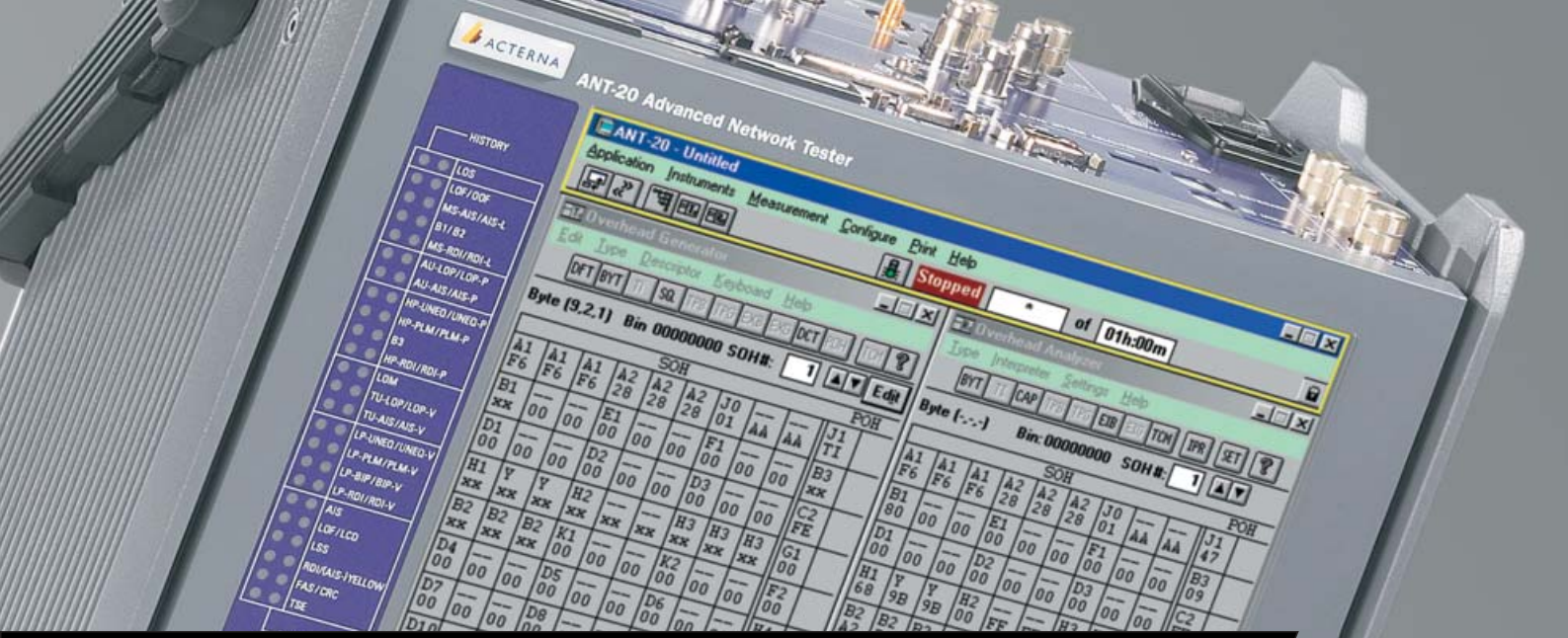

Acterna ANT-20 SDH

Advanced Network Tester

High speed networks require precise equipment specifications and high quality standards to ensure all network components are perfectly designed, tuned, and installed. As profit margins are squeezed, the pressure on network equipment manufacturers and network operators to control costs and maximize revenue from existing investment increases.
By carrying out detailed performance testing of network elements, operators and manufacturer can gather vital information for long term investment decisions and to help maximize the efficiency of installation, maintenance and troubleshooting.

Universal applications
Application areas of the ANT-20 include development labs, conformance and functional tests in production, installation and acceptance, and even pinpoint troubleshooting of in-service networks. Acterna works closely with systems manufacturers and network operators to define new quality standards in technical terms and to guarantee optimum ease of use.

Measurements are the epitome of flexibility. You can investigate all major quality parameters on diverse interfaces, ranging from simple bit error rate tests (BERT) to performance and pointer analysis, and covering even complex synchronization problems. The ANT-20 is a test solution you can customize to meet your own needs.

Superior ease of use
The ANT-20 is built around the standard Microsoft® Windows™ graphical user interface and a large display screen, combining comprehensive test facilities with superior ease of use. The instrument is operated right on screen using a mouse or the optional touchscreen. The graphical user interface facilitates rapid, application-oriented instrument settings together with simultaneous display of major parameters and test results.

Market leader
With its innovative design, the ANT-20 Advanced Network Tester quickly has become a market favorite, i. e. the market leader in Europe and a very popular instrument in nearly every country in the world.

Highlights

- Multi-rate transmission testing from E1 to STM-16c
- Modular platform offering SDH, PDH, SONET and ATM capabilities
- Built-in Pentium PC and Windows 98 user interface for easy processing of test results
- Complemented by a lot of easy-access, automated test features
- Large, color screen plus graphical results presentation

ACTERNA™
The Keepers of Communications

Configuration Guide

Mainframe			Page
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Specifications ANT-20 (Mainframe)

The ANT-20 Mainframe includes

- Generator and analyzer for electrical STM-1 signals allowing:
  - Simulation and evaluation in the SOH/POH
  - Generation and analysis of Anomalies and Defects
  - Pointer generator and analyzer
- Generator and analyzer for PDH BERT at 2, 8, 34 and 140 Mbit/s with framed and unframed patterns
- C12 mapping
- 1 extension slot
- Ethernet and USB interface

Generator unit

Digital outputs

Interfaces to ITU-T Recommendation G.703

75 Ω unbalanced output, adapter jack selectable from Versacon 9 adapter system

Bit rates and line codes

2048, 8448 and 34368 kbit/s	HDB3, CMI
139264 and 155520 kbit/s	CMI

120 Ω balanced output, Lemosa jack

Bit rate and line codes

2048 kbit/s	HDB3, CMI
Bit rate offset	±500 ppm
Step size	0.001 ppm

Clock

Internal clock generation

at all of the bit rates listed above.

Clock stability	±2 ppm

Synchronisation to external signals

via 75 Ω unbalanced input, BNC jack:

- Reference clock 2048 kHz and 1544 kHz
- 2048 kbit/s (HDB3), 1544 kbit/s (B8ZS) or
- Receive signal

Clock outputs

- Clock output at frequency of generator signal, approx. 400 mV (when terminated into 75 Ω), BNC jack.

2048 kHz reference clock output via trigger output

STM-1 output signal

Generation of a STM-1 signal conforming to ITU-T Recommendation G.707

Mappings

One selectable STM-1 mapping is included in the basic instrument. Other mappings can be added as needed.

Content of the selected container:

- Framed or unframed PDH test pattern
- PDH multiplex signal (with 64k/140M Mux/Demux chain option)
- External PDH signal (with D&I option)
- Test pattern without stuffing bits (bulk signal to O.181)

Content of non-selected containers	framed PRBS 2^{11}–1

The various mappings are described along with the options.

Generation of Pointer actions (Figure 1)

Generation of pointer actions at the AU and TU levels simultaneously.

- Pointer sequences to G.783 with programmable spacing
- Pointer increment/decrement (continuously repeated)
- Single pointer
- Pointer value setting with or without NDF

Trigger types: Single or continuous repeat

Content of SOH and POH bytes

The content of all bytes with the exception of B1/B2/B3 and H1 to H4 is programmable with any byte or a user defined byte-sequence p in m in n (p frames in m frames and the entire sequence repeated n times) can be inserted.

Bytes E1, E2, F1, F2, and byte groups D1 to D3 and D4 to D12:

- Transmission of a PRBS test pattern with bit error insertion (see test patterns)
- Insertion of an external data signal via V.11 interface (also for K1, K2, K3, N1 and N2)

Trace identifier

J0, J1, J2	programmable 16 byte ASCII sequence with CRC
J1, J2, additionally	programmable 64 byte ASCII sequence
H4 byte	4 or 48 byte sequence

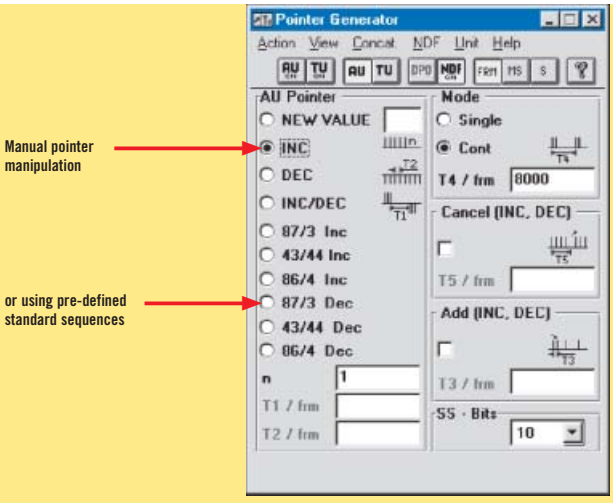


figure 1 Pointer actions

Error insertion

Error types: B1, B2, B3 parity errors, frame alignment signal errors, MS-REI, HP-REI, bit errors in test pattern, code errors (single errors)

Triggering

Single error or error ratio	2×10^{-3} to 1×10^{-10}
for B1, B3, HP-REI	2×10^{-4} to 1×10^{-10}
for bit errors	2×10^{-2} to 1×10^{-9}
Step size for mantissa and exponent	1

Burst error: m anomalies in n periods

For FAS, B1, B2, B3, MS-REI, HP-REI	m = 1 to 4.8×10^6 and n = 2 to 8001 frames or 0.2 s to 600 s

Alarm generation, dynamic

Alarm types	LOS, LOF, HP-PLM, MS-AIS, MS-RDI, AU-LOP, AU-AIS, HP-UNEQ, HP-RDI, HP-RDIEP, HP-RDIES, HP-RDIEC
m alarms in n frames	m = 1 to n–1, n_{max} = 8000

or

t1 alarm active, t2 alarm passive	t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off)

Alarm types	LOS, LOF, MS-AIS, RS-TIM, MS-RDI, AU-LOP, AU-AIS, HP-UNEQU, HP-PLM, HP-TIM, HP-RDI, HP-RDIEP, HP-RDIES, HP-RDIEC

PDH output signals

Signal structures for all bit rates:

– Unframed test pattern

– Framed test pattern (to ITU-T O.150); CRC-4 selectable for 2 Mbps

Error insertion

Error types	bit errors, FAS errors, code errors (single errors)
Trigger types: Single error or error rate	1×10^{-2} to 1×10^{-9}
Step size for mantissa and exponent	1

Alarm generation, dynamic

Alarm types	LOF, RDI
m alarms in n frames	m = 1 to n–1, n_{max} = 1000

Alarm generation, static (on/off)

Alarm types	LOS, LOF, AIS, RDI

Test patterns

Pseudo-random bit sequences

PRBS: 2^{11}–1, 2^{15}–1, 2^{20}–1, 2^{23}–1, 2^{11}–1 inv., 2^{15}–1 inv., 2^{20}–1 inv., 2^{23}–1 inv.

Programmable word

Length	16 bits

Receiver unit

Digital inputs

Interfaces to ITU-T Recommendation G.703

75 Ω unbalanced input; adapter jack selectable from Versacon 9 adapter system

Bit rates and line codes

2048, 8448 and 34 368 kbit/s	HDB3, CMI
139 264 and 155 520 kbit/s	CMI

120 Ω balanced input, Lemosa jack

Bit rate and line codes

2048 kbit/s	HDB3, CMI
Clock recovery pulling range	±500 ppm

Selectable input gain

CMI coded	15 to 23 dB
B3ZS, B8ZS, HDB3, AMI coded	15 to 26 dB

Selectable adaptive equalizers for 1544, 2048, 34 368, 44 736, 51 840, 139 264 and 155 520 kbps

Monitor input for STM-1 and STM-4 NRZ signals

STM-1 and PDH receive signals

Signal structures as for generator unit

C12 mapping (2 Mbps in STM-1, AU-3/AU-4)

Modes	asynchronous, byte synchronous (floating)
Error insertion and measurement	
Additional error types	BIP2, B3 parity errors, LP-REI, LP-BIP

Alarm generation, dynamic

Alarm types	TU-LOP, TU-AIS, LP-PLM, TU-LOM, LP-UNEQ, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
m alarms in n frames	m = 1 to n–1, n_{max} = 8000

or

t1 alarm active, t2 alarm passive	t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off) and evaluation

Alarm types	TU-LOP, TU-AIS, TU-LOM, LP-UNEQ, LP-PLM, LP-TIM, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
Alarm detection only	TU-NDF

Trigger output

75 Ω BNC connector, HCMOS signal level

Pulse output for received bit errors, transmit frame trigger, transmit pattern trigger or 2048 kHz reference clock

Automatic modes

Autoconfiguration

Automatically sets the ANT-20 to the input signal. The routine searches at the electrical and optical interfaces for the presence of standard PDH and STM-N signals (G.703, G.707, O.151, O.181) and the payload contents in channel 1.

Automatic SCAN function

The SCAN function permits sequential testing of all C11 or C12 channels via AU-3 or AU-4 in a SDH signal. The ANT-20 receiver checks for alarms in the receive signal, the SDH structure and all channels, and for synchronization of the selected test pattern in all channels. The results (OK/not OK) for each channel are entered in a matrix. The generator runs simultaneously and can be used to stimulate the device under test.

Automatic TROUBLE SCAN function

The TROUBLE SCAN function (figure 2) permits sequential testing of all C11 or C12 channels via AU-3 or AU-4 in a SDH signal. The ANT-20 receiver checks for alarms in the receive signal, the SDH structure and all channels. The results (OK/not OK) for each channel are entered in a matrix. A detailed alarm history can be displayed by selecting a channel from the matrix. The alarm status of individual channels can be displayed following the measurement. Only the receive channels are altered during a TROUBLE SCAN.

AutoScan function

This automatic "AutoScan" function (figure 3) allows you to rapidly check the signal structure, the mapping used, the trace identifier and the payload – even with mixed mapped signals. The ANT-20 receiver analyzes the incoming received signal and provides a clear overview of all the signals present in the composite receive signal. The variable scan depth setting allows even complex signal structures to be resolved and displayed clearly. All the displayed results can be printed out. Delay time 1 to 10 s.

Automatic SEARCH function

Channel shifts in the payload may occur when measuring complex network elements, depending on the configuration of the device under test. The SEARCH function permits rapid automatic location of the test channel (C11 or C12 with defined PRBS) in the payload of a SDH signal. The ANT-20 receiver checks for alarms in the receive signal, the SDH structure and all channels, and for synchronization of the selected test pattern in all channels. The results (OK/not OK) for each channel are entered in a matrix. An OK result indicates that the corresponding channel contains the signal searched for. Only the receive channels are altered during a SEARCH.

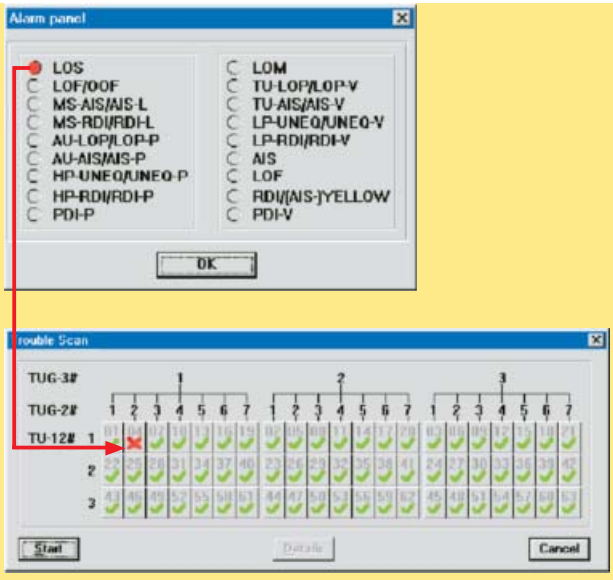


figure 2 Trouble scan

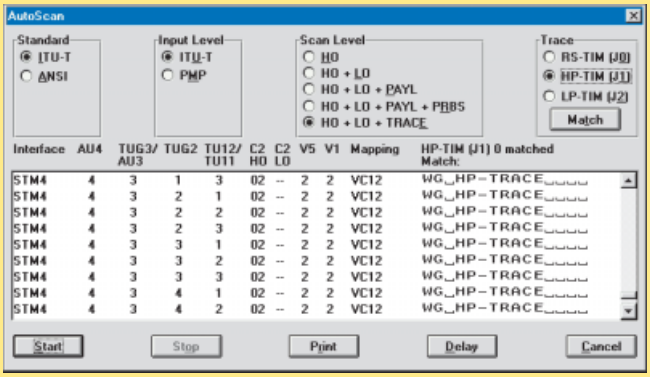


Figure 3: AutoScan

Measurement types

Error measurements

Error types	B1, B2, B3 parity errors
	MS-REI, HP-REI, bit errors in test pattern, code errors

Analysis of AU and TU pointer actions (figure 4)

Display of
- Number of pointer operations: Increment, Decrement, Sum (Increment + Decrement), Difference (Increment – Decrement)
- Pointer value

Clock frequency measurement

The deviation of the input signal clock frequency from the nominal frequency is displayed in ppm.

Alarm detection

All alarms are evaluated and displayed in parallel

Alarm types	LOS, OOF, LOF, MS-AIS, MS-RDI, RS-TIM, LTI, AU-AIS, AU-LOP, AU-NDF, HP-RDI, HP-UNEQ, HP-TIM, HP-PLM, AIS, RDI, LSS

SOH and POH evaluation

- Display of complete SOH and POH, e.g. interpretation of APS information in K1 and K2

For the bytes E1, E2, F1, F2 and byte groups D1 to D3 and D4 to D12:
- BERT using test pattern from the generator unit
- Output of the data signal via the V.11 interface (also for K1, K2, K3, N1 and N2)

For the Trace Identifier

– J0	display of 16 byte ASCII sequence
– J1, J2	display of 16 or 64 byte ASCII sequence

Measurement interval

Variable	1 second to 99 days
Measurement start	manual or automatic timer (user setting)
Measurement stop	manual or automatic timer (user setting)

Memory for errors, pointer operations and alarms

Resolution of error events and pointers	1 s
Alarm resolution	100 ms
Memory capacity	up to 1 million entries (approx. 100 days at 7 entries per minute)

Acustic Indication of Anomalies and Defects

Beeper upon any anomaly and defect.

Evaluation of PDH and SDH systems to ITU-T Recommendation G.821

ES, EFS, SES, DM and UAS are evaluated.
Pass/fail assessment based on line length allocation of 0.1 to 100%. The SES and DM thresholds are user-settable. Evaluation for higher bit rates (up to 140 Mbit/s) is obtained using a multiplex factor as per G.821, Annex D.
Measurements can be made using the following events:

PDH systems	bit errors, FAS2, FAS8, FAS34, FAS140, CRC and E bit errors
SDH systems	payload bit errors (PDH and bulk), overhead bytes E1, E2, F2, D1 to D3, D4 to D12

Evaluation to ITU-T Recommendation G.826

EB, BBE, ES, EFS, SES and UAS are evaluated.
Pass/fail assessment based on line length allocation of 0.1 to 100%.
The SES and UAS thresholds are user-settable.

In-Service Measurement (ISM)

Simultaneous in-service measurement of near end and far end of a selected path:
- Near end: B1, B2, HP-B3, LP-B3, BIP2, FAS at 140/34/8 or 2 Mbit/s, CRC-4
- Far end: HP-REI, LP-REI, E bit at 2 Mbit/s

Out of Service measurement (OOS)

Out of service measurement using bit errors in the test pattern (for PDH and SDH).

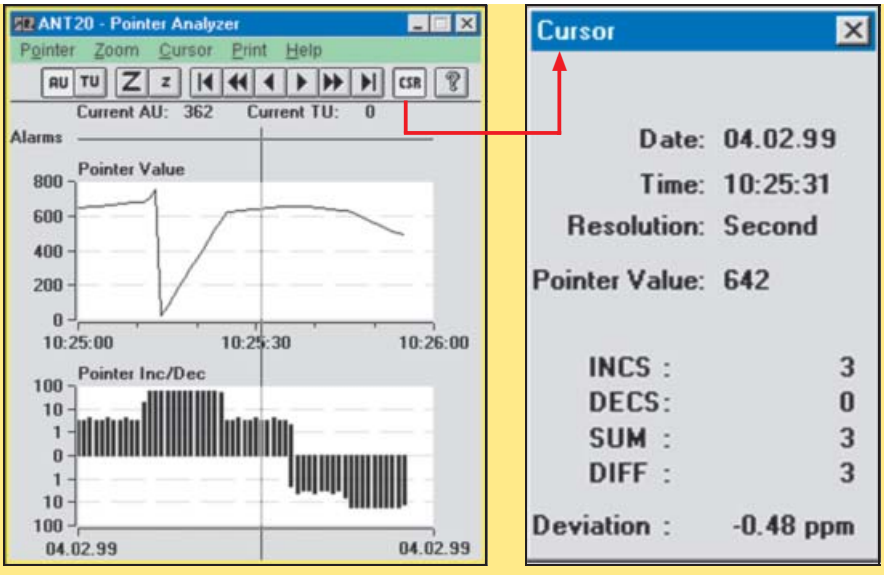


figure 4 Graphic pointers. Display showing additional evaluation of cursor position

Evaluation of PDH and SDH systems to ITU-T Recommendation M.2100

This recommendation describes requirements during line-up and maintenance (in-service) ES, EFS, SES and UAS are evaluated. Pass/fail assessment based on line length allocation of 0.1 to 100%. The UAS and BISO (bringing into service objectives) thresholds are user-settable.

ISM simultaneously for near end and far end of a selected path:

PDH systems, near end	bit errors, FAS2, FAS8, FAS34, FAS140, CRC-4
far end	E bit at 2 Mbps
SDH systems	payload bit errors (PDH and bulk), overhead bytes E1, E2, F2, D1 to D3, D4 to D12

This operating mode allows application of the "Bringing into Service" procedures as per ITU-T Rec. M.2110 and the determination of "Performance Information" as per ITU-T Rec. M.2120.

Evaluation of SDH systems to ITU-T Recommendation G.828 and G.829

The G.828 defines error performance parameters and objectives for international synchronous paths.

ES, EFS, SES, BBE, SEP and UAS are evaluated.

Pass/fail assessment based on line length allocation of 0.1 to 100%.

The SES and UAS thresholds are user-settable. The SEP can be switched off for assessment.

The recommendation G.829 defines error performance events and block structures for SDH multiplex and regenerator sections.

Evaluation of SDH systems to ITU-T Recommendation M.2101

This recommendation provides limits for bringing-into-service and maintenance of interantional SDH paths and multiplex sections.

ES, EFS, SES, BBE, SEP and UAS are evaluated.

Pass/fail assessment based on line length allocation of 0.1 to 100%.

The UAS and BISO (bringing into service objectives) thresholds are user-settable.

ISM simultaneously for near end and far end of a selected path:

PDH systems, near end	B1, B2SUM, B3, BIP8, BIP2, bit errors (TSE)
far end	MS-REI, HP-REI, LP-REI

Delay measurement

A delay measurement is used to line-up satellite hops, to test the maximum permitted latency in storage exchanges and cross-connect systems and to check the loop circuits of regenerators. The ANT-20 measures the time taken for the test pattern to be transmitted from the generator back to the receiver via the path under test.

The measurement is made on the test patterns in the selected channel, in the containers (bulk or PDH) for SDH or in the selected channel at the lowest hierarchy level of PDH multiplex systems.

To avoid ambiguities in the measurement, two measurement times are provided.

Measurement range

Bit rates from 8 to 155 Mbit/s	1 µs to 1 s
Bit rate 2 Mbit/s	10 µs to 5 s
Bit rate 64 kbit/s	100 µs to 16 s

Off-line analysis software

The software runs on standard PCs and permits comprehensive analysis of stored ANT-20 results.

After loading the results, the ANT-20 settings during the measurement and the stored results can be accessed.

Zoom and filter functions allow detailed evaluations.

The processed results can be exported in CSV format for importing into other programs such as MS Excel or MS Word for Windows for producing documentation.

Results display and instrument operation

Numerical display

Display of absolute and relative values for all error types

Intermediate results every 1 s to 99 min

Graphical display (histogram) (Figure 6)

Display of errors, pointer operations/values and alarms as bargraphs vs. time

Units, time axis seconds, minutes, 15 minutes, hours, days

Tabular display

Display of all alarm and error events with time stamp.

Result printout

ANT-20 supports a variety of dot-matrix, inkjet and laser printers (Windows Print Manager).

Printer interfaces

Serial	V.24/RS232
Parallel	Centronics/EPP/IEEE P 1284

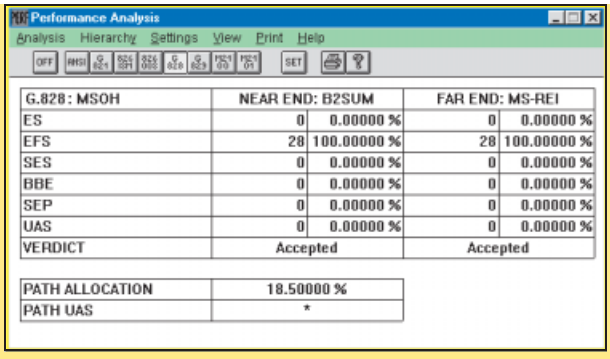


figure 5 Performance analysis to ITU-T G.828/G.829

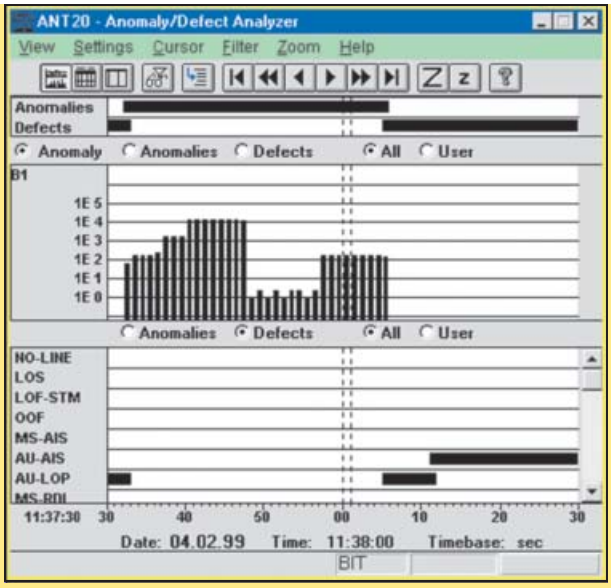


figure 6 Histogram result display

Result export

Results are stored in a database and can be processed using standard PC software.

Instrument operation

ANT-20 is operated using the standard Microsoft® Windows™ graphical user interface. Operation is menu-controlled using a trackball or optional touchscreen. A mouse can also be connected if desired.

Application selection and storage

ANT-20 includes an applications library to which customer-specific applications can be added. All applications are stored internally on the built-in hard disk drive and can be copied to any other ANT-20 via floppy disk. Easy to use filter functions allow quick selection of the desired application.

Display

A large display screen is available for the ANT-20:

Color TFT screen (touchscreen optional)	10.4″, 256 colors
Resolution	640 × 480 pixels (VGA standard)

Built-in PC

ANT-20 uses a Pentium PC as internal controller so that standard PC applications can also be run on the instrument.

RAM capacity	64 MB
Floppy drive	3.5″, 1.44 MB
Hard disk drive	6 GB (minimum)

USB interface, 10/100 Mbit/s Ethernet interface are included.

Keyboard

Full keyboard for text input, extended PC applications and future requirements. The keyboard is protected by a fold back cover.
An additional connector is provided for a standard PC keyboard.

External display connector

Simultaneous display with built-in screen interface	VGA standard

PCMCIA interface

Type	PCMCIA 2.1 types I, II and III

The PCMCIA interface provides access to GPIB, LANs, etc., via adapter cards.

Power outage function

In the event of an AC line power failure during a measurement, ANT-20 saves all data. As soon as the AC line voltage is reestablished, the measurement is resumed. Previous results are retained and the time of the power failure is recorded along with other events.

General specifications

– *Power supply*		
AC line voltage, automatic switching		100 to 127 V and 220 to 240 V
AC line frequency		50/60 Hz
Power consumption (all options fitted)		max. 230 VA
Safety class to IEC 1010-1		Class I
– *Ambient temperature*		
Nominal range of use		+5 to +40ºC (41 to 104ºF)
Storage and transport range		−20 to +70ºC (−4 to 158ºF)
– *Dimensions (w × h × d)*	in mm	approx. 320 × 350 × 170
	in inches	approx. 12.6 × 13.8 × 6.7
– *Weight*		approx. 10 kg / 22 lb

Options

Touchscreen	*BN 3035/93.11*
Upgrade for color display screens	

Extended SDH testing	*BN 3060/90.01*

C3 mapping (34 Mbps in STM-1, AU-3/AU-4)

Error insertion and measurement

Additional error types	LP-B3, LP-REI

Alarm generation, dynamic

Alarm types	TU-LOP, TU-AIS, LP-UNEQ, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
m alarms in n frames	m = 1 to n-1, n_{max} = 8000
or	
t1 alarm active, t2 alarm passive	t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off) and evaluation

Alarm types	TU-LOP, TU-AIS, LP-UNEQ, LP-PLM, LP-TIM, LP-RDI, LP-RDIEP, LP-RDIES, LP-RDIEC, LP-RFI
Alarm detection only	TU-NDF

C4 mapping (140 Mbps in STM-1 and STS-3c)

Errors and alarms as for mainframe instrument

C11 mapping (1.5 Mbps in STM-1, AU-3/AU-4)

Selectable via TU-11 or TU-12

Errors and alarms as for C12 mapping (2 Mbps in STM-1)

C3 mapping (45 Mbps in STM-1, AU-3/AU-4)

Errors and alarms as for C3 mapping (34 Mbit/s in STM-1)

C2 mapping (6 Mbps unframed/Bulk in STM-1)

STM-0 and VT2 SPE mapping (2 Mbps in STM-0 and E1 in STS-1)

See ANT-20 SONET datasheet for details

STM-0 and VT1.5 SPE mapping (1.5 Mbps in STM-0 and DS1 in STS-1)

See ANT-20 SONET datasheet for details

Mapping VT6 SPE (6 Mbps in STS-1)

See ANT-20 SONET datasheet for details

STM-0 and STS-1 SPE mapping (34/45 Mbps in STM-0 and DS3 in STS-1)

See ANT-20 SONET datasheet for details

Extended Overhead Analysis

Byte capture SOH and POH

To analyze the SOH/POH functions, it is necessary to capture individual bytes vs. time, allowing detection of errors or short-term changes with frame level precision. The Capture function is started by a selectable trigger.

Values for a selected byte are stored and can be accessed subsequently in a table of values.

Particularly in capturing the **APS sequences,** the bytes (K1, K2) are displayed as an abbreviation of the standard commands.

The function also allows recording of the N1 or N2 bytes for evaluation of **"Tandem Connection"** information. **H4 sequences** can also be analyzed very easily.

The results can be printed or exported.

Capture bytes for	
STM-0/1, el. & opt.	all SOH/POH bytes
STM-N el. & opt.	all SOH/POH bytes, channel 1 except A1, A2, B1
Storage depth for a byte	266
K1, K2	200
Trigger events	MS-AIS, AU-AIS, MS-RDI, AU-LOP, editable value in trigger byte
Capture resolution	frame precision

Tandem Connection Monitoring (TCM) (Figure 7)

TCM is a method used to monitor the performance of a subsection of a SDH path via the N1/N2 bytes. This is particularly useful when the path is routed via different network providers. If errors occur on an end-to-end connection, you can use TCM to determine which subnetwork the errors occurred in.

The ANT-20 helps to monitor the content of the N1/N2 bytes and provides users with easy interpretation of the detailed events.

Capture TCM frames	all N1/N2 bytes, TC-IEC, TC-AIS, TC-REI, TC-OEI
Trigger events	Start of TCM frame (TCM FAS word)
Storage depth	266 bytes (3.5 TCM frames)
On-line monitoring of alarms and trace identifier	
Display of actual and history values	TC-UNEQ, LTC, TC-AIS , TC-RDI, TC-ODI, TC-REI, TC-OEI
On-line display of TCM Access Point Identifier	
TCM error measurement	
Error types	TC-IEC, TC-DIFF, TC-REI, TC-OEI

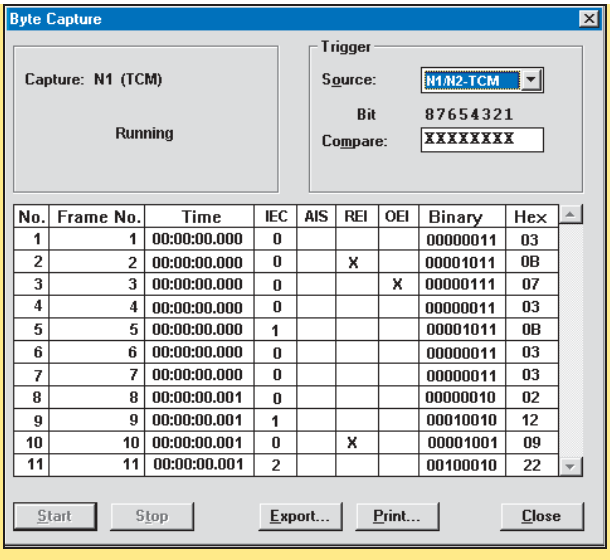


figure 7 Capture with TCM trigger and interpretation

Overhead Sequencer

This serves to test a sequential TCM process (Tandem Connection Monitoring) in the N1/N2 bytes. A sequence of 76 bytes simulating a TCM frame (equivalent frame) is generated. Individual values can be edited as binary or hexadecimal values to simulate various events for TCM evaluations.

APS time measurement

In synchronous networks, a defined maximum switch-over time is necessary for the traffic in case of a fault. To verify compliance with this requirement, the ANT-20 measures the switch-over time with 1 ms resolution. The result can be printed.

Criteria for the time measurement	TU-AIS, MS-AIS, AU-AIS, bit error, service disruption
Max. measurable switch-over time	2 s
Resolution	1 ms

Add SONET — *BN 3060/90.03*

STM-0 and VT2 SPE mapping (2 Mbps in STM-0 and E1 in STS-1)

See ANT-20SE SONET datasheet for details

STM-0 and VT1.5 SPE mapping (1.5 Mbps in STM-0 and DS1 in STS-1)

See ANT-20SE SONET datasheet for details

Mapping VT6 SPE (6 Mbps in STS-1)

See ANT-20SE SONET datasheet for details

STM-0 and STS-1 SPE mapping (34/45 Mbps in STM-0 and DS3 in STS-1)

See ANT-20SE SONET datasheet for details

BERT (1.5/6/45 Mbit/s)

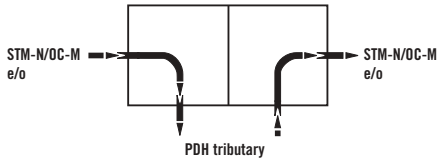
Signal structure and interfaces for generator and receiver:	
Framed and unframed test patterns (6 Mbit/s unframed)	
Additional test pattern	QRSS 20
Additionally, for unbalanced digital signal input/output	
Bit rate, line code	1544 kbit/s, 6312 kbit/s, B8ZS, AMI
Bit rate, line code	44 736 kbit/s, B3ZS
Additionally, for balanced digital signal input/output	
Bit rate, code	1544 kbit/s, B8ZS

Drop & Insert — *BN 3035/90.20*

This option provides the following functions:

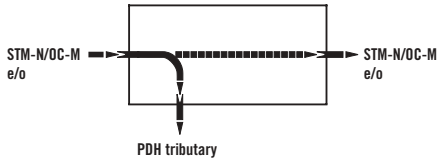
1. Generator and receiver operate independently

as mapper and demapper. The PDH signal from a selected channel is dropped from the receive signal and output to a connector. An external or internal PDH signal is inserted into the transmit signal.



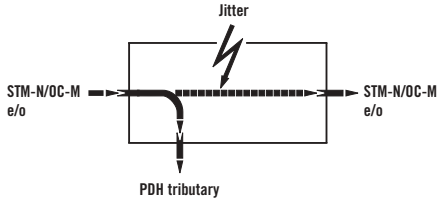
2. Through mode

The received signal is looped through the ANT-20 and re-transmitted (generator and receiver coupled). The PDH signal from a selected channel may be dropped from the receive signal and output to a connector. An internal PDH signal may be inserted into the transmit signal. The ANT-20 can operate here as an active signal monitor without affecting the signal.



3. Through mode jittering

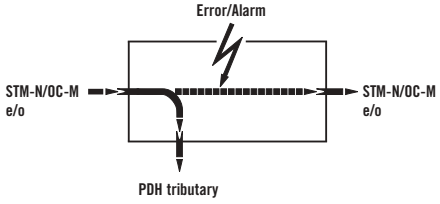
The looped-through PDH or SDH signal can also be jittered using the Jitter Generator option. This applies to all jitter frequencies up to 622 Mbit/s depending on the jitter option fitted.



4. Error insertion in through mode

The looped-through synchronous signal can be manipulated if required:

- Overwriting bytes in the SOH (except B1, B2, H1 to H3)
- Anomaly insertion
- Defect generation by programming the SOH



5. Block and Replace (B&R)

For this function, the ANT-20 is looped into the working fiber of a ring. B&R allows replacement of a synchronous tributary (e.g. STM-1 including SOH, POH and payload) in a STM-N signal. This can then be measured by the ANT-20 from the ring. By inserting specific errors, the error thresholds of the APS mechanism in the system can be tested.

Additional input and output for tributary signals 75 Ω, coaxial BNC; line codes as for mainframe instrument

Input and output for balanced tributary signals: Use balanced connectors on mainframe.

M13 MUX/DEMUX chain — *BN 3035/90.32*

M13 multiplexers are used in North America in hybrid networks and synchronous system cross-connects.

This option provides n × DS0 to DS3 multiplex and demultiplex functions. The output signal is fed to the electrical interface (requires option BN 90.34) and is available as payload in mappings (requires option BN 3060/90.01 or BN 3060/90.03).

Alarms and errors can be generated and analyzed.

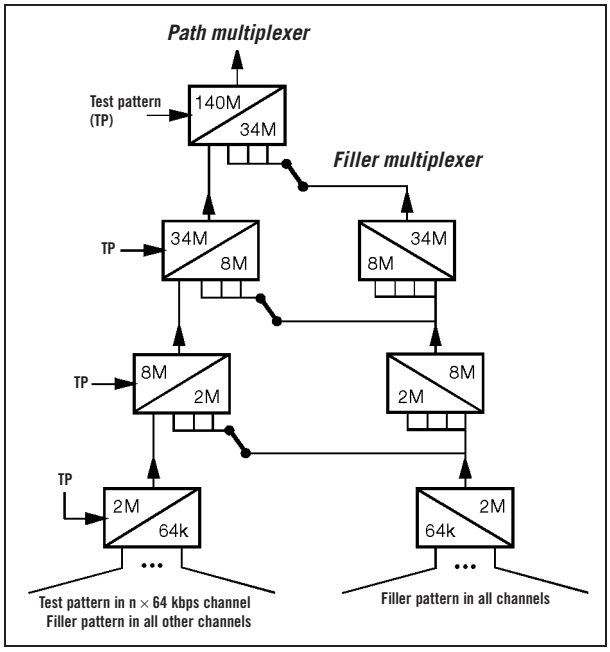


figure 8 Output signal structure. Framed and unframed pseudo-random bit sequences are available as test patterns (TP) from 2 to 140 Mbps.

BERT (1.5/6/45 Mbit/s) — *BN 3035/90.34*

Signal structure and interfaces for generator and receiver:	
Framed and unframed test patterns (6 Mbps unframed)	
Additional test pattern	QRSS 20
Additionally, for unbalanced digital signal input/output	
Bit rate, line code	1544 kbps, 6312 kbps, B8ZS, AMI
Bit rate, line code	44 736 kbps, B3ZS
Additionally, for balanced digital signal input/output	
Bit rate, code	1544 kbps, B8ZS

64k/140M MUX/DEMUX chain — *BN 3035/90.30*

This option provides n × 64 kbps to 140 Mbps multiplex and demultiplex functions. The output signal is fed to the electrical interface and is available as payload in mappings (requires options BN 3060/90.01 or BN 3060/90.03). Alarms and errors can be generated and analyzed.

Optical Interfaces

All of the optical interfaces are intended for single-mode fibers. Acterna offers a complete line of optical test adapters. Select one test adapter each for the generator and receiver from the ordering information in this data sheet. All optical interface options include the required number of test adapters. The STM-0 optical interface requires one of the options BN 3035/90.10 or BN 3035/90.12 or BN 3035/90.13 to be activated.

Optical Modules up to 155 Mbps

Optical STM-0/1, OC-1/3, 1310 nm	***BN 3035/90.43***
Optical STM-0/1, OC-1/3, 1310 & 1550 nm	***BN 3035/90.45***
Bit rate of TX and RX signal	155 520 kbit/s
additionally, for STS-1/STM-0 mappings	51 840 kbit/s
Line code	scrambled NRZ

Generator unit

The generator meets the requirements of ITU-T Rec. G.957, Tables 2 and 3 (Telcordia GR-253, ANSI T1.105.06).
Classes L1.1, L1.2 and L1.3 (LR-1, LR-2, LR-3) are covered.
There are three options for adapting to the required wavelength:

Wavelength	1310 nm, 1310 & 1550 nm (switchable in the instrument)
Output level	0 dBm +2/–3 dB
with 1310 & 1550 nm option	0 dBm +2/–3.5 dB

Receiver unit

The receiver unit meets the specifications of ITU-T Rec. G.957 (Telcordia GR-253, ANSI T1.105.06) and fulfills classes S1.1 and S1.2 (IR-1, IR-2).

Wavelength range	1100 to 1580 nm
Input sensitivity	–8 to –34 dBm
Display of optical input level	
Resolution	1 dB
155 Mbit/s electrical interface for connecting the ANT-20 to STM-1/STS-3 monitor points	
Line code	scrambled NRZ
Input voltage (peak-peak)	0.2 to 1 V
Unbalanced input	
Connector/impedance	SMA/50 Ω

Optical Modules up to 622 Mbps

Optical STM-0/1/4, OC-1/3/12, 1310 nm	***BN 3035/90.46***
Optical STM-0/1/4, OC-1/3/12, 1310 & 1550 nm	***BN 3035/90.48***
Bit rate of TX and RX signal	155 520 kbps, 622 080 kbps
additionally, for STS-1/STM-0 mappings	51 840 kbps
Line code	scrambled NRZ

Generator unit

The generator meets the requirements of ITU-T Rec. G.957, Tables 2 and 3 (Telcordia GR-253, ANSI T1.105.06). Classes L1.1, L1.2, L1.3, L4.1, L4.2 and L4.3 (LR-1, LR-2, LR-3) are covered.
There are three options for adapting to the required wavelength:

Wavelength	1310 nm, 1310 & 1550 nm (switchable in the instrument)
Output level	0 dBm +2/–3 dB
with 1310 & 1550 nm option	0 dBm +2/–3.5 dB

Generation of STM-4 TX signal in instruments with STM-1 mappings

The STM-4 TX signal consists of
– four identical STM-1 tributary signals (AU-4), or
– one internally generated STM-1 tributary signal with the other three tributaries filled with UNEQ.

Generation of OC-12 TX signal in instruments with STS-1 mappings

The OC-12 TX signal consists of
– one internally generated STS-1 tributary signal with the other 11 tributaries filled with UNEQ or

with STS-3c mapping option BN 3035/90.03, or ATM Module Option BN 3035/90.70
– one internally generated STS-3c tributary signal with the other three tributaries filled with UNEQ.

Contents of the STM-4/OC-12 overhead bytes

For all bytes except B1, B2 and H1 to H3:
– the content of each byte is statically programmable or a user defined byte-sequence p in m in n (p frames in m frames and the entire sequence repeated n times) can be inserted.

For the E1, E2, F1 bytes and the DCC channels
D1 to D3 and D4 to D12:
– Transmission of a test pattern with bit error insertion (see mainframe for pattern selection)
– Insertion of an external data signal (via the V.11 interface)

For the K1, K2, N1, N2 bytes:
– Insertion of the data signal via the V.11 interface

For the J0 bytes:
– Transmission of a 16-byte sequence, with CRC

Error insertion

Error types	B1 and B2 parity error
additionally, for STM-4	MS-REI
for OC-12	REI-L
Triggering	
Single errors or error ratio	2×10^{-3} to 1×10^{-10}
for B1 parity errors	2×10^{-4} to 1×10^{-10}
Burst error: m anomalies in n periods	
For FAS, B1, B2, B3, REI-L, REI-P	m = 1 to 4.8×10^6 and n = 2 to 8001 frames or 0.2 s to 600 s

Alarm generation, dynamic

Alarm types for STM-4	LOF, MS-AIS, MS-RDI
for OC-12	LOF, AIS-L, RDI-L
m alarms in n frames	m = 1 to n-1, n_{max} = 8000
or	
t1 alarm active, t2 alarm passive	t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off)

Alarm types	LOS, LOF
additionally, for STM-4	MS-AIS, MS-RDI, RS-TIM
for OC-12	AIS-L, RDI-L, TIM-L
Insertion on/off	

Receiver unit

The receiver unit meets the specifications of ITU-T Rec. G.957 (Telcordia GR-253, ANSI T1.105.06) and fulfills classes S1.1, S1.2, S4.1, S4.2, L4.1, L4.2 and L4.3 (IR-1, IR-2, LR-1, LR-2, LR-3).

Wavelength range	1100 to 1580 nm
Input sensitivity, STM-1/4, OC-1/3/12	–8 to –34 dBm
Display of optical input level	
Resolution	1 dB

The ANT-20 demultiplexes one selectable STM-1 or STS-3c/STS-1 tributary from the STM-4 or OC-12/OC-3 RX signal and feeds it to the internal processor for evaluation.

Measurement types

Error measurements

Error types	B1 parity error, B2 parity error of all STM-1/STS-1/STS-3c signals, MS-REI/REI-L

Alarm detection

Alarm types	LOS, LOF, OOF, LTI
additionally, for STM-4	MS-AIS, MS-RDI, RS-TIM
for OC-12	AIS-L, RDI-L, TIM-L

Overhead evaluation

– Display of the complete overhead of a selectable STM-1/STS-1/STS-3c signal
For the E1, E2, F1 bytes and the DCC channels
D1 to D3 and D4 to D12:
– BERT using a test pattern from the generator unit
– Output of the data signal via the V.11 interface
For the K1, K2, N1, N2 bytes:
– Data signal output via the V.11 interface
For the J0 byte:
– Display of 15-byte sequences in ASCII.

155/622 Mbps electrical interface

For connecting the ANT-20 to STM-1/OC-3 and STM-4/OC-12 monitor points

Line code	scrambled NRZ
Input voltage (peak-peak)	0.2 to 1 V
Coaxial input	
Connector/impedance	SMA/50 Ω

Concatenated Mappings 622 Mbps

Option VC-4-4c BERT ***BN 3035/90.90***

Only in conjunction with BN 3035/90.46 or BN 3035/90.47 or BN 3035/90.48
Contiguous concatenation signal structure to ANSI T1.105.02 and G.707.
Error measurement to O.150

Test pattern	PRBS-31, IPRBS-31, PRBS-23, IPRBS-23, PRBS-20, PRBS-15, IPRBS-15

Programmable word

Length	16 bits

Error insertion

Bit errors in test pattern, single error or error ratio	1×10^{-2} to 1×10^{-9}

Error measurement and alarm detection
Bit errors and AIS in test pattern

Option VC-4-4c Virtual Concatenation ***BN 3035/90.92***

Only in conjunction with BN 3035/90.90 or BN 3035/90.91

Signal structure

STM-4 to ITU-T G.707
Virtual concatenation with 4 AU-4 pointers

Generation of pointer actions

Manipulations on pointer #1 see mainframe
Setting of delta values for pointers #2, #3, #4

Pointer analysis

For pointer #1	see mainframe
Delta values (maximum, minimum)	±40 for pointers #2, #3, #4

POH generation/analysis

POH #1	see mainframe
POH #2, #3, #4	static setting of all bytes except B3

Automatic B3 generation for VC-4 #1, #2, #3, #4

Option VC-4-4c ATM-Testing ***BN 3035/90.91***

Only in conjuction with BN 3035/90.70 and BN 3035/90.46 or BN 3035/90.47 or BN 3035/90.48
See chapter "ATM options" for further detail.

Optical Modules up to 2488 Mbps

All optical packages include 4 optical adapters, STM-16c/OC-48c, STM-4c/OC-12c are not included.

Optical OC-1/3/12/48, STM-0/1/4/16, 1310 nm ***BN 3035/91.17***

Optical OC-1/3/12/48, STM-0/1/4/16, 1550 nm ***BN 3035/91.18***

Optical OC-1/3/12/48, STM-0/1/4/16, 1310 & 1550 nm ***BN 3035/91.19***

Optical Modules 2488 Mbps

Optical STM-16, OC-48, 1310 nm ***BN 3035/91.54***

Optical STM-16, OC-48, 1550 nm ***BN 3035/91.53***

Optical STM-16, OC-48, 1310/1550 nm switchable ***BN 3035/91.59***

One 2.5 Gbps module can be fitted in the extension slot of the ANT-20.
The optical interfaces meet the specifications of ITU-T Recommendation G.957 (Table 4) and Telcordia TA-NWT-000253 I.6 (Table 4–9, 4–10).
Classes S-16.2, L-16.2, L-16.3 (ITU-T) or IR-2, LR-2, LR-3 (Telcordia) are fulfilled at 1550 nm; classes S-16.1, L-16.1 (G.957) or IR-1, LR-1 (Telcordia) are fulfilled at 1310 nm.

Generator

Optical interfaces

Wavelengths	1310 nm, 1550 nm or 1310/1550 nm switchable
Output level at 1310 nm and 1550 nm	0 dBm +0/–2 dB
Line code	scrambled NRZ

Electrical interfaces

Line code	scrambled NRZ
Output voltage (peak-peak)	≥ 0.6 V
Connector/impedance	SMA/50 Ω

Clock generator

Internal, accuracy	±2 ppm
Offset	±50 ppm

Synchronization from external signal as for mainframe

Generation of STM-16 TX signal in instruments with STM-1 mappings

The STM-16 signal consists of one or more internally generated tributaries plus several tributaries filled with UNEQ (or non-specific UNEQ)
– 16 identical STM-1
– one STM-1 tributary and 15 × UNEQ/non specific
– four identical STM-4c (Option BN 3035/90.90 required)
– one STM-4c tributary (Option BN 3035/90.90 required) and 3 × UNEQ/non specific

Generation of OC-48 TX signals in instruments with STS-1/STS-3c mappings

The OC-48 signal consists of one or more internally generated tributaries plus several tributaries filled with UNEQ (or non-specific UNEQ)
– 48 identical STS-1
– one STS-1 tributary and 47 × UNEQ/non specific
– 16 identical STS-3c (Option BN 3035/90.03 required)
– one STS-3c tributary (Option BN 3035/90.03 required) and 15 × UNEQ/non specific
– four identical STS-12c (Option BN 3035/90.90 required)
– one STS-12c tributary (Option BN 3035/90.90 required) and 3 × UNEQ/non specific

Contents of STM-16/OC-48 overhead bytes

For all bytes except B1, B2 and H1 through to H3:
– the contents of the bytes in all SOH/TOH are statically programmable
For the bytes E1, E2, F1 and the DCC channels D1 to D3 and D4 to D12:
– Transmission of a test pattern and bit error insertion (see mainframe for pattern selection)
– Insertion of an externally-generated data signal (via V.11 interface)
For the K1, K2, N1, N2 bytes:
– Insertion of an external data signal via the V.11 interface
For the J0 byte:
– Transmission of a 16-bit sequence with CRC

Error insertion

Error types	B1, B2 parity errors
Single error or error rate B1	2×10^{-5} to 1×10^{-10}
B2	2×10^{-3} to 1×10^{-10}
additionally, for STM-16	MS-REI
for OC-48	REI-L
Single error or error rate	2×10^{-3} to 1×10^{-10}

Alarm generation, dynamic

Alarm types for STM-16	LOF, MS-AIS, MS-RDI
for OC-48	LOF, AIS-L, RDI-L
m alarms in n frames	m = 1 to n-1, n_{max} = 8000
or	
t1 alarm active, t2 alarm passive	t1 = 0 to 60 s, t2 = 0 to 600 s

Alarm generation, static (on/off)

Alarm types	LOS, LOF
additionally, for STM-16	MS-AIS, MS-RDI
for OC-48	AIS-L, RDI-L

Receiver

Optical interfaces

Wavelength	1260 to 1580 nm
Line code	scrambled NRZ
Sensitivity	–28 dBm to –8 dBm
Input overload	> –8 dBm
Display of optical input level	
Range	–30 dBm to –8 dBm
Resolution	1 dB

Electrical interfaces

Line code	scrambled NRZ
Input voltage (peak-peak)	0.3 to 1 V
Connector/impedance	SMA/50 Ω

A selectable STM-1, STS-1 or STS-3c channel is fed to the internal evaluation circuits by demultiplexing from the input signal.

Error measurement

Error types	B1 parity error, MS-REI, B2 parity sum error over all STM-1/STS-1/STS-3c channels
Evaluation (bit/block errors)	error rate, count
Error event resolution	1 s

Alarm detection

Alarm types	LOS, LOF, OOF
additionally, for STM-16	MS-AIS, MS-RDI, RS-TIM
for OC-48	AIS-L, RDI-L, TIM-L
Alarm event resolution	100 ms

SOH/TOH evaluation

Display of complete overhead
For the bytes E1, E2, F1 and the DCC channels D1 to D3 and D4 to D12:
– BERT using test pattern from generator unit
– Output of the data signal via the V.11 interface
For the K1, K2, N1, N2 bytes:
– Data signal output via the V.11 interface
For the J0 byte:
– Display of 15-byte sequences in ASCII format

Concatenated Mapping 2488 Mbps

Option OC-48c/STM-16c BERT ***BN 3035/90.93***

Only in conjunction with BN 3035/91.53 to /91.59 or /90.38
Contiguous concatenation signal structure to ANSI T1.105.02 and G.707.
Error measurement to O.150

Test pattern	PRBS-31, IPRBS-31, PRBS-23, IPRBS-23
Programmable word	
Length	16 bits

Error insertion

Bit errors in test pattern, single error or error ratio	1×10^{-3} to 1×10^{-9}

Alarm generation:

AU-AIS, AIS-C1... AIS-C16, AU-LOP, LOP-C1... LOP-C16

Error measurement and alarm detection:

AU-AIS, AU-LOP
Bit errors
Automatic Protection Switching
Sensor: MS-AIS, AU-AIS

Further options

Optical power splitter (90%/10%) ***BN 3035/90.49***

The optical power splitter is built into the ANT-20.
Three optical test adapters are required to operate it; please indicate your choice.
The optical power splitter provides an optical monitor point. The input signal is passed through to the output transparently.

Light energy forwarded	approx. 90% (–0.45 dB)
Light energy coupled out	approx. 10% (–10 dB)

The optical power splitter operates in the following ranges:

Wavelengths	1260 to 1360 nm and 1500 to 1600 nm

Acterna OLC-65 Optical Level Controller ***BN 2276/01***

The OLC-65 is a variable optical attenuator with internal power control. Variable optical attenuators are used during BER tests to simulate line loss and line interruptions. The power level control functionality allows to monitor the output power level when using the instrument in Attenuator mode or to set the output power level directly when using it in the Automatic Level Controller (ALC) mode. In tests where the device under test (DUT) is tested against the optical input power (e.g. receiver sensitivity testing) this functionality simplifies test set-ups and reduces test time. With its wide variable attenuation range and highly accurate and reproducible attenuation settings, the OLC-65 is an ideal companion to the ANT-20.

Calibrated at	1310, 1550 and 1625 nm
Attenuation range	3 to 60 dB
Resolution	0.05 dB

See OLC-65 datasheet for details.

Jitter and Wander Options

Standards

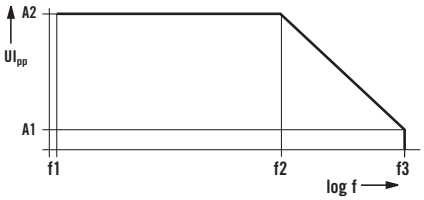
Jitter generation and jitter/wander analysis are in accordance with
- ITU-T G.783, G.823, G.824, G.825, O.171, O.172
- ETSI ETS 300 462-1 to -6, ETS 300 417-1-1, EN 302 084
- Telcordia GR-253, GR-499, GR-1244
- ANSI T1.101, T1.102, T1.105.03, T1.403, T1.404, T1.405.09

0.172 Jitter /Wander up to 155 Mbps — *BN 3035/91.29*

Jitter generator

Fully complies with or exceeds the requirements of ITU-T O.172.
Generates jitter at all bit rates included in the mainframe configuration up to 155 520 kbps.

TX signals	all test patterns and frame structures included in the mainframe configuration
Built-in modulation generator (sinewave)	0.1 Hz to 5 MHz
External modulation	0 Hz to 5 MHz
Jitter amplitude	up to 64 UI



Clock rate/kHz	A1	A2	f1/Hz	f2/Hz	f3/kHz
1 544	0.5	64	0.1	625	80
2 048				1560	200
6 312				940	120
8 448				6250	800
34 368				27 k	3 500
44 736				35 k	4 500
51 840				27 k	3 500
139 264				39 k	5 000
155 520				39 k	5 000
622 080 *	1.0	256		20 k	5 000

** Requires option BN 3035/90.83*

Modulator input

75 Ω, BNC socket

Voltage required	0 to 2 Vpp
Error limits	as per O.172

Jitter Analyzer

Jitter measurement at all bit rates included in the mainframe configuration up to 155 520 kbit/s.

Built-in filters (depending on the applied bit rate)

High-pass filters	0.1, 2, 4, 10, 20, 40, 100, 200, 400, 500, 700 Hz, 1, 3, 8, 10, 12, 18, 20, 30, 65, 80, 250 kHz
Low-pass filters	40, 60, 100, 400, 800, 1300, 3500, 5000 kHz
Filter characteristics	as per ITU-T O.172

Measurement ranges

Peak-peak	
Range I/Resolution	0 to 1.6 UIpp/1 mUIpp
Range II/Resolution	0 to 20 UIpp/10 mUIpp
Range III/Resolution	0 to 200 UIpp/100 mUIpp
RMS	
Range I/Resolution	0 to 0.8 UIpp/1 mUIpp
Range II/Resolution	0 to 10 UIpp/10 mUIpp
Range III/Resolution	0 to 100 UIpp/100 mUIpp
Measurement accuracy	as per O.172

Demodulator output

75 Ω, BNC socket

Range I (0 to 1.6 UIpp)	1 V/UIpp
Range II (0 to 20 UIpp)	0.1 V/UIpp
Range III (0 to 200 UIpp)	0.01 V/UIpp

Wander Generator

Fully complies with or exceeds the requirements of ITU-T O.172
Bit rates
Wander generation at all implemented bit rates up to 155 Mbit/s according to the equipment level of the instrument.

Amplitude range	up to 200 000 UI
Frequency range	10 µHz to 10 Hz
Accuracy	as per O.172
Resolution	1 µHz

Wander Analyzer

Fully complies with or exceeds the requirements of ITU-T O.172
For all bit rates up to 155 Mbit/s according to the equipment level of the instrument.
Other sampling rates in addition to the 30/s rate are available for detailed analysis versus time:

Sampling rate – Low-pass filter – Test duration	1/s - 0.1 Hz - 99 days
	30/s - 10 Hz - 99 h
	60/s - 20 Hz - 99 h
	300/s - 100 Hz - 5000 s
Amplitude range	±1 ns to ±1 µs
Measurement accuracy	as per O.172

Accessory: "Standard Frequency Source" for wander applications, see end of chapter

0.172 Jitter/Wander 622 Mbps — *BN 3035/91.31*

Jitter generator
Jitter modulation of STM-4 signals.

Built-in modulation generator (sinewave)	0.1 Hz to 5 MHz
External modulation	0 Hz to 5 MHz
Jitter amplitude	up to 256 UI

Jitter modulation of externally-generated signals in Through mode

Externally-generated signals can be jittered in Through mode when the D&I option is included.
This applies to all bit rates included in the mainframe configuration at the appropriate electrical and optical interfaces.

Built-in modulation generator (sinewave)	0.1 Hz to 5 MHz
External modulation	0 Hz to 5 MHz
Jitter amplitude	as for jitter generator in UIpp

Jitter Analyzer

Measurement range

Peak-peak	
Range I/Resolution	0 to 6.4 UIpp/1 mUIpp
Range II/Resolution	0 to 80 UIpp/10 mUIpp
Range III/Resolution	0 to 800 UIpp/100 mUIpp
RMS	
Range I/Resolution	0 to 3.2 UIpp/1 mUIpp
Range II/Resolution	0 to 40 UIpp/10 mUIpp
Range III/Resolution	0 to 400 UIpp/100 mUIpp
Measurement accuracy	as per O.172

Demodulator output

75 Ω, BNC socket

Range I (0 to 6.4 UIpp)	0.25 V/UIpp
Range II (0 to 80 UIpp)	0.025 V/UIpp
Range III (0 to 800 UIpp)	0.0025 V/UIpp

Wander Generator

Fully complies with or exceeds the requirements of ITU-T O.172

Bit rates

Wander generation at all implemented bit rates up to 622 Mbit/s according to the equipment level of the instrument.

Amplitude range	up to 200 000 UI
Frequency range	10 µHz to 10 Hz
Accuracy	as per O.172
Resolution	1 µHz

Wander Analyzer

Fully complies with or exceeds the requirements of ITU-T O.172

Other sampling rates in addition to the 30/s rate are available for detailed analysis versus time:

Sampling rate – Low-pass filter – Test duration	1/s - 0.1 Hz - 99 days
	30/s - 10 Hz - 99 h
	60/s - 20 Hz - 99 h
	300/s - 100 Hz - 5000 s
Amplitude range	±1 ns to $\pm 10^6$ s
Measurement accuracy	as per O.172

Reference signal input

Frequencies	1.544, 2.048, 5, 10 MHz
Bit rates	1.544, 2.048 Mbit/s
Balanced 110 Ω connector	Bantam
Clock input voltage (sine or square wave)	1.0 to 6.5 Vpp
HDB3/B8ZS input voltage	±3 V ±10%
Coaxial 75 Ω connector	BNC
Clock input voltage (sine or square wave)	1.0 to 5 Vpp
HDB3/B8ZS input voltage	±2.37 V ±10%

Accessory: “Standard Frequency Source” for wander applications, see end of chapter

Jitter Analysis

Current values (continuous measurement)	
Peak jitter value	in UI_{pp}
Positive peak value	in UI_{+p}
Negative peak value	in UI_{-p}
Maximum value (gated measurement)	
Maximum peak jitter value	in UI_{pp}
Maximum positive peak value	in UI_{+p}
Maximum negative peak value	in UI_{-p}
Result averaging (switchable)	1 to 5 s

The ANT-20 retains phase synchronicity even when pointer jitter occurs (phase tolerance to O.172).

Phase hits

The instrument detects when the programmable threshold for positive and negative jitter values is exceeded. The result indicates how often this threshold was exceeded.

Setting range for positive and negative thresholds (depending on measurement range) 0.1 up to the half measurement range

Jitter versus time

This function is used to record variations of jitter with time.

It allows the positive and negative peak values or peak-to-peak values to be displayed versus time. Measured values have one second resolution.

Measurement duration is up to 99 days. By simultaneously evaluating alarms and errors, corellations between events can be quickly identified.

Clock jitter measurement

The ANT-20 can also measure the jitter on the clock signals (square-wave) at standard bit rates. All built-in bit rates with electrical interfaces up to 155 Mbps can be measured.

RMS measurement

G.958 (or G.783 rev.), T1.105.03, GR-253, GR-499

The RMS value is measured on-line and displayed in UI. The peak jitter and RMS values can be displayed simultaneously; a graph versus time is available for long-term analysis. An RMS filter preset is available.

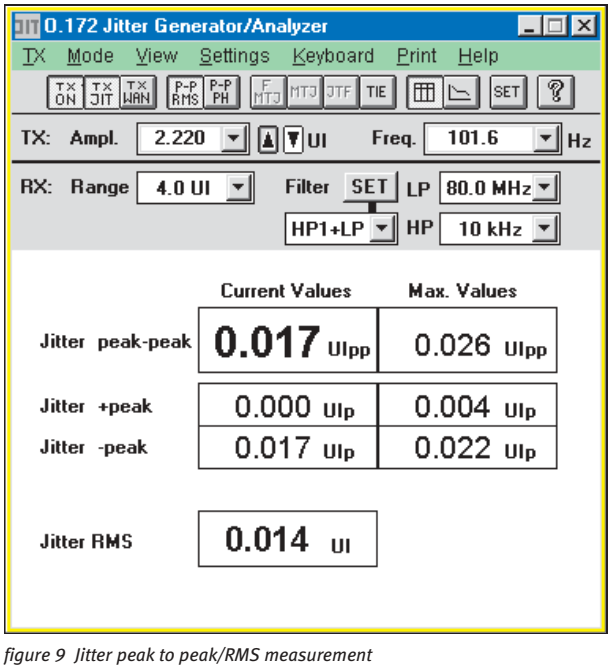


figure 9 Jitter peak to peak/RMS measurement

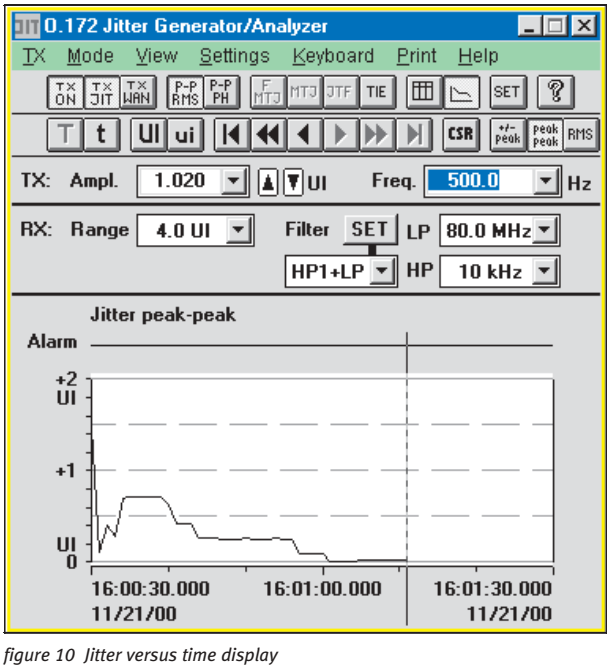


figure 10 Jitter versus time display

Wander Analysis

Time Interval Error (TIE)

to 0.172	numerical and graphical
Sampling rates	see under 0.172 Wander Analyzer for up to 622 Mbps

MTIE is additionally determined as a continually updated numerical value.
To prevent data loss or premature termination of long term measurements, the ANT-20 checks the remaining space on the hard disk before the start of the measurement. If necessary, the selected measurement time can be adjusted.
The TIE values are recorded and are then available for subsequent off-line MTIE/TDEV evaluations. The values are also saved in .csv format for documentation or further analysis.

MTIE/TDEV Off-line Analysis Software

This software provides extended off-line statistical analysis facilities for the results of wander measurements.
TIE values results obtained using the ANT-20 are analyzed according to ETSI ETS 300 462, EN 302 084, ITU-T O.172, G.810 to G.813, ANSI T1.101, Telcordia GR-1244.
Network synchronization quality is presented graphically using the MTIE (maximum time interval error) and TDEV (time deviation) parameters. To ensure correct assessment, the tolerance masks for PRC (primary reference clock), SSU (synchronization supply unit), SEC (synchronous equipment clock) or PDH can be superimposed. The results and masks can be printed out with additional user-defined comments.
This software allows several TIE results to be displayed simultaneously.
Decisive details during long term measurements disappear in the multitude of results. An effective zoom function is available for detailed wander characteristic analysis.

Result printout and export

The results can be printed out and stored internally or on floppy disk. The file format allows further processing using standard PC software.

Frequency offset and frequency drift rate (ANSI T1.101)

To ensure reliable operation when a clock source is in holdover mode, the frequency characteristics must not exceed specific deviation limits relative to an absolute reference source.
To verify this data, the ANT-20 determines the following over the selected measurement interval:

Frequency offset	in ppm
Frequency drift rate	in ppm/s

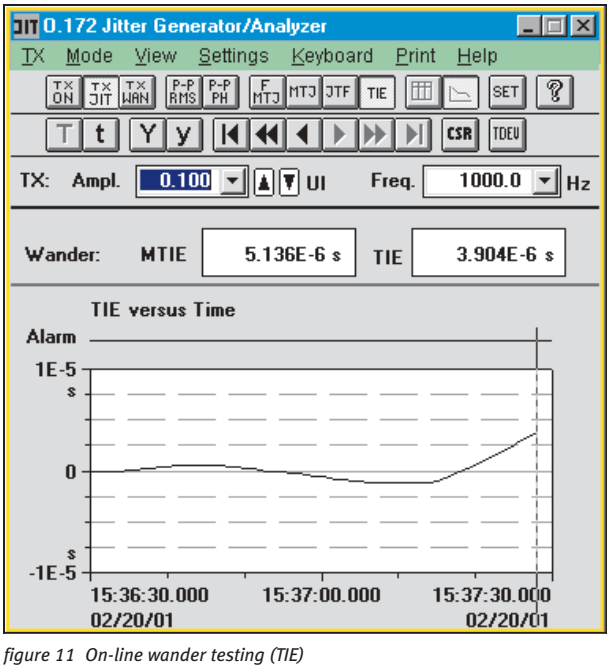


figure 11 On-line wander testing (TIE)

MRTIE – Relative MTIE (G.823 and EN 302 084)

If the reference is unavailable (too far away) when analyzing the wander of asynchronous signals, the MTIE analysis may have a superimposed frequency offset. This offset depends on the difference between the signal and local reference clocks. The MRTIE measurement subtracts the frequency offset from the result so that the "actual" wander characteristic is shown.

Accessory for wander analysis

"Acterna TSR-37 Rubidium Timing Signal Reference"	see end of chapter

Automatic Measurements

The following automatic measurements can be run for all standard bit rates and interfaces included in the mainframe configuration (electrical/optical) up to 2488 Mbps.

Automatic determination of selective Jitter Transfer Function

ITU-T G.958, Telcordia GR-499, GR-253, ANSI T1.105.03
The jitter transfer function indicates the ratio of the jitter amplitude at the output of the device under test to that at the input at various frequencies.This determines whether the device under test reduces or amplifies input jitter and at which frequencies. After a calibration measurement to minimize intrinsic errors, the ANT-20 outputs a pre-selected jitter amplitude at various frequencies and measures selectively the jitter amplitude at the output of the device under test. The ratio of the amplitudes in dB is the jitter transfer function. The preselected amplitudes correspond to the mask for maximum permitted input jitter. The jitter frequencies and amplitudes can also be edited. The calibration values can be saved and used again for other measurements.

Additional measurement mode

– Transfer MTJ results:
  An MTJ measurement is first performed. The measured amplitude values can then be used automatically as generator values for the JTF measurement. The results can be displayed in tabular and graphical form.
  The graphical display includes the standard tolerance masks specified in G.735 to G.739, G.751, G.758 or T1.105.03 and GR-253. The distance of the measurement points from the tolerance masks indicates the degree to which the device under test meets the requirements of the standard.
  Tolerance mask violations during the measurement are indicated in the numerical table.

Freely programmable tolerance masks

The existing tolerance masks for the ANT-20 can be altered as required to suit requirements that do not conform to specific standards. The new values selected for jitter frequency and jitter gain/loss are stored when the application is saved.

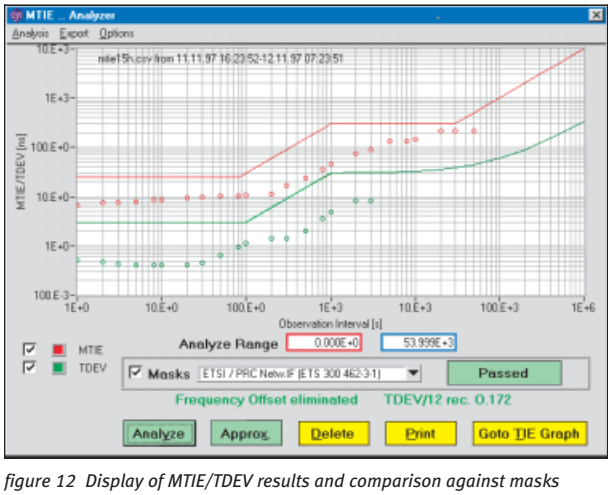


figure 12 Display of MTIE/TDEV results and comparison against masks

Automatic limit testing of Maximum Tolerable Jitter (Fast Maximum Tolerable Jitter F-MTJ)

IITU-T G.823, G.824, G.825, G.958, ANSI T1.403, T1.404, T1.105.03, Telcordia GR-253, GR-499

This extremely fast measurement tests the device under test for conformance to the standard tolerance mask limits for maximum tolerable jitter.

Jitter frequencies	up to 10 fixed frequencies corresponding to standard tolerance mask
Detection criteria	TSE (bit error), code error, B2, B3, REI, RDI
Error threshold	0 to 999 999 errors
Settling time	0.1 to 99.9 s

The editable frequency/amplitude values are set sequentially and the test pattern monitored for the permitted bit error count by the receiver.

The result of each measurement is shown in a table as the status message "OK" or "FAILED".

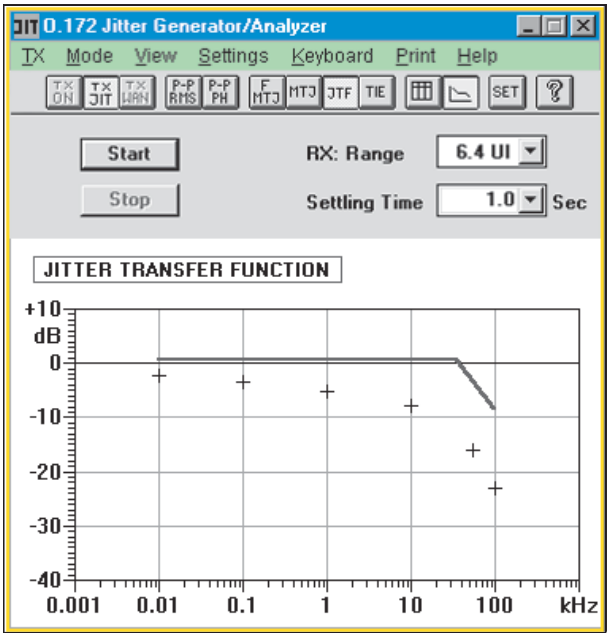


figure 13 Jitter transfer testing results

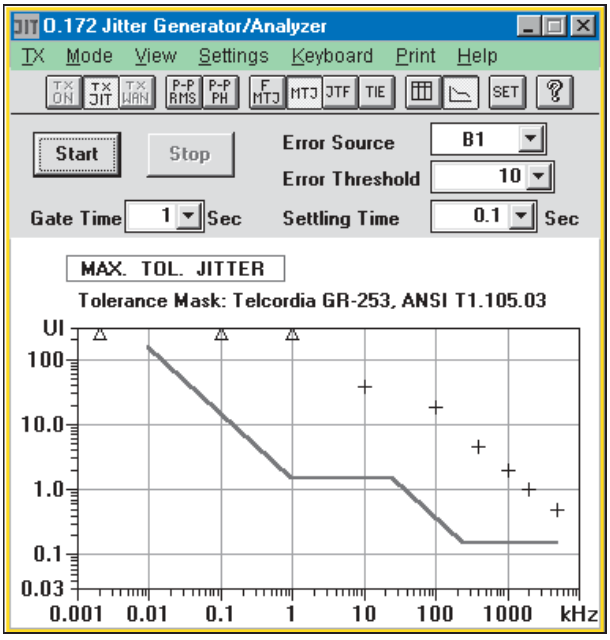


figure 14 Maximum Tolerable Jitter testing

Automatic determination of Maximum Tolerable Jitter (MTJ)

ITU-T G.823, G.824, G.825, G.958, ANSI T1.403, T1.404, T1.105.03, Telcordia GR-253, GR-499

The ANT-20 automatically determines the maximum jitter amplitude tolerated by the device under test at each jitter frequency.

Jitter frequencies	20 freely selectable frequencies
Detection criteria	TSE (bit error), code error, B2, B3, REI, RDI
Error threshold	0 to 999 999 errors
Settling time	0.1 to 99.9 s
Gating time	1 to 60 s

The maximum permissible jitter amplitude is determined precisely and quickly using a successive method. The ANT-20 determines the exact limit value. The method is derived from long experience in the performance of jitter tolerance tests and is recognized by leading systems manufacturers. The frequency/amplitude result pairs can be displayed in tabular and graphical form. The graphical display includes the standard tolerance masks. The distance of the measurement points from the tolerance masks indicates the degree to which the device under test meets the requirements of the standard. Tolerance mask violations during the measurement are indicated in the numerical table.

Freely programmable tolerance masks

The existing tolerance masks for the ANT-20 can be altered as required to suit requirements that do not conform to specific standards. The new values selected for jitter frequency and amplitude are stored when the application is saved.

Automatic pointer sequences for analyzing combined jitter

(available with CATS Test Sequencer option)

Among other things, ITU-T G.783 defines various pointer sequence scenarios for testing combined jitter (mapping and pointer jitter) at network elements. These sequences are normally selected manually and the jitter measured. ANT-20 allows simple automation of these sequences. The entire sequence is started and the maximum pointer jitter determined with a single key press. This saves considerable time spent in setting up the test and executing the measurement.

Automatic limit testing of Maximum Tolerable Wander (MTW)

ITU-T G.823, G.824

The ANT-20 tests the device under test for conformance to the standard tolerance mask limits for maximum tolerable wander.

Measurement points	up to 10 frequency/amplitude values
Detection criteria	TSE (bit error), alarms
Frequency range	10 µHz to 10 Hz, step 1 µHz
Amplitude range	0.1 to 200 000 UI, step: 0.1 UI

The result of each measurement is shown in a table with an "OK" or "FAILED" message.

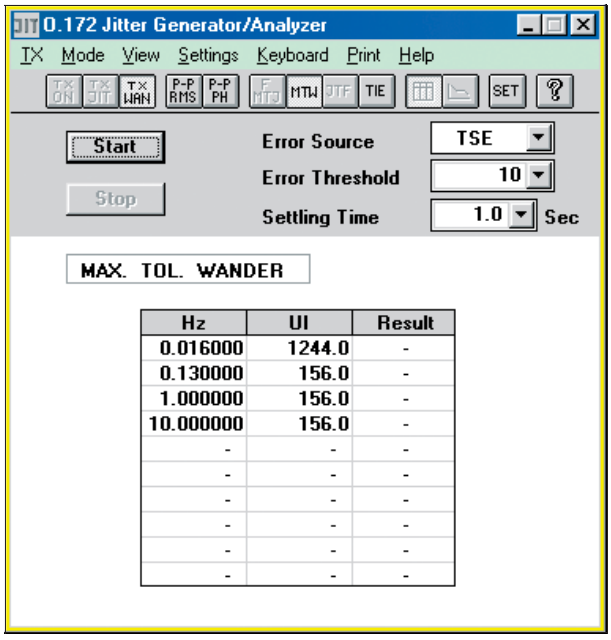


figure 15 Maximum Tolerable Wander result display

Complementary product

Acterna TSR-37 ***DA 81700000***

Rubidium Timing Signal Reference

The TSR-37 is a powerful reference source to quickly measure and test the synchronization quality of PDH/SDH/SONET digital networks. MTIE and TDEV measurements for up to 1000 seconds can be easily performed without a GPS reference. Coupled with the optional GPS-FC, the range of observation time can be largely extended to meet specific requirements.Provides the reference clock for wander analysis using the ANT-20.

- PDH/SDH/SONET wander measurement source
- Accuracy at 25ºC: $+5 \times 10^{-11}$ without GPS; $< 1 \times 10^{-11}$ with GPS
- 12 outputs; framed and unframed:
  5 MHz, 10 MHz, 2.048 kHz, 1.544 kHz, E1, T1
- Compact, robust and lightweight
- External autocalibration input
- Input for GPS or Cesium reference

See Acterna TSR-37 data sheet for details.

ATM Options

ATM Basic **BN 3035/90.70**

General

Adjustable test channel from 0 to 150 Mbps

In ATM network elements, user channels are monitored with the UPC (usage parameter control). The sensors of the control instance can be quickly checked if the bandwidth of a test channel exceeds the set threshold in the network element. For all measurements, the test channel in the ANT-20 is set on-line. Settings are made directly with a control (Figure 17) which shows the bandwidth in Mbit/s, Cells/s or %. This makes it easy to simulate CBR (Constant Bit Rate) sources.

For each interface, the load setting has a range from 0.01% to 100%. This corresponds to the load conditions which can occur in the real world.

Load profiles

A test channel can be generated with typical load profiles in order to stress network elements or simulate source profiles. In burst mode, for example, the burst load, burst length and burst period parameters can be used to simulate a video signal whose key figures correspond to a real-life signal.

Background load generator

To make a real-time measurement under loaded conditions, additional background load can be simulated to supplement the test channel (foreground traffic). The ATM channels are defined using an editor. The user specifies the repetition rate of the load cell and a sequence of empty cells. Load channels can be transmitted continuously as a sequence. The load generator can also be used separately with the test channel switched off. In this case, the channels and profiles can be user-specified.

Determining Cell Delay Variation

The ANT-20 includes very powerful tools for measuring delay parameters. Once a precise measurement has been made, subsequent measurements usually require only a low-resolution display to allow rapid pass/fail assessment. Delay values are displayed by the ATM Traffic Analyzer as a histogram with a minimum class width equal to 160 ns (maximum 335 ms). As a result, delay fluctuations are shown graphically with the same resolution. An adjustable offset can be used to maintain measurement accuracy even if the delay values are high, e.g. over international links.

F4/F5 OAM alarm flow

In accordance with I.610 and the ATM forum standard, the status of ATM paths and channels is transmitted in the OAM cell stream (fault management). The ANT-20 generates the alarms VP-AIS, VC-AIS or VP-RDI, VC-RDI for the foreground channel. The receiver simultaneously detects alarms and error messages in the channel and path.

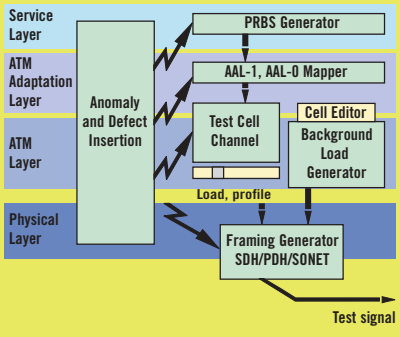


figure 16 ATM BERT generator configuration

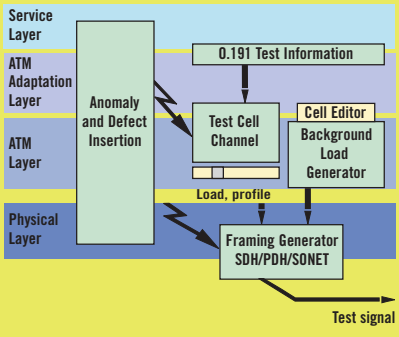


figure 17 Generator configuration for performance measurement

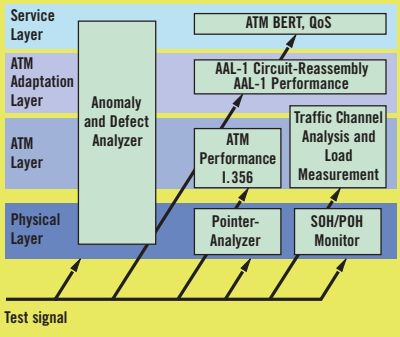


figure 18 Analyzers in the ANT-20 – A hierarchical overview

The ATM module comprises:

- Generation and analysis of ATM cell streams
- ATM layer cell transfer performance as per ITU-T I.356, O.191
- AAL-1 segmentation/reassembly for circuit emulation
- STM-1/STS-3c with C4 ATM mapping, ITU-T G.707, ANSI T1.105/107
- F4/F5 fault management OAM flow for AIS and RDI as per ITU-T I.610, ATM forum UNI 3.1

Generator unit

Bit rates of the framed cell streams	155.520 Mbps
Cell scrambler $X^{43}+1$ (ITU-T)	can be switched on and off

Test cell channel

Adjustable from	0 to 149.760 Mbps
Header setting	editor
Load setting in	Mbps, Cells/sec, %

Test cells, payload pattern

AAL-0, pseudo-random bit sequences (PRBS)	$2^{11}-1$, $2^{15}-1$, $2^{23}-1$
AAL-1, pseudo-random bit sequences (PRBS)	$2^{11}-1$, $2^{15}-1$, $2^{23}-1$
Programmable word, length	16 bits
Test pattern for ATM performance analysis, with Sequence number	3 bytes
Time stamp	4 bytes
Error correction	CRC-16

Load profiles

Equidistant, setting range	1 to 10 000 cell times
Constant Bit Rate (CBR), setting range	0.01% to 100%
Variable Bit Rate (VBR), settings	
Peak cell rate	1% to 100%
Mean cell rate	1% to 100%
Burst size	1 to 1023 cell times
Burst period	2 to 32 767 cell times

Error insertion

Physical layer as with ANT-20 basic instrument
ATM layer, AAL:
Correctable and non-correctable header errors

- AAL-0, cell payload bit errors
- AAL-1, sequence number errors
- AAL-1, SAR-PDU bit errors
- AAL-1 SNP, CRC errors
- AAL-1 SNP, parity errors

Triggering: single errors, error ratio, N errors in M cells

Alarm generation

Physical layer as with basic instrument, also:
Loss of cell delineation: LCD
ATM layer (for selected test cell channel):

OAM F4/F5 fault flow	VP AIS, VP RDI, VP AIS+VC AIS, VC AIS, VC RDI, VP RDI+VC RDI

Background load generator

For programming user-defined cell sequences. The sequences can be transmitted at a selectable repetition rate.

Editor	200 ATM channels
Header	user-selectable
Payload	1 filler byte, user-selectable

Circuit emulation

(for selected test cell channel)

Generation of an asynchronous channel	1544, 2048, 6312, 8448, 34 368, 44 736 kbps, 2048 kbps with PCM30 frame structure
ATM channel segmentation	AAL-1, ITU-T I.363

Receiver unit

Bit rates of framed cell streams	155.520 Mbps
Cell scrambler $X^{43}+1$ (ITU-T)	can be switched on and off

Measurement types

Error measurement (anomalies), statistics

Detection of the following error types:

- Correctable and non-correctable header errors
- AAL-0, cell payload bit errors
- AAL-1, sequence number errors
- AAL-1, SAR-PDU bit errors
- AAL-1 SNP, CRC errors
- AAL-1 SNP, parity errors

ATM performance analysis

- Cell error ratio
- Cell loss ratio
- Cell misinsertion rate
- Mean cell transfer delay
- 2-point cell delay variation
  measured between minimum and maximum cell transfer delay values
- Cell transfer delay histogram

Number of classes	128
Minimum class width	160 ns
Maximum class width	335 ms
Settable offset	0 to 167 ms
Offset step width	2.5 µs

Alarm detection (defects)

Physical layer as with ANT-20 basic instrument, also:
Loss of cell delineation: LCD
ATM layer (for selected test cell channel):

OAM F4/F5 fault flow	VP AIS, VP RDI, VC AIS, VC RDI

User channel analysis

Concurrent X-Y chart (load vs. time) for:

- All user cells
- Average cell rate of a selected cell channel
- Peak cell rate of a selected cell channel

Display units: Mbps, Cells/sec, %
Channel utilization histogram

- All user cells (\(assigned cells\))
- A selected cell channel (\(user cells\))

Cell distribution of a selected cell channel with classification by:

- User cells
- F5 OAM flow
- F4 OAM flow
- User cells with CLP = 1

Circuit reassembly

(for selected test cell channel)

Reassembly	AAL-1, ITU-T I.363
Error measurement on an asynchronous channel	1544, 2048, 6312, 8448, 34 368, 44 736 kbps, 2048 kbps with PCM30 frame structure

ATM Broadband
Analyzer/Generator **BN 3035/90.80**

Selection of ready-to-run applications and graphics-supported test settings

The graphical method for making test settings is unique. The way that the ANT-20 is connected to the device under test, the protocol layers and settings included in the test, or the ATM services to be tested can be quickly and easily seen. Users can select from a range of pre-defined test setups or customize their own. Pre-defined ATM channels can be selected from a database or new channels added. Additionally, all characteristics and parameters for each channel are also stored, for example: traffic type, circuit type, header, traffic contract, traffic source. An editor program is provided for defining the test circuits.

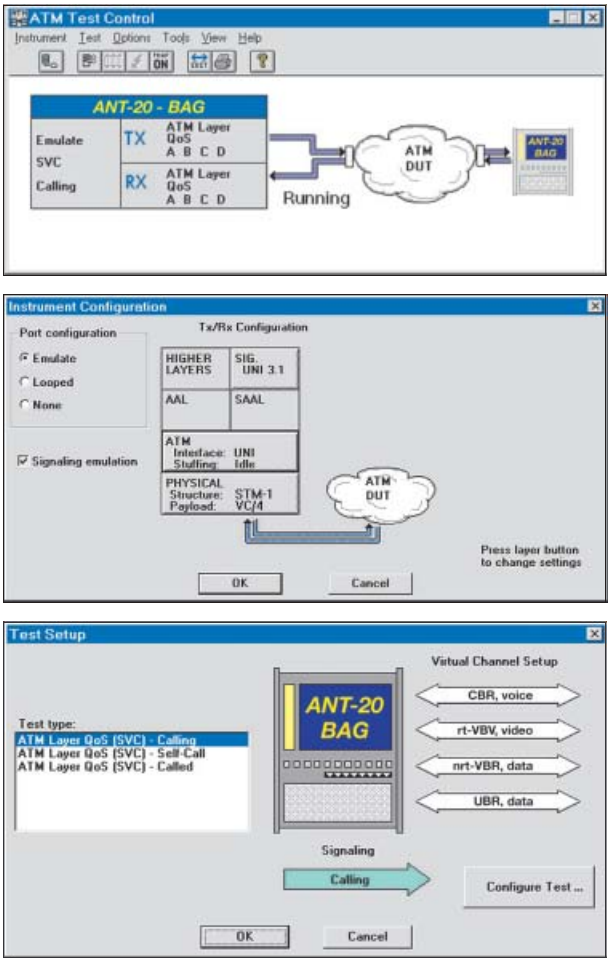


figure 19 The ATM Test Control windows makes operation simple

Direct testing of all contract parameters

Some of the main tasks facing measurement services are determining whether users are keeping to traffic contracts and how they are doing so, and establishing how the network handles such contracts. These questions can only be answered by means of a test that allows all the major service parameters to be set and measured.

For such applications, the Broadband Module includes an editor that permits all of the contract parameters for the various ATM services to be set for the first time. For terminal emulation, all contract characteristics and of the traffic model used for the test can be defined with the Channel Editor.

After starting the measurement, the ANT-20 generates test traffic using the selected parameters. This allows direct demonstration of the way that the ATM network handles the user traffic and whether the agreed network resources were in fact available.

The source parameters can be varied on-line during the measurement. This makes it possible to detect policing errors or incorrect network access threshold settings quickly and easily.

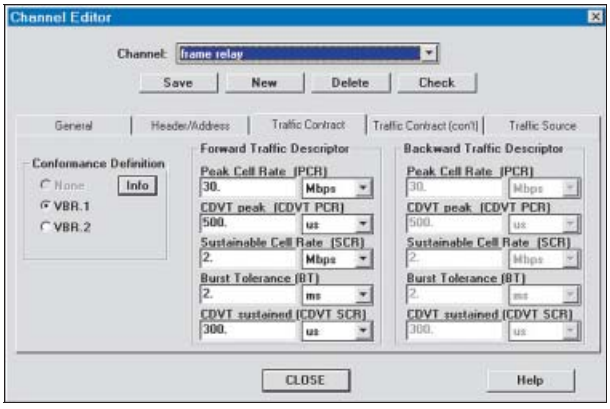


figure 20 Channel Editor: Setting the traffic descriptor

ATM QoS test with 4 different SVCs

The ANT-20 with BAG can perform SVC and PVC tests on up to 4 circuits simultaneously. Multi-channel services, such as those used for multimedia applications, can thus be simulated. Any channel type can be selected from the database or newly defined for each channel.

Real-time measurements conform to the ITU-T O.191 standard which defines the test cell format and the test algorithm. Important source parameters can be regulated on-line during the test. The results are clearly displayed, with graphics elements used to indicate defects or highlight status information.

Signaling analysis

Sequence errors in the signaling protocol adversely affect correct management of ATM services. They can be detected by recording and displaying all channel states and changes of state in chronological order with timestamp information. The ANT-20 constantly monitors the states of the SVCs being tested. The protocol can thus be checked for correctness and any errors detected rapidly. The connection set up time is measured for all test channels.

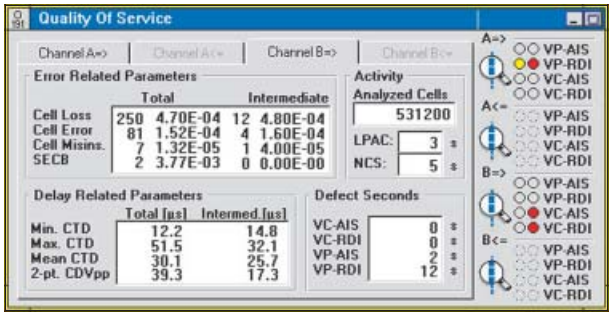


figure 21 ATM test results for a real-time measurement on channel A

Traffic management and contract optimization

Traffic shaping (single/dual leaky bucket) can be switched on for each ATM channel, even on-line during the measurement. In addition, the following are displayed per channel with soft LEDs:

– Non Conforming Cells (NCC)
– Dropped Cells (DC)

Using this information it is possible to check whether the UPC (Usage Parameter Control) functions of the network are working and are implemented in compliance with the standard. At the same time, the degree of utilization of the traffic contracts can be determined. Using the facilities for simulating all relevant source parameters with up to four competing channels, it is possible to optimize the contract parameters in the network.

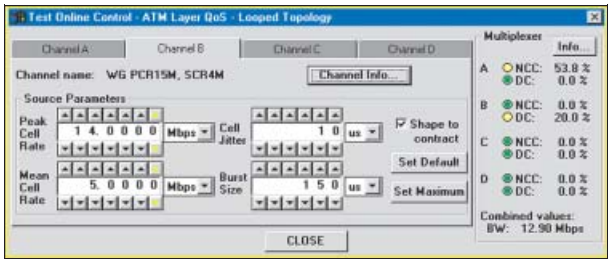


figure 22 Soft-LED indication of multiplex results

Professional record of results

The ANT-20 generates a professional record of instrument settings and test results that is output from a standard printer.

The record can be used for various purposes, e.g.:

– Guarantee documentation
– Acceptance documentation
– Installation record
– Evidence of adherence to contract, etc.

In other words, the ANT-20 handles the entire process from measurement through to producing a permanent record of the results.

Broadband Analyzer/Generator

The module includes software test functions for
- ATM Test Controller
- ATM Test Results
- ATM Channel Explorer
- STM-1/STS-3c with C4/SPE ATM mapping to ITU-T G.707, I.432 and ANSI T1.105/107

ATM test controller

Instrument port configurations

Emulation	SVCs, PVCs
Looped signal	PVCs

Test cell channels

– 4 test channels settable from	0 to 149.760 Mbit/s
Header setting	via editor
Load setting in	kbps, Mbps, cells/s
Test cell format	to ITU-T O.191

ATM service categories

Switched circuits and permanent circuits for:

Constant Bit Rate	CBR
Real-time Variable Bit Rate	rt-VBR
Non real-time Variable Bit Rate	nrt-VBR
Deterministic Bit Rate	DBR
Statistical Bit Rate	SBR
Unspecified Bit Rate	UBR

Signaling emulation

Terminal emulation at the UNI as per ITU-T and ATM Forum recommendations

Protocol types	UNI 3.0, UNI 3.1, Q.2931, Q.2961
Test types	Self-call, 2 SVCs, Calling, 4 SVCs Called, 4 SVCs

ATM channel editor

Traffic contract:

Direction type	unidirectional, bi-directional symmetrical, bi-directional asymmetrical

Traffic descriptor

Peak Cell Rate	PCR
Cell Delay Variation Tolerance peak	CDVT peak
Sustainable Cell Rate	SCR
Burst Tolerance	BT
Cell Delay Variation Tolerance sustained	CDVT sustained
Source parameters	Cell clumping, Burst size, Mean cell rate, Peak cell rate

On-line channel settings

Peak cell rate
Cell clumping
Mean cell rate
Burst size

Traffic management

User-selectable shaping

CBR	Single leaky bucket
DBR	Single leaky bucket
rt-VBR	Dual leaky bucket
nrt-VBR	Dual leaky bucket
SBR	Dual leaky bucket
UBR	Dual leaky bucket

Error insertion

Correctable and uncorrectable header errors
Cell loss
Cell error
Cell misinsertion
Severely errored cell blocks

Alarm generation

ATM layer alarms (for all test channels):

OAM F4/F5 fault flow	VP AIS, VP RDI, VC AIS, VC RDI

ATM test results

Measurement modes

ISM	In-Service Measurement
OOS	Out-of-Service Measurement

Receiver status (ISM, OOS)

Signal load, bandwidth
Correctable and uncorrectable header errors

Errored seconds	LCD, physical layer defects

ATM Quality of Service (QoS) for 4 SVCs or 4 PVCs

- Cell error ratio
- Cell loss ratio
- Cell misinsertion rate
- Mean cell transfer delay
- Maximum cell transfer delay
- Minimum cell transfer delay
- 2-point cell delay variation
- Severely errored cell block ratio

Errored seconds	VP AIS, VP RDI, VC AIS, VC RDI
Activity	Analyzed cells, Not connected seconds (SVCs), Loss of performance assessments capability seconds

Alarm detection, defects (ISM, OOS)

ATM layer alarms (for selected test cell channel):

OAM F4/F5 fault flow	VP AIS, VP RDI, VC AIS, VC RDI

Signaling analysis

Channel set-up time
Channel status with interpretation and timestamp
Representation of ATM QoS for the SVC after clearing down the circuit.

ATM channel explorer (ISM, OOS)

Channel search:
Automatic determination of up to 1000 ATM channels with indication of:

Channel number	VPI, VCI
Explicit forward congestion Indication BandWidth (%)	CI-BW
CLP = 1 BandWidth (%)	CLP1-BW
Average BandWidth	AvBW
Current BandWidth	CuBW

Aging (switchable function)
Sorts out inactive channels from the activity list.
AAL analysis:
Automatic determination of AAL type for 1000 ATM channels.
Graphic display of distribution.
Trouble scan:
Automatic determination of VC AIS, VC RDI, VP AIS and VP RDI in up to 1000 ATM channels.

Add ATM SDH — *BN 3060/90.52*

The ATM mapping options provide further frame structures for interfaces conforming to ITU-T G.804/832/707 and ANSI T1.105/107.
Corresponding physical layer measurement functions are offered by the mapping options for the interfaces. These include error and alarm insertion, error measurement and alarm detection.
The following ATM mappings are available:

E4 (140 Mbps) ATM mapping

Bit rate	139 264 kbps

E3 (34 Mbps) ATM mapping

Bit rate	34 368 kbps

E1 (2 Mbps) ATM mapping

Bit rate	2048 kbps

STM-1/VC3 ATM mapping

Bit rate	155 520 kbps

Add ATM SONET — *BN 3060/90.53*

The ATM mapping options provide further frame structures for interfaces conforming to ANSI T1.105/107.
Corresponding physical layer measurement functions are offered by the mapping options for the interfaces. These include error and alarm insertion, error measurement and alarm detection.
The following ATM mappings are included:

STS-1/STS-3 ATM mapping

Bit rate	
STS-1	51 840 kbps
STS-3 (3 × STS-1)	155 520 kbps

DS3 (45 Mbps) ATM mapping and STS-1 DS3 ATM mapping

PLCP-based mapping	
HEC-based mapping	
Bit rate	44 736 kbps

DS1 (1.5 Mbps) ATM mapping — *BN 3035/90.76*

Bit rate	1544 kbps

VC-4-4c ATM testing — *BN 3035/90.91*

Only in conjunction with BN 3035/90.70 and BN 3035/90.46 or BN 3035/90.47 or BN 3035/90.48
Signal structure (TC sublayer) contiguous concatenation to T1.646, I.432 and af-phy-0046.000

Cell scrambler $X^{43}+1$ (ITU-T)	can be switched off

Test cell channel

Adjustable from	0 to 149.760 Mbps
Header setting	editor
Load setting in	Mbps, Cells/sec, %

Test cells, pay load pattern

AAL-0, pseudorandom bit sequences (PRBS)	2^{11}–1, 2^{15}–1, 2^{23}–1
AAL-1, pseudorandom bit sequences (PRBS)	2^{11}–1, 2^{15}–1, 2^{23}–1
Programmable word, length	16 bits
Test cells for ATM performance analysis:	
Sequence number	3 bytes
Timestamp	4 bytes
Error checking	CRC-16

Load profiles

Equidistant, setting range	4 to 40 000 cell times +1
Constant Bit Rate (CBR), setting range	0.01% to 25%
Variable Bit Rate (VBR), settings	
Peak cell rate	1% to 25%
Mean cell rate	1% to 25%
Burst size	4 to 4092 cell times
Burst period	8 to 131 068 cell times

Error insertion

Physical layer like basic ANT-20 instrument
ATM layer, AAL:
- Correctable and non-correctable header errors
- AAL-0, cell payload bit error
- AAL-1, sequence number error
- AAL-1, SAR-PDU bit error
- AAL-1 SNP, CRC error
- AAL-1 SNP, parity error
- Resolution:
  Single error, error ratio, M errors in N cells

Alarm generation

Loss of Cell Delineation	LCD

ATM layer (for any selected cell channel):
OAM F4/F5 fault flow:
VP AIS, VP RDI, VP AIS+VC AIS, VC AIS, VC RDI, VP RDI+VC RDI

Background load generator

1 ATM channel can be switched ON/OFF

Header	freely definable
Payload	1 fill byte freely settable
CBR	449 Mbps

Circuit emulation

Generation of asynchronous channels	1.544, 2.048, 6.312, 8.448, 34.368, 44.736 kbps, 2.048 kbps with PCM30 frame structure
ATM channel segmentation	AAL-1, ITU-T I.363

Error measurement, anomalies, statistics

Detection of following error types:
- Correctable and non-correctable header errors
- AAL-0, cell payload bit error
- AAL-1, sequence number error
- AAL-1, SAR-PDU bit error
- AAL-1 SNP, CRC error
- AAL-1 SNP, parity error

ATM performance analysis

- Cell error ratio
- Cell loss ratio
- Cell misinsertion rate
- Mean cell transfer delay
- 2-point cell delay variation
  Measured between greatest and smallest value of cell transfer delay
- Cell transfer delay histogram:

Number of classes	128
Min. class width	160 ns
Max. class width	335 ms
Adjustable offset	0 to 167 ms
Offset steps	2.5 µs

Alarm detection, defects (ISM, OOS)

Loss of Cell Delineation	LCD

ATM layer (for any selected cell channel):
OAM F4/F5 fault flow:
VP AIS, VP RDI, VC AIS, VC RDI

Traffic channel analysis

Time chart simultaneously for
- All traffic cells
- Average cell rate of any selected cell channel
- Peak cell rate of any selected cell channel
  Display in — Mbps, Cells/sec, %

Channel utilization histogram
- All assigned cells
- One selected cell channel (user cells)
  Cell distribution in traffic channel

Classification of one selected cell channel by
- User cells
- F5 OAM flow
- F4 OAM flow
- User cells with CLP = 1

Circuit reassembly

Reassembly	AAL-1, ITU-T I.363
Error measurement on asynchronous channels	1.544, 2.048, 6.312, 8.448, 34.368, 44.736 kbps, 2.048 kbps with PCM30 frame structure

AUTO – Remote

ANT-20 applications in the remote controlled production environment

V.24/RS232 Remote Control Interface BN 3035/91.01

Remote control of instrument functions using SCPI command structure
Interface V.24/RS232

GPIB (PCMCIA) Remote Control Interface BN 3035/92.10

Remote control of instrument functions using SCPI command structure. A GPIB adapter card for the ANT-20 PCMCIA interface is supplied with this option
Interface GPIB

TCP/IP Remote Control Interface BN 3035/92.11

Remote control of instrument functions using SCPI command structure
Interface 10/100 Mbps Ethernet

Test Sequencer CATS BASIC BN 3035/95.90

The Test Sequencer is the ideal tool for rapid, simple adaptation and automatic performance of complete test sequences on the ANT-20 (CATS = Computer Aided Test Sequencer). This saves time where repetitive tests are required in the production, installation and monitoring of SDH, SONET and ATM network elements. The comprehensive test case library includes solutions for various applications, such as BERTs, alarm sensor tests, jitter, offset and pointer tests and monitoring ATM quality of service (QoS) parameters. Once created, test sequences are started with a single mouse click. A report in ASCII format for documentation purposes is compiled during the measurement. All test cases are pre-defined and ready to run. They can also be easily customized.
More information is found in the data sheet “Test Automation and Remote Control”.

Test Sequencer CATS PROFESSIONAL BN 3035/95.95

In many cases, especially in Design Verification, R&D, Regression Testing, Manufacturing and Conformance Testing it is not sufficient to automate a single test set. Rather, the software application has to deal with a number of test sets from different vendors, and in most cases it is also necessary to include the \6System under Test\9 into an automated setup.
The CATS PROFESSIONAL package is designed to make it easy to integrate the ANT-20 into such test environments, by making existing CATS test routines available in such a way that they will run not only in a self-contained manner, but also as ready-made ‘plug-ins’ into the customer’s own test solution.

Remote Operation BN 3035/95.30

These options allow operation of the ANT-20 from a Windows PC. The complete ANT-20 user interface is transferred to the PC screen via modem or LAN link. This means that all the functions of the instrument can be used from any remote location. The results are simply transferred to the controlling PC for further processing. Applications include trouble-shooting networks or centralized operation of test instrumentation and devices in the production and system test environment.
The package provides remote operation via a PCMCIA or external modem (V.24/RS232) which must be purchased separately or provides remote operation via a Ethernet Socket.

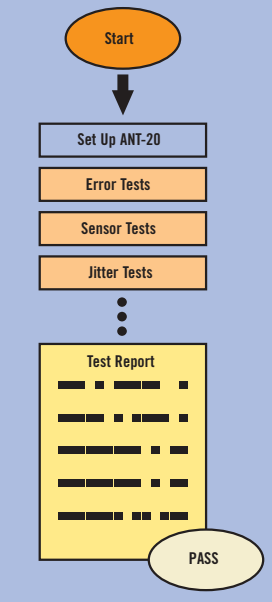


figure 23 Automatic test sequences with the ANT-20

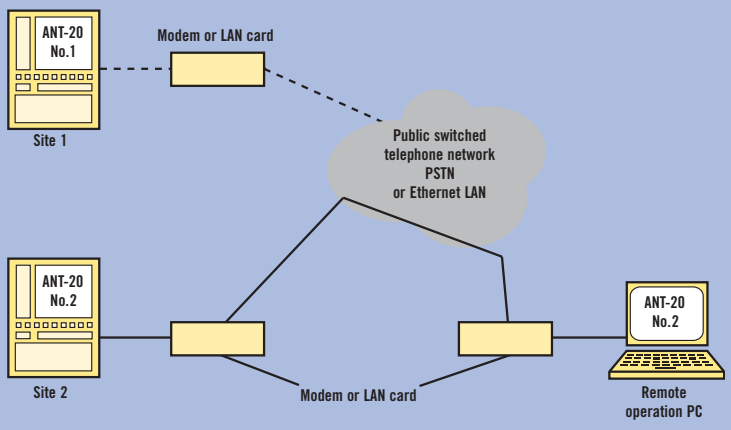


figure 24 Remote operation of the ANT-20

Ordering Information

ANT-20 Advanced Network Tester, SDH version BN 3035/41
(Includes one selectable STM-1 mapping; menu in English or German.)
With color TFT display

Options	
Touchscreen	BN 3035/93.11
CPU RAM expansion to 128 MB	BN 3035/92.25

Extended SDH testing	BN 3060/90.01

C3 (34 Mbps in STM-1)
C4 (140 Mbps in STM-1)
C11 (1.5 Mbps in STM-1)
C3 (45 Mbps in STM-1)
C2 (6 Mbps in STM-1)
APS, TCM Analysis
OH capture, OH sequencing

Add SONET	BN 3060/90.03

STM-0 mappings
STM-0 and VT2 SPE (2 Mbps)
STM-0 and VT1.5 SPE (1.5 Mbps)
VT6 SPE (6 Mbps)
STM-0 and STS-1 SPE (34/45 Mbps)
BERT (1.5/6/45 Mbps)

BERT 1.5/6/45 Mbps	BN 3035/90.34
Drop & Insert/Through Mode	BN 3035/90.20
Mux/Demux M13	BN 3035/90.32
Mux/Demux 64k/140M	BN 3035/90.30

Optical Interfaces	
The following options, BN 3035/90.43 to /90.48, are alternatives.	
STM-0/1, OC-1/3, 1310 nm	BN 3035/90.43
STM-0/1, OC-1/3, 1310 & 1550 nm	BN 3035/90.45
STM-0/1/4, OC-1/3/12, 1310 nm	BN 3035/90.46
STM-0/1/4, OC-1/3/12, 1310 nm & 1550 nm	BN 3035/90.48
The options BN 3035/91.53, /91.54, /91.59 are alternatives.	
Optical STM-16, OC-48, 1310 nm	BN 3035/91.54
Optical STM-16, OC-48, 1550 nm	BN 3035/91.53
Optical STM-16, OC-48, 1310/1550 nm switchable	BN 3035/91.59
OC-12c/STM-4c options	
VC-4-4c Bit Error Tester requires Optical Module BN 3035/90.46 or /90.48	BN 3035/90.90
VC-4-4c ATM Testing requires Optical Module BN 3035/90.46 or /90.48 and ATM Module BN 3035/90.70	BN 3035/90.91
VC-4-4c Virtual Concatenation requires BN 3035/90.90 or /90.91	BN 3035/90.92
OC-48c/STM-16c option	
VC-4-16c Bit Error Tester (Bulk)	BN 3035/90.93
Optical packages	
include optical interfaces from 52 Mbit/s to 2488 Mbit/s and four optical adapters – please select; not included STM-16c/OC-48c,STM-4c/OC-12c	
Optics STM-0/1/4/16, OC-1/3/12/48, 1310 nm includes BN 3035/90.46, /91.54	BN 3035/91.17
Optics STM-0/1/4/16, OC-1/3/12/48, 1550 nm includes BN 3035/90.47, /91.53	BN 3035/91.18
Optics STM-0/1/4/16, OC-1/3/12/48, 1310 & 1550 nm includes BN 3035/90.48, /91.59	BN 3035/91.19
Optical attenuator (plug-in) SC-PC, 1310 nm, 15 dB	BN 2060/00.61
Optical power splitter (90%/10%)	BN 3035/90.49
Optical test adapters	
ST type (AT&T)	BN 2060/00.32
HMS-10/A, HFS-13/A (Diamond)	BN 2060/00.34
HMS-10, HFS-13 (Diamond)	BN 2060/00.35
"Keyed Biconic", Twist-Proof (AT&T)	BN 2060/00.37
D4 (NEC)	BN 2060/00.40
DIN 47256	BN 2060/00.50
FC, FC-PC (NTT)	BN 2060/00.51
E 2000 (Diamond)	BN 2060/00.53
SC, SC-PC (NTT)	BN 2060/00.58

Acterna offers a wide range of optical power meters, sources and attenuators. Contact your local sales representative for details.

O.172 Jitter and Wander packages	
O.172 Jitter/Wander Packet up to 155 Mbps includes MTIE/TDEV offline analysis	BN 3035/91.29
O.172 Jitter/Wander Packet up to 622 Mbps includes MTIE/TDEV offline analysis	BN 3035/91.31

ATM functions	
ATM module for STM-1/STS-3c	BN 3035/90.70
ATM Broadband Analyzer/Generator module	BN 3035/90.80
ATM PVC & SVC testing package includes BN 3035/90.70 and /90.80	BN 3035/91.81
Add ATM SDH	
requires ATM module BN 3035/90.50 or BN 3035/90.51	
E4 (140 Mbps) ATM mapping	
E3 (34 Mbps) ATM mapping	
E1 (2 Mbps) ATM mapping	
VC-3 ATM mapping in STM-1 (AU-3/AU-4)	BN 3060/90.52
Add ATM mappings	
requires ATM module BN 3035/90.50 or BN 3035/90.51	
STS-1 (51 Mbps) ATM mapping	
DS-3 (45 Mbps) ATM mapping	
DS-1 (1.5 Mbps) ATM mapping	BN 3060/90.53
VC-4-4c ATM testing requires Optical Module BN 3035/90.46 or /90.48 and ATM Module BN 3035/90.70	BN 3035/90.91

Remote Control Interfaces	
V.24/RS232 Remote Control Interface	BN 3035/91.01
GPIB Remote Control Interface	BN 3035/92.10
TCP/IP Remote Control Interface	BN 3035/92.11

Remote Operation	
Remote Operation	BN 3035/95.30

Test Automation	
Test Sequencer CATS BASIC	BN 3035/95.90
Test Sequencer CATS PROFESSIONAL	BN 3035/95.95

Calibration Report	
Calibration Report (Calibration is carried out in accordance with quality management system certified to ISO 9001.)	BN 3035/94.01

Accessories	
Transport case	BN 960/00.08
Soft case	BN 3035/92.02
External keyboard (UK/US)	BN 3035/92.04
Decoupler (–20 dB, 1.6/5.6 jack plug)	BN 3903/63

Acterna Advantage[SM] – adding value with global services and solutions From basic instrument support for your field technicians to management of complex, company-wide initiatives, Acterna's service professionals are committed to helping you maximize your return on investment. Whatever your needs – product support, system management, education services, or consulting – we offer programs that will give you the competitive edge. To learn more about how Acterna Advantage can help your business be more successful, visit the services section on your local web page at http://www.acterna.com/.

Acterna is the world's largest provider of test and management solutions for optical transport, access, and cable networks, and the second largest communications test company overall. Focused entirely on providing equipment, software, systems, and services, Acterna helps customers develop, install, manufacture, and maintain optical transport, access, cable, data/IP, and wireless networks.

Worldwide Headquarters

12410 Milestone Center Drive
Germantown, Maryland
20876-7100
USA

Acterna is present in more than 80 countries. To find your local sales office go to:
www.acterna.com

Regional Sales Headquarters

North America
12410 Milestone Center Drive
Germantown, Maryland
20876-7100
USA
Toll Free: 1 866 ACTERNA
Toll Free: 1 866 228 3762
Tel: +1 301 353 1560 x 2850
Fax: +1 301 353 9216

Latin America
Av. Eng. Luis Carlos Berrini
936/8º e 9º andares
04571-000 São Paulo
SP-Brazil
Tel: +55 11 5503 3800
Fax: +55 11 5505 1598

Asia Pacific
42 Clarendon Street
PO Box 141
South Melbourne
Victoria 3205
Australia
Tel: +61 3 9690 6700
Fax: +61 3 9690 6750

Western Europe
Arbachtalstraße 6
72800 Eningen u.A.
Germany
Tel: +49 7121 86 2222
Fax: +49 7121 86 1222

Eastern Europe, Middle East & Africa
Elisabethstraße 36
2500 Baden
Austria
Tel: +43 2252 85521 0
Fax: +43 2252 80727

1st Neopalimovskiy Per.
15/7 (4th floor)
RF 119121 Moscow
Russia
Tel: +7 095 248 2508
Fax: +7 095 248 4189

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