inserted by parity formation	
C2 (hex)	“04” for mapping signal “FE” for bulk signal	“04”
G1 (hex)	“00”	
F2 (hex)	“00”	
H4 (hex)	”FF”	
Z3 (hex)	“00”	
K3 (hex)	“00”	
N1 (hex)	“00”	

Table S-16 VC-3 POH (Standard Overhead) contents

Test channel byte contents (VC-3)

- Static bytes: All except B3, H4
- Overhead sequence m, n, p: J1, C2, G1, F2, F3, K3, N1
- Trace Identifier (Length = 16 frames with CRC7 formation): J1
- Dynamic byte filled using pseudo-random bit sequence: F2
- Dynamic bytes via V.11 interface (V.11): F2, K3, N1

Filler channel byte contents

Fixed, non-editable (see Tab. S-16).

1.6.2 VC-3 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in Sec. 1.4.2, Page S-6:

Anomaly	Single	Rate
LP-B3[1]	yes	2E-4 to 1E-10
LP-REI	yes	2E-4 to 1E-10

1 Static error insertion, can be edited using a 8-bit mask (x = don’t care, 1 = insert error)

Table S-17 Additional available anomalies (VC-3)

Error insertion refers to the selected measurement channel.

1.6.3 VC-3 alarm generation (defects)

The following defects can be inserted in addition to the defects specified in Sec. 1.4.3, Page S-7:

Defect	**Test sensor function**	**Sensor thresholds**	
	On/Off	M in N	I----t1----I I------t2------I
TU-LOP	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-AIS	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-UNEQ	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-PLM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-RDI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-TIM	yes	-	-

Table S-18 Additional available defects (VC-3)

Alarm generation refers to the selected measurement channel.

1.6.4 VC-3 error measurement (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-11:

Anomaly	**LED**
LP-B3	LP-BIP
LP-REI	-

Table S-19 LED display of additional anomalies (VC-3)

Evaluation and display refer to the selected measurement channel.

1.6.5 VC-3 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in Sec. 1.4.6, Page S-12:

Defect	LED
TU-LOP	TU-LOP
TU-AIS	TU-AIS
LP-UNEQ	LP-UNEQ
LP-PLM	LP-PLM
LP-RDI	LP-RDI
LP-TIM	-

Table S-20 LED display of additional defects (VC-3)

Evaluation and display refer to the selected measurement channel.

1.6.6 VC-3 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J1

Output

- Bit error measurement using PRBS 11: F2 (byte)
- Byte output via DCC/ECC interface (V.11): F2, K3, N1

1.7 C-4 mapping (140 Mbit/s in STM-1/STS-3c)

Option BN 3035/90.03

STS-3c see also
Operating Manual “STS-1 mappings”, section “STS-3c SPE mappings”.

Mapping structure

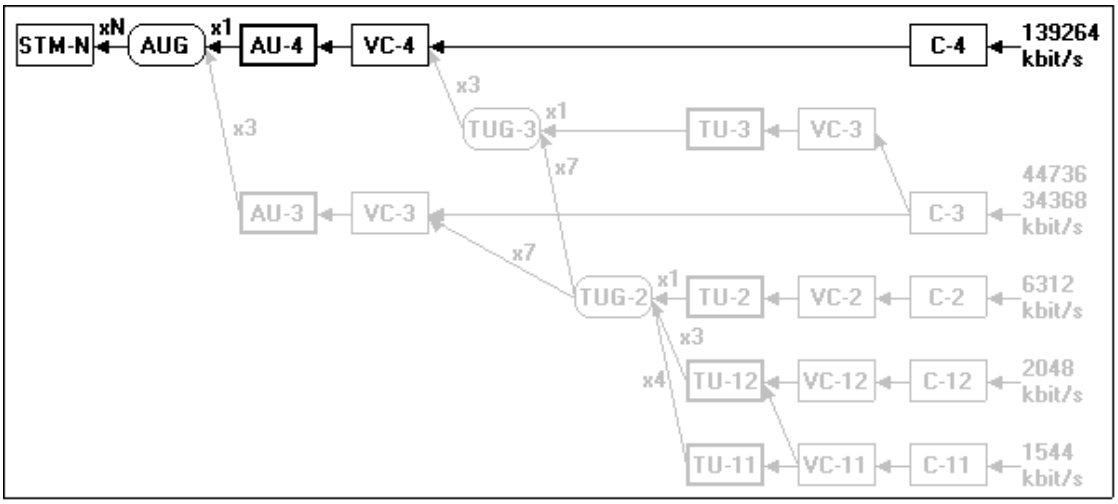

Fig. S-13 Mapping structure: 140 Mbit/s → AU-4 → STM-1

The mapping characteristics are described in Sec. 1.4, Page S-5.

1.8 C-11 mapping (1.5 Mbit/s in STM-1, AU-3/AU-4, TU-11/TU-12)

Option BN 3035/90.04

Mapping structure: AU-3, TU-11

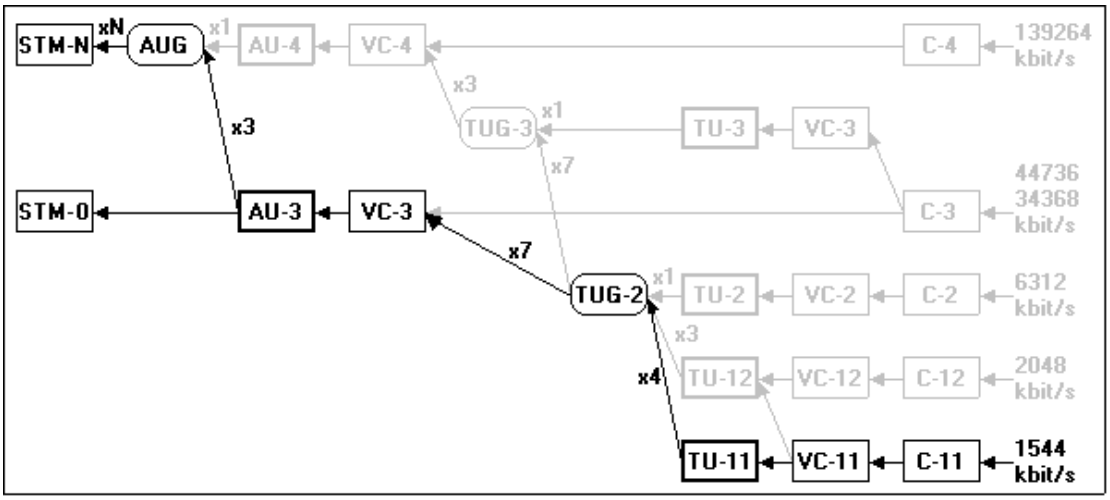

Fig. S-14 Mapping structure: 1.5 Mbit/s → C-11 → TU-11 → AU-3 → STM-1
Mapping structure: 1.5 Mbit/s → C-11 → TU-11 → AU-3 → STM-0;
option 3035/90.10 required

Mapping structure: AU-3, TU-12

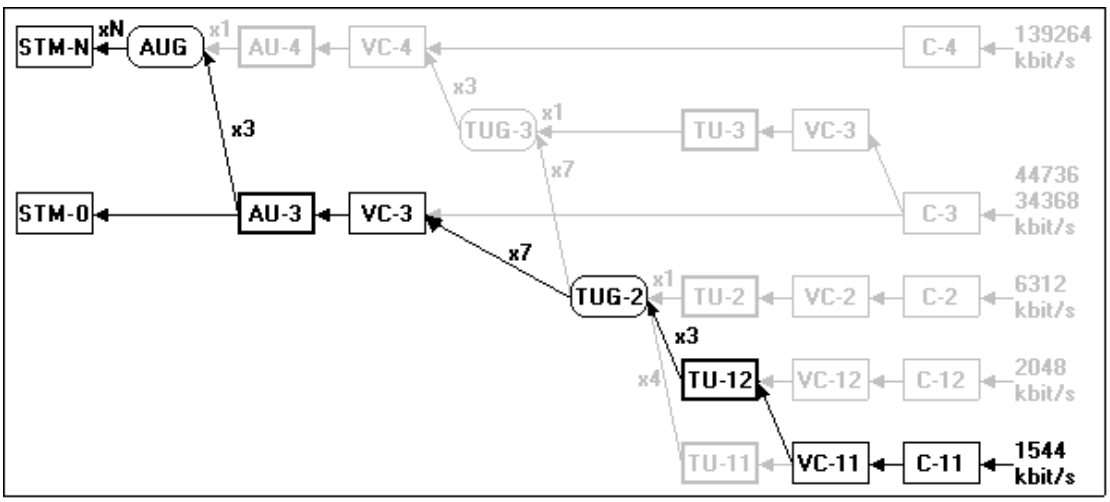

Fig. S-15 Mapping structure: 1.5 Mbit/s → C-11 → TU-12 → AU-3 → STM-1
Mapping structure: 1.5 Mbit/s → C-11 → TU-12 → AU-3 → STM-0;
option 3035/90.10 required

Mapping method

The following modes are available:

- Asynchronous mode
- Byte-synchronous mode (floating); only TU-11

Mapping structure: AU-4, TU-11

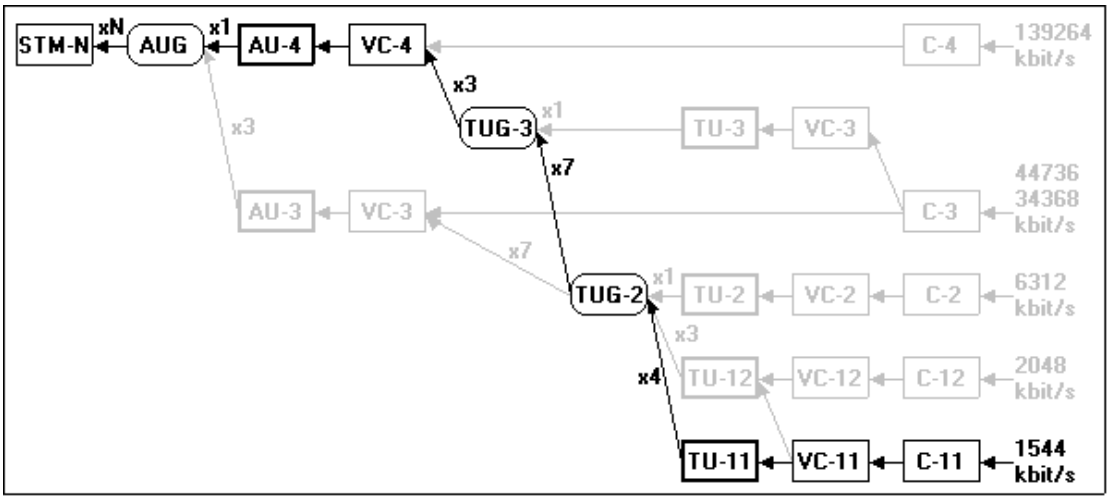

Fig. S-16 Mapping structure: 1.5 Mbit/s → C-11 → TU-11 → AU-4 → STM-1

Mapping structure: AU-4, TU-12

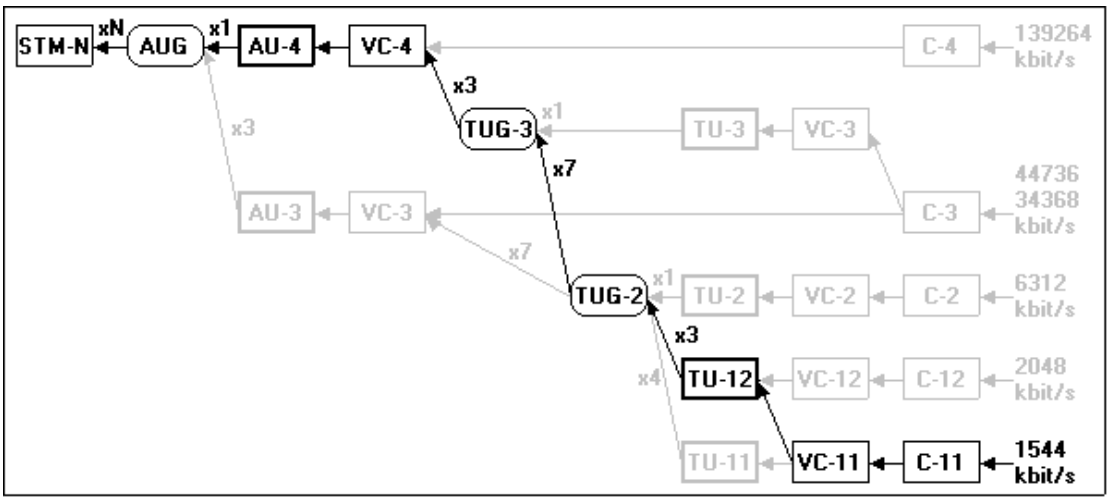

Fig. S-17 Mapping structure: 1.5 Mbit/s → C-11 → TU-12 → AU-4 → STM-1

Mapping method

The following modes are available:

- Asynchronous mode
- Byte-synchronous mode (floating)

1.8.1 VC-11 Path Overhead contents

POH byte	Measurement channel	Filler channels
V5 (binary)		
LP-BIP (bits 1-2)	Inserted by parity formation	Inserted by parity formation
LP-REI (bit 3)	“0”	“0”
LP-RFI (bit 4)	“0”	“0”
Path Label (bit 5-7)	“010” for asynchronous mode “100” for byte-synchronous mode “110” for bulk signal	“010” for asynchronous mode “100” for byte-synchronous mode
LP-RDI (bit 8)	“0”	“0”
J2 (ASCII)	“WG LP-TRACE”	“WG IDLE”
N2 (hex)	“00”	“00”
K4 (hex)	“00”	“00”

Table S-21 VC-11 POH (Standard Overhead) contents

Measurement channel byte contents (VC-11)

- Static bytes: all except bits 1-2 of V5
- Overhead sequence m, n, p: J2, N2, K4
- Trace Identifier (Length = 16 frames with CRC7 formation): J2
- Dynamic bytes via V.11 interface (V.11): N2

Filler channel byte contents (VC-11)

Fixed, non-editable (see Tab. S-21).

1.8.2 VC-11 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in Sec. 1.4.2, Page S-6:

Anomaly	Single	Rate
BIP-2[1]	yes	2E-4 to 1E-10
LP-REI	yes	2E-4 to 1E-10

1 Static error insertion, can be edited using a 2-bit mask (x = don’t care, 1 = insert error)

Table S-22 Additional available anomalies (VC-11)

Error insertion refers to the selected measurement channel.

1.8.3 VC-11 alarm generation (defects)

The following defects can be generated in addition to the alarm types specified in Sec. 1.4.3, Page S-7:

Defect	**Test sensor function**	**Sensor thresholds**	
	On/Off	M in N	I----t1----I I------t2------I
TU-LOM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-LOP	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-AIS	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-UNEQ	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-PLM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-RDI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-TIM	yes	-	-
LP-RFI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s

Table S-23 Additional available defects(VC-11)

Alarm generation refers to the selected measurement channel.

1.8.4 VC-11 error measurements (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-11:

Anomaly	**LED**
LP-BIP	LP-BIP
LP-REI	-

Table S-24 LED display of additional anomalies (VC-11)

Evaluation and display refer to the selected measurement channel.

1.8.5 VC-11 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in Sec. 1.4.6, Page S-12:

Defect	LED
TU-LOM	TU-LOM
TU-LOP	TU-LOP
TU-AIS	TU-AIS
LP-UNEQ	LP-UNEQ
LP-PLM	LP-PLM
LP-RDI	LP-RDI
LP-TIM	-
LP-RFI	-

Table S-25 LED display of additional defects (VC-11)

Evaluation and display refer to the selected measurement channel.

1.8.6 VC-11 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J2

Output

- via DCC/ECC interface (V.11): N2

1.9 C-2 mapping (6.3 Mbit/s in STM-1, AU-3/AU-4, TU-2)

Option BN 3035/90.06

Mapping structure: AU-3, TU-2

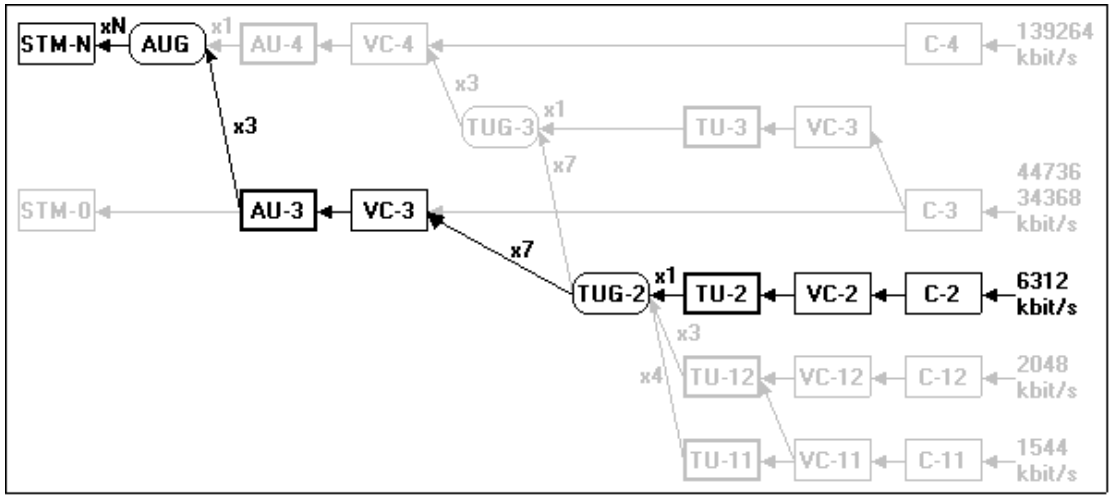

Fig. S-18 Mapping structure: 6.3 Mbit/s → C-2 → TU-2 → AU-3 → STM-1

Mapping method

The following mode is available:

- Asynchronous mode

Mapping structure: AU-4, TU-2

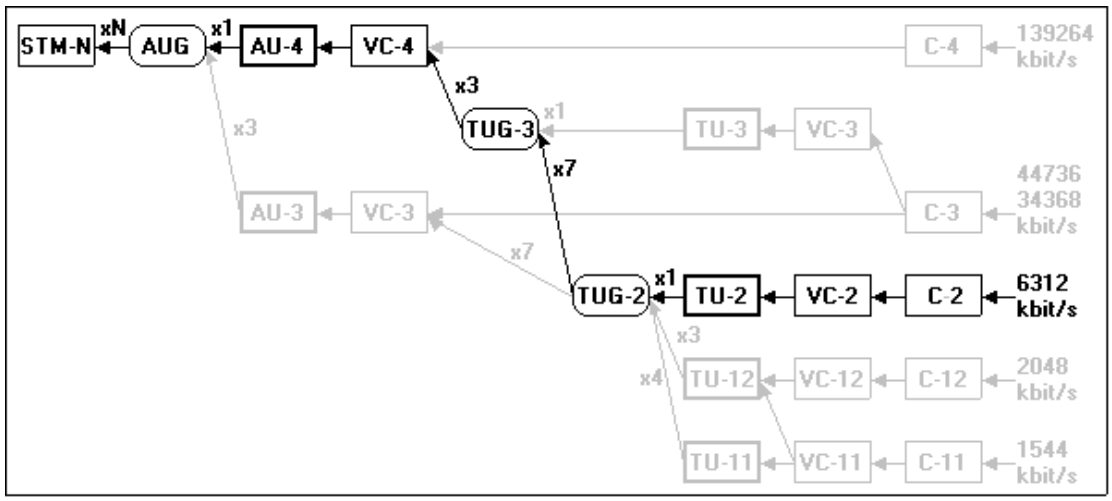

Fig. S-19 Mapping structure: 6.3 Mbit/s → C-2 → TU-2 → AU-4 → STM-1

Mapping method

The following mode is available:

- Asynchronous mode

1.9.1 VC-2 Path Overhead contents

POH byte	Measurement channel	Filler channels
V5 (binary)		
LP-BIP (bits 1-2)	Inserted by parity formation	Inserted by parity formation
LP-REI (bit 3)	“0”	“0”
LP-RFI (bit 4)	“0”	“0”
Path Label (bit 5-7)	“010” for asynchronous mode “110” for bulk signal	“010” for asynchronous mode
LP-RDI (bit 8)	“0”	“0”
J2 (ASCII)	“WG LP-TRACE”	“WG IDLE”
N2 (hex)	“00”	“00”
K4 (hex)	“00”	“00”

Table S-26 VC-2 POH (Standard Overhead) contents

Measurement channel byte contents (VC-2)

- Static bytes: all except bits 1-2 of V5
- Overhead sequence m, n, p: J2, N2, K4
- Trace Identifier: J2 (Length = 16 frames with CRC7 formation)
- Dynamic bytes via V.11 interface (V.11): N2

Filler channel byte contents (VC-2)

Fixed, non-editable (see Tab. S-26).

1.9.2 VC-2 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in Sec. 1.4.2, Page S-6:

Anomaly	Single	Rate
BIP-2[1]	yes	2E-4 to 1E-10
LP-REI	yes	2E-4 to 1E-10

1 Static error insertion, can be edited using a 2-bit mask (x = don’t care, 1 = insert error)

Table S-27 Additional available anomalies (VC-2)

Error insertion refers to the selected measurement channel.

1.9.3 VC-2 alarm generation (defects)

The following defects can be generated in addition to the alarm types specified in Sec. 1.4.3, Page S-7:

Defect	Test sensor function	Sensor thresholds	
	On/Off	M in N	I----t1----I I------t2------I
TU-LOM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-LOP	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TU-AIS	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-UNEQ	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-PLM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-RDI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LP-TIM	yes	-	-
LP-RFI	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s

Table S-28 Additional available defects (VC-2)

Alarm generation refers to the selected measurement channel.

1.9.4 VC-2 error measurements (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-11:

Anomaly	LED
LP-BIP	LP-BIP
LP-REI	-

Table S-29 LED display of additional anomalies (VC-2)

Evaluation and display refer to the selected measurement channel.

1.9.5 VC-2 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in Sec. 1.4.6, Page S-12:

Defect	LED
TU-LOM	TU-LOM
TU-LOP	TU-LOP
TU-AIS	TU-AIS
LP-UNEQ	LP-UNEQ
LP-PLM	LP-PLM
LP-RDI	LP-RDI
LP-TIM	-
LP-RFI	-

Table S-30 LED display of additional defects (VC-2)

Evaluation and display refer to the selected measurement channel.

1.9.6 VC-2 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J2

Output

- via DCC/ECC interface (V.11): N2

1.10 Filler channel contents

Mapping structure as for measurement channel, test pattern PRBS11.

2 Drop & Insert / Through Mode

Option: BN 3035/90.20

2.1 Functions

This Option provides the following functions for all mapping options fitted to the ANT-20SE.

Drop & Insert

Generator and receiver operate independently as mapper and demapper. The signal from a selected channel is dropped from the receive signal and output to a connector. An external signal is inserted into the transmit signal.

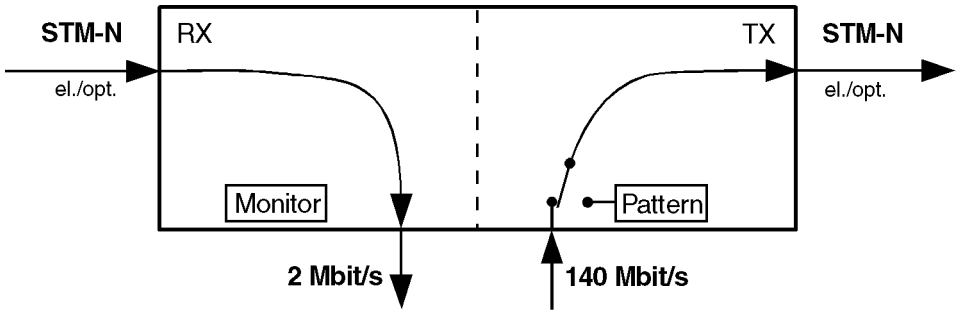

Fig. S-20 Drop & Insert: Generator and receiver operate independently

An unbalanced digital input and output are provided on the mainframe instrument for dropping and for inserting tributary signals (see Sec. 2.2.1, Page S-38 and Sec. 2.3.1, Page S-39).

The mainframe instrument is also equipped with a balanced output [13] and input [12] for dropping and for inserting tributary signals via balanced interfaces.

Through Mode

The received signal is looped through the ANT-20SE and re-transmitted by the generator. One tributary signal can be output (dropped).

The ANT-20SE can also operate in Through Mode as a signal monitor without affecting the signal content.

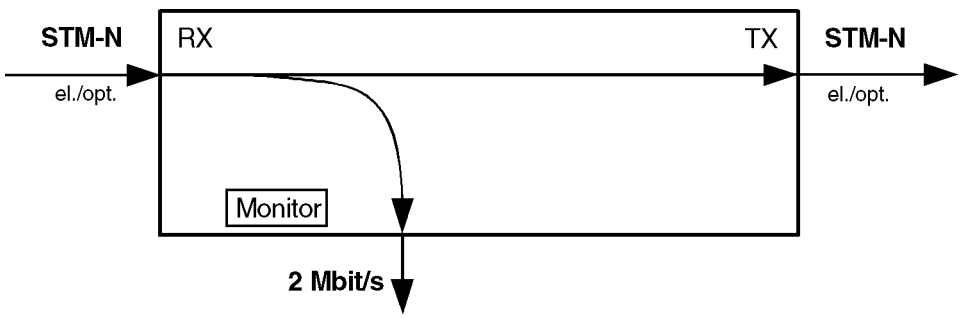

Fig. S-21 Through Mode: Generator and receiver coupled

In conjunction with the Options “PDH MUX/DEMUX” and “M13 MUX/DEMUX”, BN 3035/90.30 to BN 3035/90.32, the ANT-20SE provides access to the tributary channels within the MUX/DEMUX chain (except DS2). This also applies if the PDH signal is transmitted in a container.

The looped-through signal can also be jittered using the Jitter Generator options (Jitter Generator up to 155 or 622 Mbit/s, BN 3035/90.60 to 61). This function is available for all bit rates fitted to the instrument.

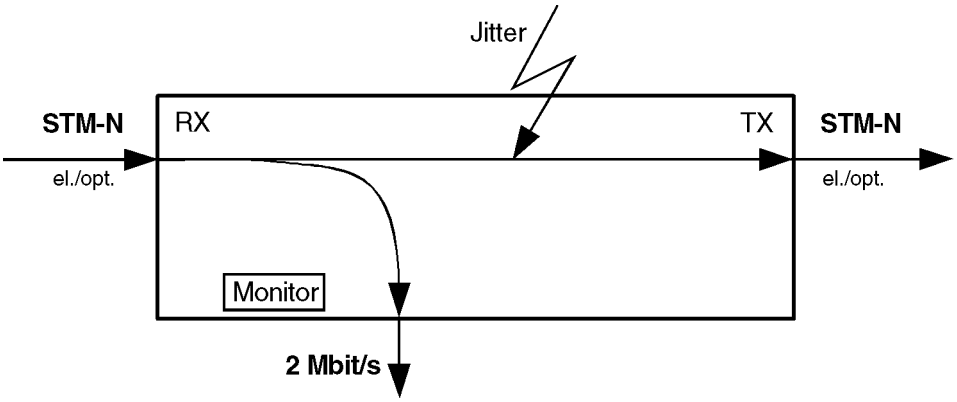

Fig. S-22 Through Mode: Adding jitter to the looped-through signal

In Through Mode, anomalies can be inserted in the SOH or the SOH bytes can be manipulated.

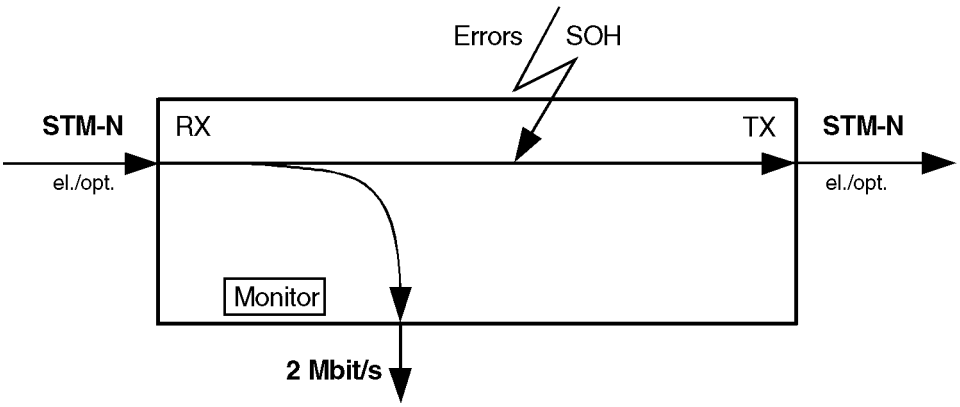

Fig. S-23 Through Mode: Inserting errors in the SOH

2.1.1 Clock generator

Drop & Insert

As specified in the mainframe instrument.

Through Mode

In Through Mode, clock generation is always derived from the receive signal clock.
No offset is possible in this operating mode (see also “Specifications” of the mainframe instrument).

2.1.2 Overhead generator

Drop & Insert

As specified in Sec. 1.4.1, Page S-5.

Through Mode

The “From Rx” function can be set in addition to the functions described in Sec. 1.4.1, Page S-5 for all bytes except bytes B1, B2 and M1.

2.1.3 Anomaly insertion

Drop & Insert

As specified in Sec. 1.4.2, Page S-6.

Through Mode

Anomaly insertion in bytes B1, B2 and MS-REI.
Insertion limits are specified in Sec. 1.4.2, Page S-6.

2.1.4 Defect generation

Drop & Insert

As specified in Sec. 1.4.3, Page S-7.

Through Mode

No direct defect generation is possible.

Alarms (defects) in the SOH can be generated by manipulating the SOH bytes.

2.1.5 Pointer generation

Drop & Insert

As specified in Sec. 1.4.4, Page S-8.

Through Mode

The receive-side pointer is re-transmitted unchanged.

2.1.6 Measurements

There are no restrictions on measurements.
See Sec. 1.4.5, Page S-11 through Sec. 1.4.10, Page S-16.

2.2 Signal outputs

2.2.1 AUXILIARY signal output [11], electrical

Connector . . . . . unbalanced, (coaxial)

Socket type . . . . . BNC

Output impedance . . . . . 75 Ω

Max. permitted peak spurious input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Output voltage
E4	139.264	CMI	± 0.5 V
DS3	44.736	B3ZS	± 1.0 V
E3	34.368	HDB3	
E2	8.448	HDB3	± 2.37 V
DS2	6.312	B8ZS	± 2.0 V
E1	2.048	HDB3	± 2.37 V
DS1	1.544	B8ZS	
The bit rates depend on the mapping options fitted.			

Table S-31 Specifications of the AUXILIARY signal output [11], electrical

2.2.2 LINE/AUXILIARY signal output [13], electrical

Connector . . . . . balanced

Socket type . . . . . Lemo SA (Bantam)

Output impedance
2.048 Mbit/s . . . . . 120 Ω
1.544 Mbit/s . . . . . 100 Ω

Max. permitted peak spurious input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Output voltage
E1	2.048	HDB3	± 3.0 V
DS1	1.544	B8ZS	DSX-1 compatible
The bit rates depend on the mapping options fitted.			

Table S-32 Specifications of the LINE/AUXILIARY signal output [13], electrical

The balanced output is used both as “LINE” and as “AUXILIARY” output.

2.3 Signal inputs

2.3.1 AUXILIARY signal input [10], electrical

Connector . . . . . unbalanced, (coaxial)

Socket type . . . . . BNC

Input impedance . . . . . 75 Ω

Max. permitted frequency offset . . . . . ± 500 ppm

Input voltage range . . . . . 0 dB attenuation referred to nominal level

Max. permitted peak input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Input voltage
E4	139.264	CMI	1.0 V ±10 %
DS3	44.736	B3ZS	1.0 V ±10 %
E3	34.368	HDB3	
E2	8.448	HDB3	2.37 V ±10 %
DS2	6.312	B8ZS	2.0 V ±10 %
E1	2.048	HDB3	2.37 V ±10 %
DS1	1.544	B8ZS	
The bit rates depend on the mapping options fitted.			

Table S-33 Specifications of the AUXILIARY signal input [10], electrical

LOS (Loss of Signal) status display

LED lights up if the signal input is active but no signal is present.

2.3.2 LINE/AUXILIARY signal input [12], electrical

Connector . . . . . balanced

Socket type . . . . . Lemo SA (Bantam)

Input impedance
2.048 Mbit/s . . . . . 120 Ω
1.544 Mbit/s . . . . . 100 Ω

Max. permitted frequency offset . . . . . ± 500 ppm

Max. number of consecutive zeros for line code = AMI 15

Max. permitted peak input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Input voltage
E1	2.048	HDB3	3.0 V ±10 %
DS1	1.544	B8ZS	
The bit rates depend on the mapping options fitted.			

Table S-34 Specifications of the LINE/AUXILIARY signal input [12], electrical

LOS (Loss of Signal) status display

LED lights up if the signal input is active but no signal is present.

The balanced input is used both as “LINE” and as “AUXILIARY” input.

Specifications STS-1 Mappings

These specifications apply to the options:

SONET mappings

STS-1 mapping for ANSI tributaries

STS-1 mapping for ETSI tributaries

1 STS-1 mapping

1.1 General information

STS-1 and STS-3 signals

STS-1 and STS-3 signals are generated and evaluated to conform with Bellcore GR-253 and ANSI T1.105.

The STS-3 signal consists of one STS-1 tributary equipped with a selected payload and two unequipped STS-1 tributaries.

Mapping/Demapping

One selected STS-1 mapping is included in the mainframe instrument. Other mappings can be added as required.

Container contents:

- Framed or unframed asynchronous payload in a selected container.
- Filling of a selected container with a test pattern,
  without justification bits (bulk signal).

Drop & Insert

An additional Drop & Insert Option (BN 3035/90.20) for dropping or inserting tributary signals (via sockets) is available in conjunction with the mapping options.

1.2 Tributary channel numbering

VT1.5 locations

VT1.5#	Group #/VT #	Column[1] #s	VT1.5#	Group #/VT #	Column[1] #s
1	1, 1	2, 31, 60	15	1, 3	16, 45, 74
2	2, 1	3, 32, 61	16	2, 3	17, 46, 75
3	3, 1	4, 33, 62	17	3, 3	18, 47, 76
4	4, 1	5, 34, 63	18	4, 3	19, 48, 77
5	5, 1	6, 35, 64	19	5, 3	20, 49, 78
6	6, 1	7, 36, 65	20	6, 3	21, 50, 79
7	7, 1	8, 37, 66	21	7, 3	22, 51, 80
8	1, 2	9, 38, 67	22	1, 4	23, 52, 81
9	2, 2	10, 39, 68	23	2, 4	24, 53, 82
10	3, 2	11, 40, 69	24	3, 4	25, 54, 83
11	4, 2	12, 41, 70	25	4, 4	26, 55, 84
12	5, 2	13, 42, 71	26	5, 4	27, 56, 85
13	6, 2	14, 43, 72	27	6, 4	28, 57, 86
14	7, 2	15, 44, 73	28	7, 4	29, 58, 87

1 Column 1 = STS POH
Column 30, 59 = Fixed stuff

Table S-35 VT1.5 locations

VT2 locations

VT2#	Group #/VT #	Column[1] #s	VT2#	Group #/VT #	Column[1] #s
1	1, 1	2, 23, 45, 67	12	5, 2	13, 35, 56, 78
2	2, 1	3, 24, 46, 68	13	6, 2	14, 36, 57, 79
3	3, 1	4, 25, 47, 69	14	7, 2	15, 37, 58, 80
4	4, 1	5, 26, 48, 70	15	1, 3	16, 38, 60, 81
5	5, 1	6, 27, 49, 71	16	2, 3	17, 39, 61, 82
6	6, 1	7, 28, 50, 72	17	3, 3	18, 40, 62, 83
7	7, 1	8, 29, 51, 73	18	4, 3	19, 41, 63, 84
8	1, 2	9, 31, 52, 74	19	5, 3	20, 42, 64, 85
9	2, 2	10, 32, 53, 75	20	6, 3	21, 43, 65, 86
10	3, 2	11, 33, 54, 76	21	7, 3	22, 44, 66, 87
11	4, 2	12, 34, 55, 77	-	-	-

1 Column 1 = STS POH
Column 30, 59 = Fixed stuff

Table S-36 VT2 locations

VT6 locations

VT6#	Group #/VT #	Column[1] #s
1	1, 1	2, 9, 16, 23, 31, 38, 45, 52, 60, 67, 74, 81
2	2, 1	3, 10, 17, 24, 32, 39, 46, 53, 61, 68, 75, 82
3	3, 1	4, 11, 18, 25, 33, 40, 47, 54, 62, 69, 76, 83
4	4, 1	5, 12, 19, 26, 34, 41, 48, 55, 63, 70, 77, 84
5	5, 1	6, 13, 20, 27, 35, 42, 49, 56, 64, 71, 78, 85
6	6, 1	7, 14, 21, 28, 36, 43, 50, 57, 65, 72, 79, 86
7	7, 1	8, 15, 22, 29, 37, 44, 51, 58, 66, 73, 80, 87

1 Column 1 = STS-1 POH
Colunm 30, 59 = Fixed stuff

Table S-37 VT6 locations

1.3 Scrambling/Descrambling

The STS-N signal is scrambled/descrambled as described in Bellcore GR-253 and ANSI T1.105.

1.4 Overhead generation

1.4.1 Transport Overhead (TOH)

Standard overhead, STS-1 (hex)

TOH			
	1	**2**	**3**
1	A1 F6	A2 28	J0 01
2	B1 XX	E1 00	F1 00
3	D1 00	D2 00	D3 00
4	H1 60	H2 00	H3 00
5	B2 XX	K1 00	K2 00
6	D4 00	D5 00	D6 00
7	D7 00	D8 00	D9 00
8	D10 00	D11 00	D12 00
9	S1 00	M0 00	E2 00

Table S-38 TOH contents, STS-1

Standard overhead, STS-3 (hex), STS-3c

TOH										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
1	A1 F6	A1 F6	A1 F6	A2 28	A2 28	A2 28	J0 01	— 02	— 03	
2	B1 XX	— 00	— 00	E1 00	— 00	— 00	F1 00	— 00	— 00	
3	D1 00	— 00	— 00	D2 00	— 00	— 00	D3 00	— 00	— 00	
4a	H1 60	H1 60	H1 60	H2 00	H2 00	H2 00	H3 00	H3 00	H3 00	at STS-3
4b	H1 60	Y 93	Y 93	H2 00	— FF	— FF	H3 00	H3 00	H3 00	at STS-3c
5	B2 XX	B2 XX	B2 XX	K1 00	— 00	— 00	K2 00	— 00	— 00	
6	D4 00	— 00	— 00	D5 00	— 00	— 00	D6 00	— 00	— 00	
7	D7 00	— 00	— 00	D8 00	— 00	— 00	D9 00	— 00	— 00	
8	D10 00	— 00	— 00	D11 00	— 00	— 00	D12 00	— 00	— 00	
9	S1 00	Z1 00	Z1 00	Z2 00	Z2 00	M1 00	E2 00	— 00	— 00	

Table S-39 TOH contents, STS-3

XX: Inserted by parity formation (B1, B2)

H1 and H2 depend on the pointer address setting (pointer address = 0 is shown), H3 depends on whether or not a pointer action takes place.

TOH byte contents

- Static bytes: all except B1, B2, H1, H2, H3
- Overhead sequence m, n, p: all except B1, B2, H1, H2, H3
- Dynamic bytes filled using PRBS 11: E1, F1, E2
- Dynamic byte groups filled using PRBS 11: D1 to D3, D4 to D12
- Dynamic bytes filled via DCC/ECC interface (V.11): E1, F1, E2
- Dynamic byte groups filled via DCC/ECC interface (V.11): D1 to D3, D4 to D12, K1 to K2

1.4.2 STS-N error insertion (anomalies)

Error insertion (anomalies) . . . . . B1, B2, B3 parity errors, FAS word errors, REI-L, REI-P, bit errors in test pattern (TSE), code errors (single errors only)

Trigger types . . . . . Single or Rate

When Rate triggering is selected a bit error rate is inserted.

Anomaly	**Single**	**Rate**[1]	**Burst m, n (frames)**
FAS	yes	2E-3 to 1E-10	m = 1 to 196000
B1	yes	2E-4 to 1E-10	m = 1 to 196000
B2	yes	2E-3 to 1E-10	m = 1 to 196000
REI-L	yes	2E-3 to 1E-10	m = 1 to 196000
B3[2]	yes	2E-4 to 1E-10	m = 1 to 196000
REI-P	yes	2E-4 to 1E-10	m = 1 to 196000
TSE	yes	1E-2 to 1E-8	-
BPV (code error)	yes	-	-

1 Mantissa: 1 to 9 (only 1 for TSE), exponent: -1 to -10 (whole numbers)
2 Static error insertion, can be edited using a 8-bit mask (x = don't care, 1 = insert error)

Table S-40 Available anomalies and trigger modes (STS-N)

The insertion of **errors** (anomalies) **and alarms** (defects) are mutually exclusive. The first action selected is active. The second action is rejected.

1.4.3 STS-N alarm generation (defects)

Defect	Test sensor function	Test sensor thresholds	
	On/Off	M in N	|----t1----| |------t2------|
LOS[1]	ja	M = 800 bis 7200 N = 1600 bis 8000	t1 = 0.1 bis 60.0 s t2 = 0.2 bis 600 s
LOF	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TIM-L	yes	-	-
AIS-L	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
RDI-L	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LOP-P	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
AIS-P	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
UNEQ-P	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
PLM-P	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
RDI-P	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TIM-P	yes	-	-
PDI-P	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s or t1 = 0.5 to 250 ms t2=1 to 8000 ms

1 Only in conjunction with an optical interface

Table S-41 Available defects (STS-N)

The insertion of **alarms** (defects) **and errors** (anomalies) are mutually exclusive. The first action selected is active. The second action is rejected.

1.4.4 Pointer action generation

Stimulation

Pointer sequences

On all pointer levels to ANSI T1.105.03

T1, T4: 0.25 ms to 600 s . . . . . (2 to 4800000 frames)

T2, T3: 0.25 ms to 10 s . . . . . (2 to 80000 frames)

T5: 0 ms to 600 s. . . . . (0 to 4800000 frames)

n: 1 to 2000

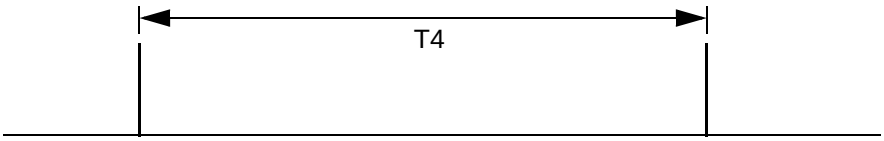

Fig. S-24 Perodic (single/multiple) pointers with identical polarity

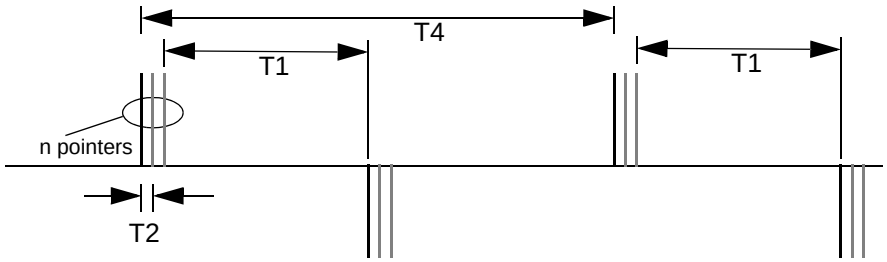

Fig. S-25 Perodic (single/multiple) pointers with different polarity

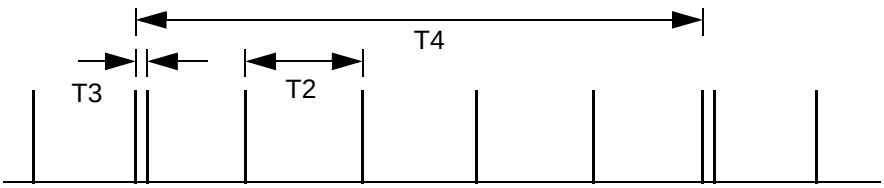

Fig. S-26 Periodic pointers with one double pointer

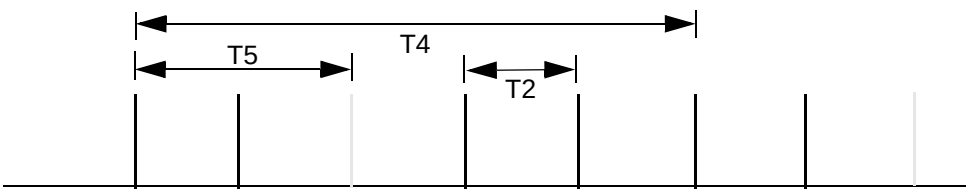

Fig. S-27 Periodic pointers with one missing pointer

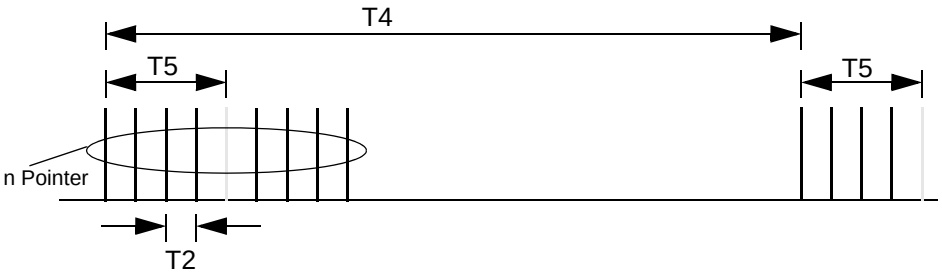

Fig. S-28 Pointer burst with missing pointers

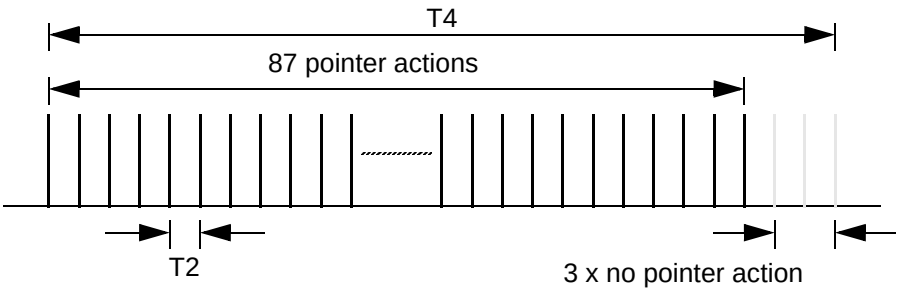

Fig. S-29 ”87-3” sequence

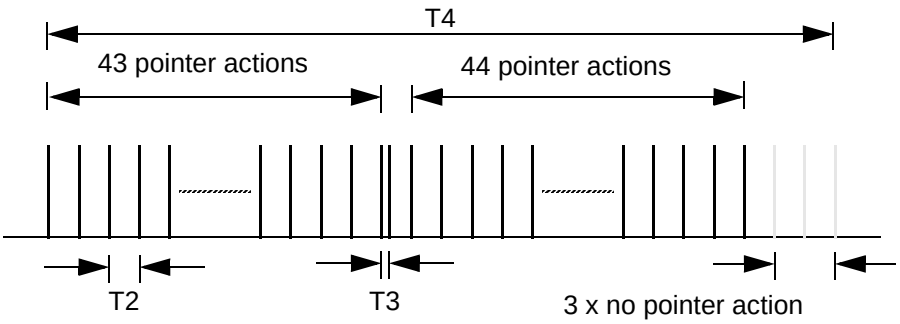

Fig. S-30 ”43-44” sequence with double pointer

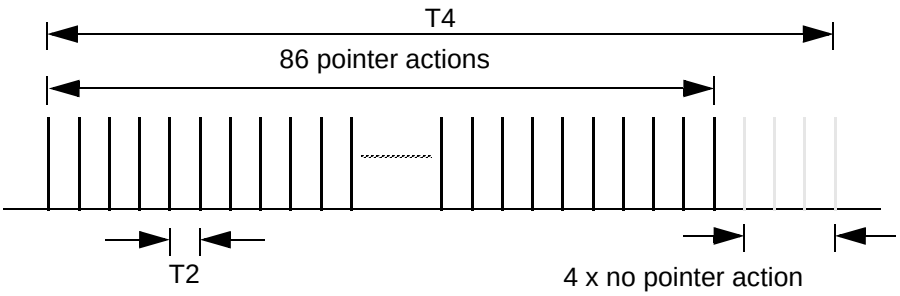

Fig. S-31 ”86-4” sequence with missing pointer

Pointer jumps

Pointer jump from pointer value A to pointer value B (also setting a new pointer).

Pointer jumps are executed with or without NDF.

Pointer range A + B:
STS pointer . . . . . 0 to 782
VT6 pointer . . . . . 0 to 427
VT2 pointer . . . . . 0 to 139
VT1.5 pointer . . . . . 0 to 103

1.4.5 STS-N error measurements (anomalies)

Evaluation

All errors (anomalies) are counted simultaneously and stored.

Gate times . . . . . 1 to 99 seconds
or 1 to 99 minutes
or 1 to 99 hours
or 1 to 99 days

Intermediate results . . . . . 1 to 99 seconds
or 1 to 99 minutes

Display

of anomalies via LEDs:

CURRENT LED (red) is on when the anomaly is present

HISTORY LED (yellow) is on if the anomaly has occurred at least once during the current measurement interval.

Display of errors as count or ratio values (equivalent bit error ratio): When calculating the ratio value, correction formulae are used for the anomalies B1, B2, B3 and BIP-2 as well as REI-L and REI-P. These take into account that a multiple error in the same bit can lead to clearance of the error.

Anomaly	**LED**
OOF	LOF/OOF
FAS	-
B1	B1/B2
B2	B1/B2
REI-L	-
B3	B3
REI-P	-

Table S-42 LED display of available anomalies (STS-N)

Evaluation and display refer to the selected measurement channel.

1.4.6 STS-N alarm detection (defects)

Evaluation

All alarms (defects) which occur are evaluated simultaneously where possible and stored. Storage takes place only within a started measurement interval.

Time resolution of defects . . . . . 100 ms

Display

of defects via LEDs:

CURRENT LED (red) is on when the defect is present

HISTORY LED (yellow) is on if the defect has occurred at least once during the current measurement interval.

Defect	**LED**
LOS	LOS
LOF	LOF/OOF
TIM-L	-
AIS-L	MS-AIS/AIS-L
RDI-L	MS-RDI/RDI-L
LOP-P	AU-LOP/LOP-P
AIS-P	AU-AIS/AIS-P
UNEQ-P	HP-UNEQ/UNEQ-P
PLM-P	HP-PLM/PLM-P
RDI-P	HP-RDI/RDI-P
TIM-P	-
PDI-P	-

Table S-43 LED display of available defects (STS-N)

Evaluation and display refer to the selected measurement channel.

1.4.7 Evaluation of STS and VT pointer actions

Evaluation

All pointers in the selected path are shown as absolute values and the direction and number of pointer movements is detected and counted.

NDF (New Data Flag) is detected and counted.

Display

of:

- Number of pointer operations separate for STS and VT pointers:
  Increments, decrements, sum of increments + decrements,
  difference of increments - decrements
- Pointer address
- Number of NDF events
- Corresponding clock deviation
- NDF-P and NDF-V can be indicated by the LED display on the front panel
  (Application Manager - “Configuration” menu - LED Display ...):
  – the “AU-LOP/LOP-P” LED indicates “NDF-P” in addition to “LOP-P”
  – the “TU-LOP/LOP-V”LED indicates “NDF-V” in addition to “LOP-V”

Absolute pointer values, increments, decrements, sum of increments + decrements and NDF are displayed as a histogram with selectable time resolution in seconds, minutes, hours or days.

Printout

Absolute pointer values, increments, decrements, sum of increments + decrements and NDF are printed out as a table with 1 second time resolution.

1.4.8 Evaluation of Transport Overhead (TOH) and Path Overhead (POH)

Evaluation

Bit error measurement

using PRBS 11 (bytes) E1, F1, E2, F2
using PRBS 11 (byte groups) . . . . . D1 to D3, D4 to D12

Output

as bytes via DCC/ECC interface (V.11) E1, F1, E2, F2, K3
as byte groups via DCC/ECC interface (V.11) . . . . . .D1 to D3, D4 to D12, K1 to K2

Display

of complete TOH and POH . . . . . hexadecimal
of Trace Identifier J0, J1. . . . . .ASCII, plain text

1.4.9 STS Path Overhead (POH)

Standard overhead

POH Byte	Option 3035/90.10 Option 3035/90.11 Option 3035/90.13	Option 3035/90.12	Option 3035/90.03	Option 3035/90.70 Option 3035/90.71
J1 (ASCII)	“WG STS-TRACE”			
B3 (hex)	Inserted by parity formation			
C2 (hex)	“02”	“04”	“12” at mapping “01” at bulk	“13”
G1 (hex)	“00”			
F2 (hex)	“00”			
H4 (hex)	“FC”, ”FD”, ”FE”, ”FF” sequence across 4 frames	“FF”	“FF”	“FF”
	48-frames-sequence as GR253			
F3 (hex)	“00”			
Z4 (hex)	“00”			

Table S-44 POH contents

STS POH byte contents

- Static bytes: all except B3, H4
- Overhead sequence m, n, p: J1, C2, G1, F2, F3, Z4
- Trace Identifier (Length = 64 frames): J1
- Dynamic byte filled using PRBS 11: F2
- Dynamic bytes filled via DCC/ECC interface (V.11): F2, Z4, N1
- H4 sequence, switchable, 4/48 Bytes

1.5 STS-3c mapping (E4 in STS-3c, ATM in STS-3c)

Option BN 3035/90.03 or BN 3035/90.70 required

STS-3c SPE mapping structure

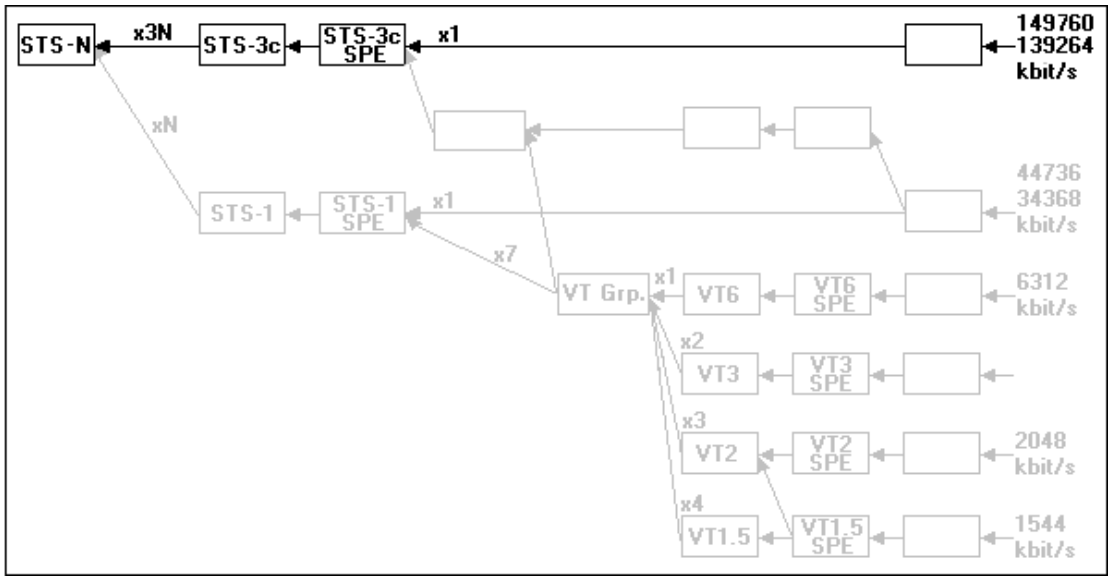

Fig. S-32 Mapping structure: 139 MBits/s → STS-3c SPE → STS-3c

Path overhead contents Sec. 1.4, Page S-44.

1.6 STS-1 SPE mapping (DS3 in STS-1, 34/45 Mbit in STM-0)

Option BN 3035/90.12 required

34/45 Mbit/s in STM-0 see also: “STM-1 mapping” Operating Manual”.

STS-3c SPE mapping structure

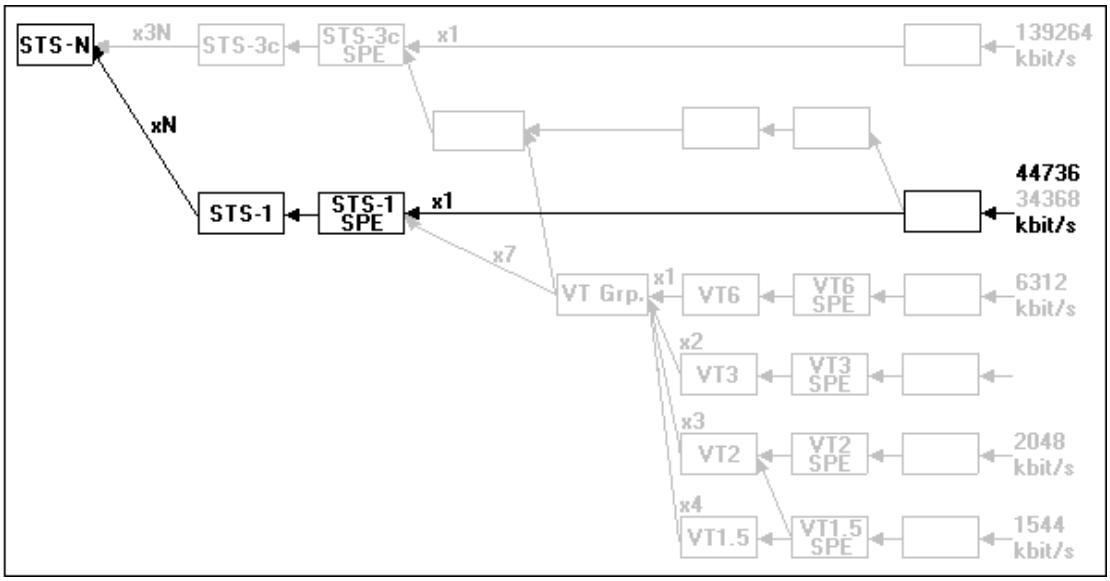

Fig. S-33 Mapping structure: DS3 → STS-1 SPE → STS-1/3

Path overhead contents Sec. 1.4, Page S-44.

1.7 VT1.5 SPE mapping (DS1 in STS-1/3, 1.5 Mbit in STM-0)

Option BN 3035/90.10

1.5 Mbit/s in STM-0 see also: “STM-1 mapping” Operating Manual, section “C-11 mapping”.

VT1.5 mapping structure

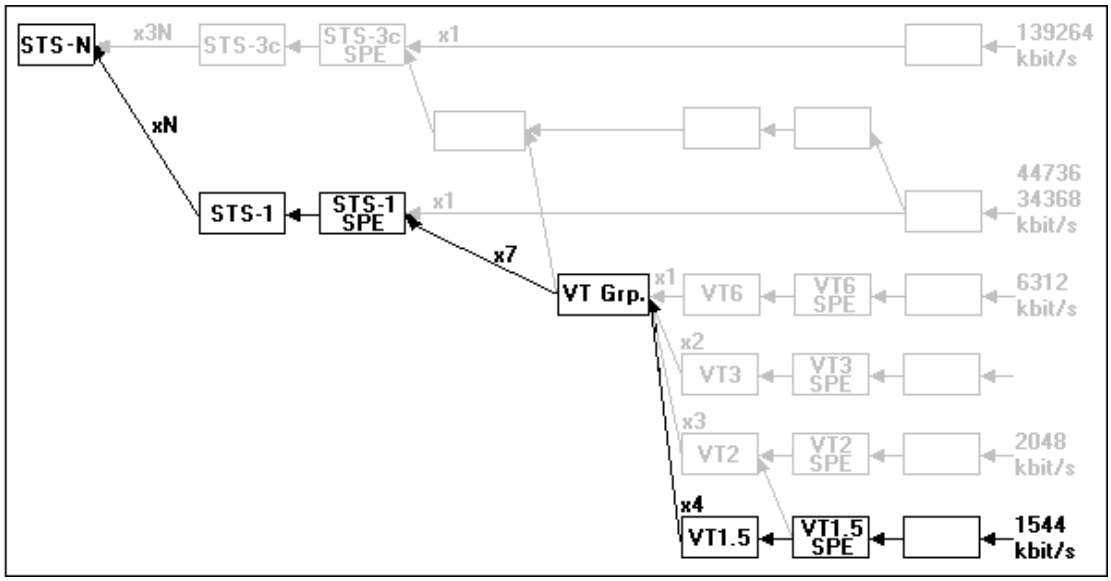

Fig. S-34 Mapping structure: DS1 → VT1.5 → STS-1 SPE → STS-1/3

1.5 Mbit/s in STM-0 mapping structure (AU-3, TU-11)

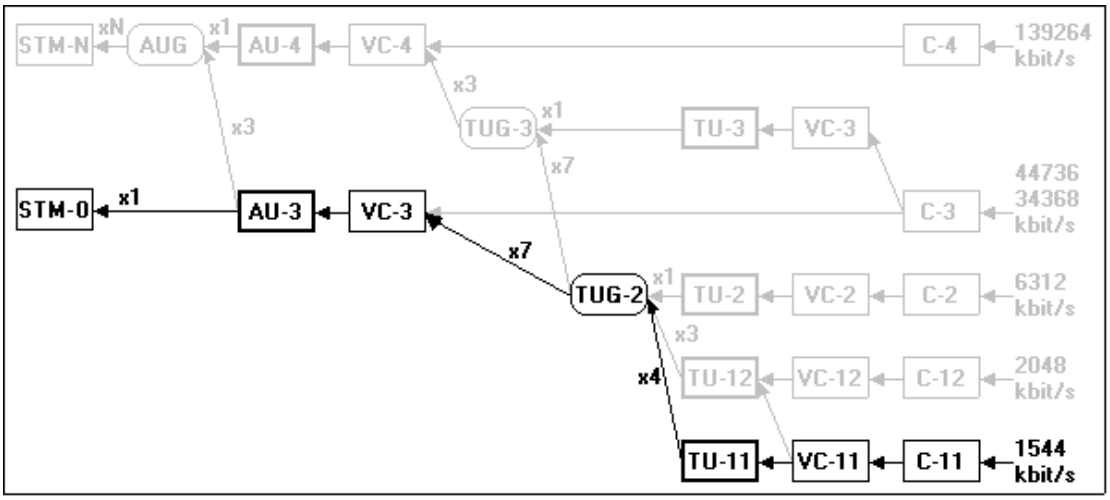

Fig. S-35 Mapping structure: 1.5 Mbit/s → C-11 → TU-11 → AU-3 → STM-0

1.5 Mbit/s in STM-0 mapping structure (AU-3, TU-12)

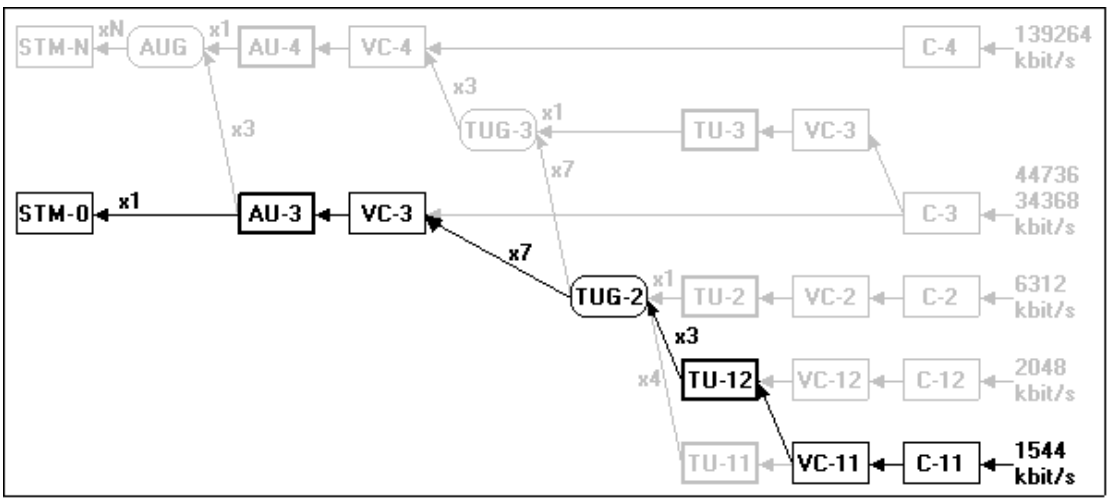

Fig. S-36 Mapping structure: 1.5 Mbit/s → C-11 → TU-12 → AU-3 → STM-0

Mapping method

The following modes are available:

- Asynchronous mode
- Byte-synchronous mode (floating); TU-11

1.7.1 VT1.5 Path Overhead contents

POH byte	Measurement channel	Filler channels
V5 (binary)		
BIP-V (bits 1-2)	Inserted by parity formation	Inserted by parity formation
REI-V (bit 3)	“0”	“0”
RFI-V (bit 4)	“0”	“0”
Path Label (bit 5-7)	“010” for asynchronous mode “100” for byte-synchronous mode “001” for bulk signal	“010” for asynchronous mode “100” for byte-synchronous mode
RDI-V (bit 8)	“0”	“0”
J2	“WG VT-TRACE” (ASCII)	“00” (hex)
Z6 (hex)	“00”	“00”
Z7 (hex)	“00”	“00”

Table S-45 VT1.5 POH (Standard Overhead) contents

Measurement channel byte contents (VT1.5)

- Static bytes: all except bits 1-2 of V5
- Overhead sequence m, n, p: J2, N2, K4
- Trace Identifier (Length = 64 frames): J2
- Dynamic bytes filled via DCC/ECC interface (V.11): Z6

Filler channel byte contents (VT1.5)

Fixed (non-editable) as in (see Tab. S-45)

1.7.2 VT1.5 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in Sec. 1.4.2, Page S-46:

Anomaly	Single	Rate
BIP-V[1]	yes	2E-4 to 1E-10
REI-V	yes	2E-4 to 1E-10

1 Static error insertion, can be edited using a 2-bit mask (x = don’t care, 1 = insert error)

Table S-46 Additional anomalies (VT1.5)

Error insertion refers to the selected measurement channel.

1.7.3 VT1.5 alarm generation (defects)

The following defects can be generated in addition to the alarm types specified in Sec. 1.4.3, Page S-47:

Defect	**Test sensor function**	**Sensor thresholds**	
	On/Off	M in N	I----t1----I I------t2------I
LOM-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LOP-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
AIS-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
UNEQ-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
PLM-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
RDI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TIM-V	yes	-	-
RFI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
PDI-V	yes	M = 1 toN - 1 N = 1 to 8000	t1 = 0,1 to 60,0 s t2 = 0.2 to 600 s or t1 = 0.5 to 250 ms t2=1 to 8000 ms

Table S-47 Additional defects (VT1.5)

Alarm generation refers to the selected measurement channel.

1.7.4 VT1.5 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J2

Output

- via DCC/ECC interface (V.11): Z6

1.7.5 VT1.5 error measurements (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-50:

Anomaly	**LED**
BIP-V	LP-BIP/BIP-V
REI-V	-

Table S-48 LED display of additional anomalies (VT1.5)

Evaluation and display refer to the selected measurement channel.

1.7.6 VT1.5 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in Sec. 1.4.6, Page S-52:

Defect	**LED**
LOM	TU-LOM
LOP-V	TU-LOP/LOP-V
AIS-V	TU-AIS/AIS-V
UNEQ-V	LP-UNEQ/UNEQ-V
PLM-V	LP-PLM/PLM-V
RDI-V	LP-RDI/RDI-V
TIM-V	-
RFI-V	-
PDI-V	-

Table S-49 LED display of additional defects (VT1.5)

Evaluation and display refer to the selected measurement channel.

1.8 VT2 mapping (E1 in STS-1/3, 2 Mbit/s in STM-0)

Option: BN 3035/90.13

2 Mbit/s in STM-0: see also “STM-1 mappings” Operating Manual, section “C-12 mapping”.

VT2 mapping structure

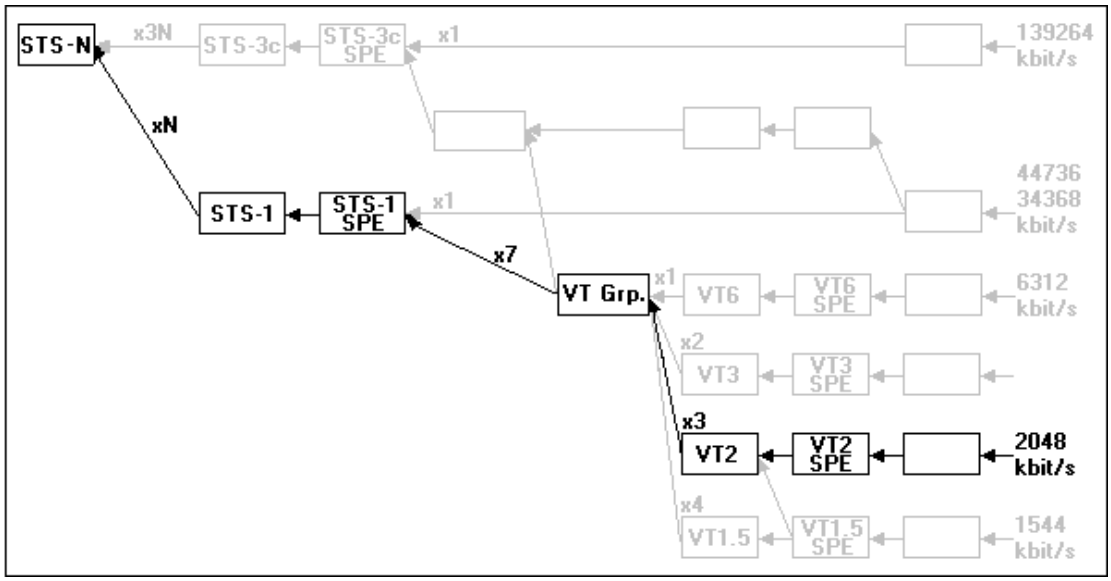

Fig. S-37 Mapping structure: 2 Mbit/s → VT2 SPE → STS-1 SPE → STS-1/3

2 Mbit/s in STM-0 mapping structure

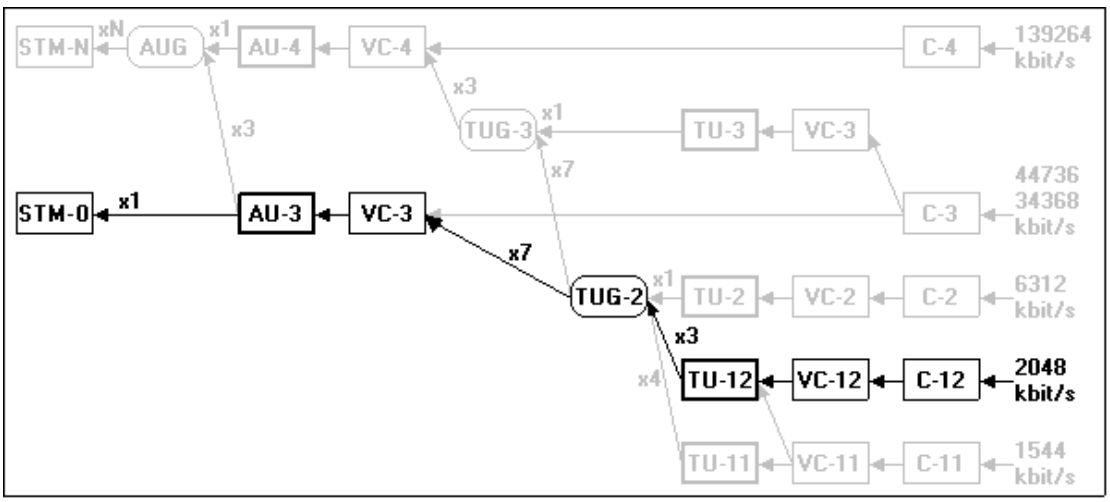

Fig. S-38 Mapping structure: 2 Mbit/s → AU-3 → STM-0

Mapping method

The following modes are available:

- Asynchronous mode
- Byte-synchronous mode (floating)

1.8.1 VT2 Path Overhead contents

POH byte	Measurement channel	Filler channels
V5 (binary)		
BIP-V (bits 1-2)	Inserted by parity formation	Inserted by parity formation
REI-V (bit 3)	“0”	“0”
RFI-V (bit 4)	“0”	“0”
Path Label (bit 5-7)	“010” for asynchronous mode “100” for byte-synchronous mode “001” for bulk signal	“010” for asynchronous mode “100” for byte-synchronous mode
RDI-V (bit 8)	“0”	“0”
J2	“WG VT-TRACE” (ASCII)	“00” (hex)
Z6 (hex)	“00”	“00”
Z7 (hex)	“00”	“00”

Table S-50 VT2 POH (Standard Overhead) contents

Measurement channel byte contents (VT2)

- Static bytes: all except bits 1-2 of V5
- Overhead sequence m, n, p: J2, N2, K4
- Trace Identifier: J2 (Length = 64 frames)
- Dynamic bytes filled via DCC/ECC interface (V.11): Z6

Filler channel byte contents (VT2)

Fixed (non-editable) as in Tab. S-50, Page S-63

1.8.2 VT2 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in Sec. 1.4.2, Page S-46:

Anomaly	Single	Rate
BIP-V[1]	yes	2E-4 to 1E-10
REI-V	yes	2E-4 to 1E-10

1 Static error insertion, can be edited using a 2-bit mask (x = don’t care, 1 = insert error)

Table S-51 Additional anomalies (VT2)

Error insertion refers to the selected measurement channel.

1.8.3 VT2 alarm generation (defects)

2 Mbit/s in STM-0: see “STM-1 mapping” Operating Manual, section “C-12 mapping”.

The following defects can be generated in addition to the alarm types specified in Sec. 1.4.3, Page S-47:

Defect	**Test sensor function**	**Sensor thresholds**	
	On/Off	M in N	I----t1----I I------t2------I
LOM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LOP-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
AIS-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
UNEQ-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
PLM-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
RDI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TIM-V	yes	-	-
RFI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s or t1 = 0.5 to 250 ms t2 = 1 to 8000 ms
PDI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s

Table S-52 Additional defects (VT2)

Alarm generation refers to the selected measurement channel.

1.8.4 VT2 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J2

Output

- via DCC/ECC interface (V.11): Z6

1.8.5 VT2 error measurements (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-50:

Anomaly	**LED**
BIP-V	LP-BIP/BIP-V
REI-V	-

Table S-53 LED display of additional anomalies (VT2)

Evaluation and display refer to the selected measurement channel.

1.8.6 VT2 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in Sec. 1.4.6, Page S-52:

Defect	**LED**
LOM	LOM
LOP-V	TU-LOP/LOP-V
AIS-V	TU-AIS/AIS-V
UNEQ-V	LP-UNEQ/UNEQ-V
PLM-V	LP-PLM/PLM-V
RDI-V	LP-RDI/RDI-V
TIM-V	-
RFI-V	-
PDI-V	-

Table S-54 LED display of additional defects (VT2)

Evaluation and display refer to the selected measurement channel.

1.9 VT6 mapping (6 Mbit/s in STS-1/3)

Option BN 3035/90.11

Mapping structure: VT6

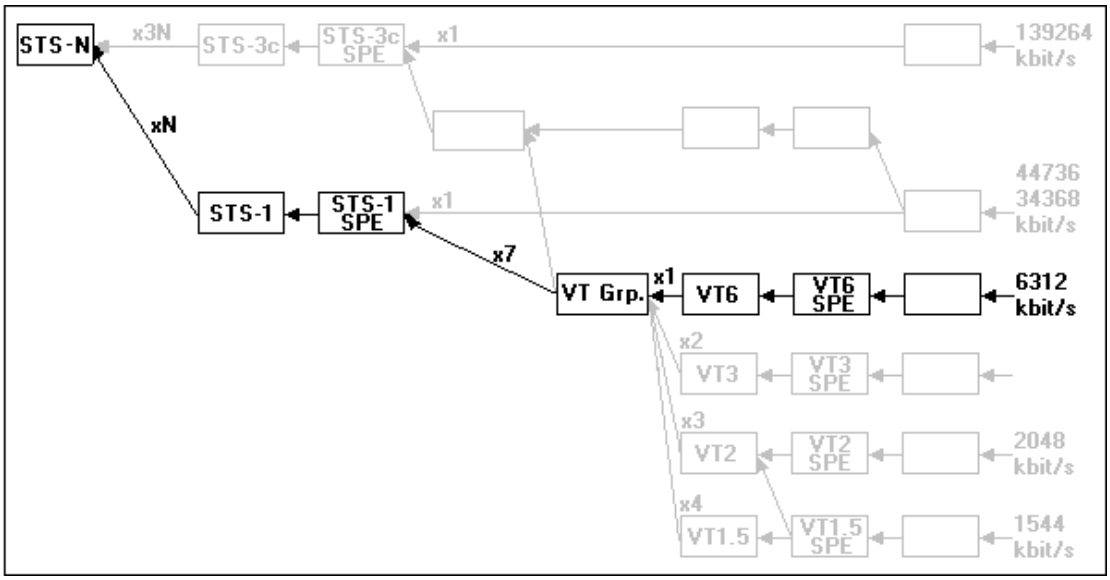

Fig. S-39 Mapping structure: 6 Mbit/s → VT6 SPE → STS-1 SPE → STS-1/3

Mapping method

The following mode is available:

- Asynchronous mode

1.9.1 VC-6 Path Overhead contents

POH byte	Measurement channel	Filler channels
V5 (binary)		
BIP-V (bits 1-2)	Inserted by parity formation	Inserted by parity formation
REI-V (bit 3)	“0”	“0”
RFI-V (bit 4)	“0”	“0”
Path Label (bit 5-7)	“010” for asynchronous mode “001” for bulk signal	“010” for asynchronous mode
RDI-V (bit 8)	“0”	“0”
J2	“WG VT-TRACE” (ASCII)	“00” (hex)
Z6 (hex)	“00”	“00”
Z7 (hex)	“00”	“00”

Table S-55 VT6 POH (Standard Overhead) contents

Measurement channel byte contents (VT6)

- Static bytes: all except bits 1-2 of V5
- Overhead sequence m, n, p: J2, N2, K4
- Trace Identifier: J2 (Length = 64 frames)
- Dynamic bytes filled via DCC/ECC interface (V.11): Z6

Filler channel byte contents (VT6)

Fixed (non-editable) as in (see Tab. S-55)

1.9.2 VT6 error insertion (anomalies)

The following anomalies can be inserted in addition to the error types specified in section 1.4.2 “STS-N error insertion (anomalies)”:

Anomaly	Single	Rate
BIP-V[1]	yes	2E-4 to 1E-10
REI-V	yes	2E-4 to 1E-10
1 Static error insertion, can be edited using a 2-bit mask (x = don’t care, 1 = insert error)		

Table S-56 Additional anomalies (VT6)

Error insertion refers to the selected measurement channel.

1.9.3 VT6 alarm generation (defects)

The following defects can be generated in addition to the alarm types specified in Sec. 1.4.3, Page S-47:

Defect	**Test sensor function**	**Sensor thresholds**	
	On/Off	M in N	I----t1----I I------t2------I
LOM	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
LOP-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
AIS-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
UNEQ-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
PLM-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
RDI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s
TIM-V	yes	-	-
RFI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s or t1 = 0.5 to 250 ms t2 = 1 to 8000 ms
PDI-V	yes	M = 1 to N - 1 N = 1 to 8000	t1 = 0.1 to 60.0 s t2 = 0.2 to 600 s

Table S-57 Additional defects (VT6)

Alarm generation refers to the selected measurement channel.

1.9.4 VT6 Path Overhead evaluation

Display

- of the complete POH (hexadecimal)
- of the Trace Identifier (ASCII, plain text): J2

Output

- via DCC/ECC interface (V.11): Z6

1.9.5 VT6 error measurements (anomalies)

The following anomalies can be evaluated and displayed in addition to the error measurements specified in Sec. 1.4.5, Page S-50:

Anomaly	LED
BIP-V	LP-BIP/BIP-V
REI-V	-

Table S-58 LED display of additional anomalies (VT6)

Evaluation and display refer to the selected measurement channel.

1.9.6 VT6 alarm detection (defects)

The following defects can be evaluated and displayed in addition to the alarm detection specified in section 1.4.6 “STS-N alarm detection (defects)”:

Defect	LED
LOM	LOM
LOP-V	TU-LOP/LOP-V
AIS-V	TU-AIS/AIS-V
UNEQ-V	LP-UNEQ/UNEQ-V
PLM-V	LP-PLM/PLM-V
RDI-V	LP-RDI/RDI-V
TIM-V	-
RFI-V	-
PDI-V	-

Table S-59 LED display of additional defects (VT6)

Evaluation and display refer to the selected measurement channel.

1.10 Filler channel contents

Mapping structure like measurement channel, test pattern PRBS11.

2 Drop & Insert / Through Mode

Option BN 3035/90.20

2.1 Function

This option provides the following functions for all the mapping options included in the ANT-20SE.

Drop & Insert

Generator and receiver operate independently as mapper and demapper. The signal from a selected channel is dropped from the receive signal and output to a connector. An external signal is inserted into the transmit signal.

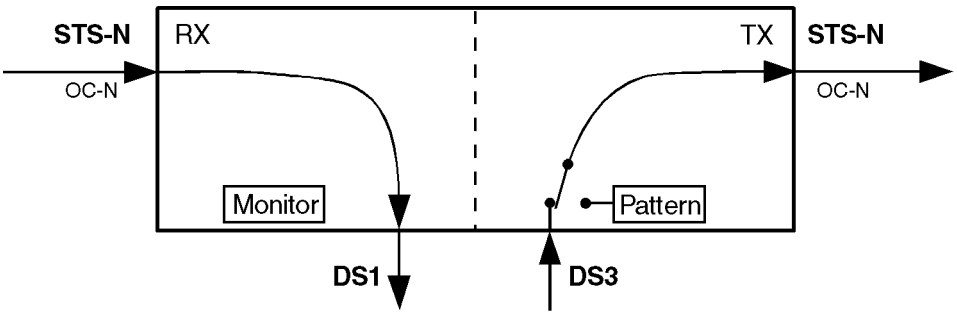

Fig. S-40 Drop & Insert: Generator and receiver operate independently

An unbalanced digital input and output are provided on the mainframe instrument for dropping and for inserting tributary signals (see Sec. 2.2.1, Page S-73 and Sec. 2.3.1, Page S-74).

The mainframe instrument is also equipped with a balanced output [13] and input [12] for dropping and for inserting tributary signals via balanced interfaces.

Through Mode

The received signal is looped through the ANT-20SE and re-transmitted by the generator. One tributary signal can be output (dropped).

The ANT-20SE can also operate in Through Mode as a signal monitor without affecting the signal content.

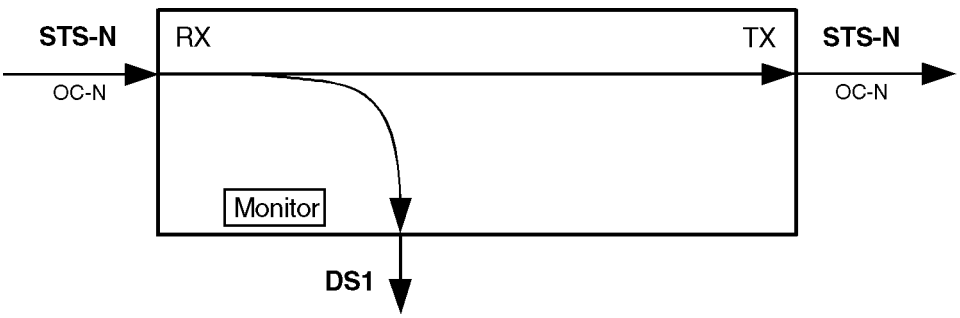

Fig. S-41 Through Mode: Generator and receiver coupled

In conjunction with the Options “PDH MUX/DEMUX” and “M13 MUX/DEMUX”, BN 3035/90.30 to BN 3035/90.32, the ANT-20SE provides access to the tributary channels within the MUX/DEMUX chain (except DS2). This also applies if the PDH signal is transmitted in a container.

The looped-through signal can also be jittered using the Jitter Generator options (Jitter Generator up to 155 or 622 Mbit/s, BN 3035/90.60 to 61). This function is available for all bit rates fitted to the instrument.

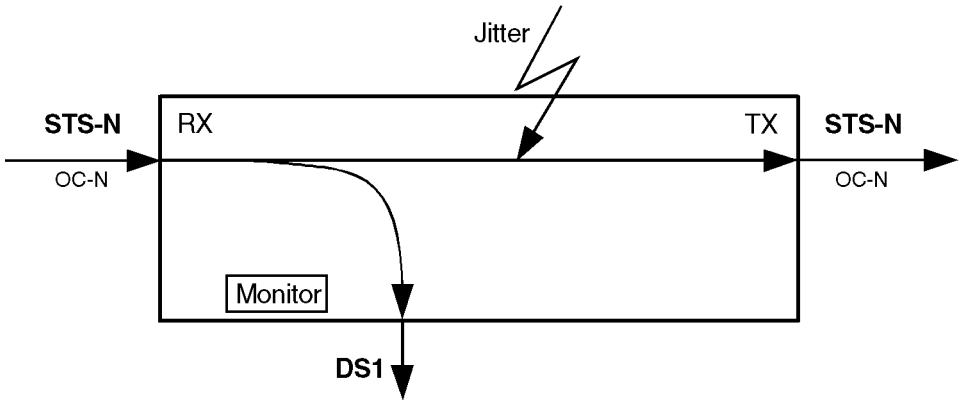

Fig. S-42 Through Mode: Adding jitter to the looped-through signal

In Through Mode, anomalies can be inserted in the SOH or the SOH bytes can be manipulated.

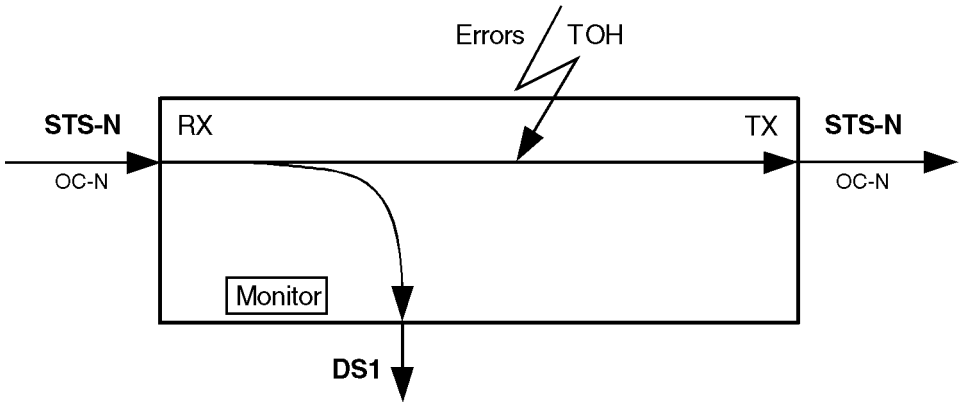

Fig. S-43 Through Mode: Inserting errors in the TOH

2.1.1 Clock generator

Drop & Insert

As specified in the “Specifications” of the mainframe instrument, section 1.2.

Through Mode

In Through Mode, clock generation is always derived from the receive signal clock.
No offset is possible in this operating mode (see also the “Specifications” of the mainframe instrument).

2.1.2 Overhead generator

Drop & Insert

As specified in Sec. 1.4.1, Page S-44.

Through Mode

The “From Rx” function can be set in addition to the functions described in Sec. 1.4.1, Page S-44 for all bytes except bytes B1, B2 and M1.

Dynamic filling of the byte group D4 to D12 via DCC/ECC interface is not possible for STS-1.

2.1.3 Anomaly insertion

Drop & Insert

As specified in Sec. 1.4.2, Page S-46.

Through Mode

Anomaly insertion in bytes B1, B2 and REI-L.
Insertion limits are specified in Sec. 1.4.2, Page S-46.

2.1.4 Defect generation

Drop & Insert

As specified in Sec. 1.4.3, Page S-47.

Through Mode

No direct defect generation is possible.

Alarms (defects) in the TOH can be generated by manipulating the TOH bytes.

2.1.5 Pointer generation

Drop & Insert

As specified in Sec. 1.4.4, Page S-48.

Through Mode

The receive-side pointer is re-transmitted unchanged.

2.1.6 Measurements

There are no restrictions on measurements.
See Sec. 1.4.5, Page S-50 through Sec. 1.4.9, Page S-54.

2.2 Signal outputs

2.2.1 AUXILIARY signal output [11], electrical

Connector . . . . . unbalanced, (coaxial)

Socket type . . . . . BNC

Output impedance . . . . . 75 Ω

Max. permitted peak spurious input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Output voltage
E4	139.264	CMI	± 0.5 V
DS3	44.736	B3ZS	± 1.0 V
E3	34.368	HDB3	
E2	8.448	HDB3	± 2.37 V
DS2	6.312	B8ZS	± 2.0 V
E1	2.048	HDB3	± 2.37 V
DS1	1.544	B8ZS	
The bit rates depend on the mapping options fitted.			

Table S-60 Specifications of the AUXILIARY signal output [11], electrical

2.2.2 LINE/AUXILIARY signal output [13], electrical

Connector . . . . . balanced

Socket type . . . . . Lemo SA (Bantam)

Output impedance
2.048 Mbit/s . . . . . 120 Ω
1.544 Mbit/s . . . . . 100 Ω

Max. permitted peak spurious input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Output voltage
E1	2.048	HDB3	± 3.0 V
DS1	1.544	B8ZS	DSX-1 compatible
The bit rates depend on the mapping options fitted.			

Table S-61 Specifications of the LINE/AUXILIARY signal output [13], electrical

The balanced output is used both as “LINE” and as “AUXILIARY” output.

2.3 Signal inputs

2.3.1 AUXILIARY signal input [10], electrical

Connector . . . . . unbalanced, (coaxial)

Socket type . . . . . BNC

Input impedance . . . . . 75 Ω

Max. permitted frequency offset . . . . . ± 500 ppm

Input voltage range . . . . . 0 dB attenuation referred to nominal level

Max. permitted peak input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Code	Input voltage
E4	139.264	CMI	1.0 V ±10 %
DS3	44.736	B3ZS	1.0 V ±10 %
E3	34.368	HDB3	
E2	8.448	HDB3	2.37 V ±10 %
DS2	6.312	B8ZS	2.0 V ±10 %
E1	2.048	HDB3	2.37 V ±10 %
DS1	1.544	B8ZS	
Available bitrates depending on mapping options			

Table S-62 Specifications of the AUXILIARY signal input [10], electrical

LOS (Loss of Signal) status display

LED is on if the signal input is active but no signal is present.

2.3.2 LINE/AUXILIARY signal output [12], electrical

Connector . . . . . balanced
Socket type . . . . . Lemo SA (Bantam)

Input impedance
2.048 Mbit/s . . . . . 120 Ω
1.544 Mbit/s . . . . . 100 Ω

Max. permitted frequency offset . . . . . ± 500 ppm

Max. number of consecutive zeros for line code = AMI 15

Max. permitted peak input voltage . . . . . ± 5 V

Interface	Bit rate (Mbit/s)	Line code	Input voltage
E1	2.048	HDB3	3.0 V ±10 %
DS1	1.544	B8ZS	
The bit rates depend on the mapping options fitted.			

Table S-63 Specifications of the LINE/AUXILIARY signal input [12], electrical

LOS (Loss of Signal) status display

LED is on if the signal input is active but no signal is present.

The balanced input is used both as “LINE” and as “AUXILIARY” input.

3 Note for ANT-20SE users

The following hardware and software bundles have been formed for the ANT-20SE.

Assignments of modules and software ANT-20SE – ANT-20/ANT-20E:

	Module / Software	BN number ANT-20SE	Equivalent BN number
ANT-20SE Mainframe	Mainframe, SDH	3060/01	3035/41 or 3035/21 + 3035/92.15 + 3035/93.11 + 3035/90.01
	Mainframe, SONET	3060/02	3035/42 or 3035/22 + 3035/92.15 + 3035/93.11 + 3035/90.10
	Extended SDH Testing	3060/90.01	3035/90.02, 3035/90.03, 3035/90.04, 3035/90.05, 3035/90.06, 3035/90.15
	Extended SONET Testing	3060/90.02	3035/90.11, 3035/90.12, 3035/90.13, 3035/90.03, 3035/90.15
	Add SONET (SONET expansion for SDH mainframe)	3060/90.03	3035/90.10, 3035/90.11, 3035/90.12, 3035/90.13, 3035/90.34
	Add SDH (SDH expansion for SONET mainframe)	3060/90.04	3035/90.01, 3035/90.02, 3035/90.04, 3035/90.05, 3035/90.06, 3035/90.33
	Drop&Insert (Through mode, Block&Replace)	3060/90.10	3035/90.20
	PDH MUX/DEMUX (64/140)	3060/90.11	3035/90.30
	M13 MUX/DEMUX	3060/90.12	3035/90.32
Optics STM-1/4, OC-1/3/12	STM-1, OC-1/3 1310 nm	3060/91.01	3035/90.43 + 2 Adapters
	STM-1, OC-1/3 1310 nm & 1550 nm	3060/91.02	3035/90.45 + 2 Adapters
	STM-1/4, OC-1/3/12 1310 nm	3060/91.11	3035/90.46 + 2 Adapters
	STM-1/4, OC-1/3/12 1310 nm & 1550 nm	3060/91.12	3035/90.48 + 2 Adapters
	Optical power splitter	3060/91.05	3035/90.49 + 3 Adapters
	OC-12c BULK	3060/90.90	3035/90.90
	OC-12c Virtual concatenation	3060/90.92	3035/90.92

Table O-64 Assignments of modules and software

	Module / Software	BN number ANT-20SE	Equivalent BN number
Optics STM-16, OC-48	STM-16, OC-48 1550 nm	3060/91.50	3035/91.53 + 2 Adapters
	STM-16, OC-48 1310 nm	3060/91.51	3035/91.54 + 2 Adapters
	STM-16, OC-48 1310 nm & 1550 nm	3060/91.52	3035/91.59 + 2 Adapters
	STM-16, OC-48 15... nm, special	3060/91.53	3035/90.38 + 2 Adapters
	OC-48c BULK	3060/90.93	3035/90.93
	Package: STM-0/1/4/16 1310 nm + Concatenation	3060/90.55	3035/90.46, 3035/91.54, 3035/90.90, 3035/90.93, + 4 Adapters
	Package: STM-0/1/4/16 1550 nm + Concatenation	3060/90.56	3035/90.47, 3035/91.53, 3035/90.90, 3035/90.93, + 4 Adapters
	Package: STM-0/1/4/16 1310 nm & 1550 nm + Concatenation	3060/90.57	3035/90.48, 3035/91.59, 3035/90.90, 3035/90.93, + 4 Adapters
	Package: STM-0/1/4 1310 nm STM-16 1550 nm + Concatenation	3060/90.58	3035/90.46, 3035/91.53, 3035/90.90, 3035/90.93, + 4 Adapters
Jitter O.172	Package: O.172 Jitter/Wander up to 155 Mbit/s	3060/91.30	3035/90.81, 3035/90.85, 3035/90.82, 3035/90.86
	Package: O.172 Jitter/Wander up to 622 Mbit/s	3060/91.31	3035/91.31
	Package: O.172 Jitter/Wander up to 2488 Mbit/s	3060/91.32	3035/91.32
	MTIE/TDEV Analysis Part of 3060/91.30 to 91.32	-	3035/95.21
ATM	ATM Basic	3060/90.50	3035/90.70
	ATM Comprehensive	3060/90.51	3035/91.80
	Add ATM SDH	3060/90.52	3035/90.72, 3035/90.74, 3035/90.75, 3035/90.77, 3035/90.33
	Add ATM SONET	3060/90.53	3035/90.71, 3035/90.73, 3035/90.76, 3035/90.34,
	OC-12c ATM Testing	3060/90.91	3035/90.91
Accessories	Remote control, V.24	3035/91.01	
	Remote control, GPIB	3035/92.10	
	Remote Operation Modem	3035/95.30	
	Remote Operation LAN/PCMCIA	3035/95.31	
	PDH/SDH NEXT Expert	3035/95.40	
	Test Sequencer	3035/95.90	
	LabWindows/CVI drivers	3035/95.99	
	Calibration report	3035/94.01	
	Transport case	3035/92.03	

Table O-64 Assignments of modules and software

Notes: