



**Advanced Test Equipment Rentals**

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# Acterna ANT-20SE

## Advanced Network Tester "Speed Evolution" – SONET



As digital communications networks expand, the number of network operators is growing too, and not just due to providers merging across borders. Different networks such as Cellular, CATV and Internet are converging too. Nowadays, customers demand next-to-perfect network availability, and a top-level transmission quality has become a given.

### **ANT-20SE: A design future-proofed for success**

Powerful, precise test capability or simple operation? PDH, SDH, SONET with all bit rates from 1.5 Mbit/s to 10 Gbit/s, or ATM? Don't worry about alternatives! You don't have to choose. ANT-20SE delivers sophisticated, precision testing that is easy to use even in the most demanding environment for all the above bit rates and for ATM. In addition comprehensive jitter/wander measurements up to OC-48 in complete compliance with the ITU-T Rec. O.172 for comparable, insightful and accurate measurement results.

The remote operation facilities, gives you the opportunity to reduce your costs e.g. operating the instrument from any windows PC via modem or Ethernet LAN. Always ready for new standards, higher bit rates and the intelligent system components of the future the ANT-20SE is at the forefront of network installation and manufacturing applications. Now with the ANT-10Gig a subset of the ANT-20SE, it is taking you one step further allowing the analysis of OC-192/STM-64 signal structures.

One outstanding feature of the ANT-20 test solution has always been its ease of use, thanks to the very large display and graphical user interface based on Windows 98. The new ANT-20SE is even better since the size and brightness of the display have been further improved. The high speed access buttons are another useful detail, allowing you to rapidly launch commonly occurring measurements.

The test solution that sets the pace in analyzing digital communications systems

- *Multi-rate transmission testing from DS1 to OC-192*
- *Modular platform offering SONET, DSn, SDH 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 touchscreen plus graphical results presentation*
- *Prepared for OC-192 upgrade*

**Edition: May 2001**

## ANT-20SE – SONET – Mainframe

BN 3060/02 ☐

### SONET

page 3–8

**Extended SONET testing**

BN 3060/90.02 ☐

**Add SDH**

BN 3060/90.04 ☐

**Drop & Insert/Through mode**

BN 3060/90.10 ☐

**M13 Mux/Demux**

BN 3060/90.12 ☐

**Mux/Demux 64k/140M**

BN 3060/90.11 ☐

**Add BERT SDH**

BN 3060/90.33 ☐

### Optic

page 9–12

**OC-1/3, 1310 nm**

BN 3060/91.01 ☐

**OC-1/3, 1310/1550 nm**

BN 3060/91.02 ☐

**OC-1/3/12, 1310 nm**

BN 3060/91.11 ☐

**OC-1/3/12, 1310/1550 nm**

BN 3060/91.12 ☐

**OC-1/3/12/48\*, 1310 nm + concatenated**

BN 3060/90.55 ☐

**OC-1/3/12/48\*, 1550 nm + concatenated**

BN 3060/90.56 ☐

**OC-1/3/12/48\*, 1310/1550 nm + concatenated**

BN 3060/90.57 ☐

**OC-1/3/12, 1310 nm + OC-48, 1550 nm + concatenated**

BN 3060/90.58 ☐

### CONC

page 10–12

**OC-12c BERT**

BN 3060/90.90 ☐

**OC-12c ATM**

BN 3060/90.91 ☐

**OC-12c virtual concatenation**

BN 3060/90.92 ☐

**OC-48c BERT**

BN 3060/90.93 ☐

### Jitter

page 13–18

**Jitter/Wander up to 155 Mbit/s**

BN 3060/91.30 ☐

**Jitter/Wander up to 622 Mbit/s**

BN 3060/91.31 ☐

**Jitter/Wander up to 2.5 Gbit/s**

BN 3060/91.32 ☐

**Jitter/Wander at only 2.5 Gbit/s**

BN 3060/91.33 ☐

**Jitter at only 2.5 Gbit/s**

BN 3060/91.34 ☐

### ATM

page 19–24

**ATM Basic**

BN 3060/90.50 ☐

**ATM Comprehensive (PVC + SVC)**

BN 3060/90.51 ☐

**Add ATM SONET**

BN 3060/90.53 ☐

**Add ATM SDH**

BN 3060/90.52 ☐

### AUTO – Remote

page 25–26

**Automatic Test Sequencer CATS BASIC**

BN 3035/95.90 ☐

**Automatic Test Sequencer CATS PROFESSIONAL**

BN 3035/95.95 ☐

\* For OC-48 only see chapter optical interface

# Specifications

# ANT-20SE SONET

## ANT-20SE Mainframe

BN 3060/02

### Includes:

- Generator and analyzer for electrical STS-1 and STS-3 signals allowing:
  - Simulation and evaluation in the TOH / POH
  - Generation and analysis of Anomalies and Defects
  - Pointer generator and analyzer
- Generator and analyzer for bit error rate tests (BERT) at 6 Mbit/s with unframed, 1.5 and 45 Mbit/s with framed and unframed test patterns
- VT1.5 mapping (DS1 in STS-1)
- Touchscreen
- 4 extension slots
- Ethernet and USB Interface

## Generator unit

### Digital outputs

Interfaces to Telcordia GR-253, TR-TSY-000499, ANSI T1.102  
75  $\Omega$  coaxial output, adapter jack selectable from Versacon 9 adapter system

Bit rates and line codes

DS1 .....	1544 kbit/s; B8ZS, AMI, CMI
DS2 .....	6312 kbit/s; B8ZS, CMI
DS3 .....	44 736 kbit/s; B3ZS, CMI
STS-1 .....	51 840 kbit/s; B3ZS, CMI
STS-3 .....	155 520 kbit/s; CMI

100  $\Omega$  balanced output, Bantam jack

Bit rate and line codes

DS1 .....	1544 kbit/s; B8ZS, AMI, CMI
Output pulses	
DS1 .....	DSX-1 compatible
DS2 .....	rectangular
DS3, STS-1 .....	HIGH, LOW, DSX-3

Bit rate offset. ....	$\pm 500$ ppm
Step size .....	0.001 ppm

### Clock

#### Internal clock generation

at all of the bit rates listed above.

Clock stability .....	$\pm 2$ ppm
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#### Synchronisation to external signals

via 100  $\Omega$  balanced input, Bantam jack:

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

#### Clock outputs

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

### STS-3 output signal

Generation of a STS-3 signal conforming to Telcordia GR-253, ANSI T1.105

The STS-3 signal consists of one internal STS-1 tributary signal with the remaining two tributaries filled with UNEQ.

### STS-1 output signal

Generation of a STS-1 signal conforming to Telcordia GR-253, ANSI T1.105a

Manual  
pointer  
manipulation

or using  
pre-defined  
standard  
sequences

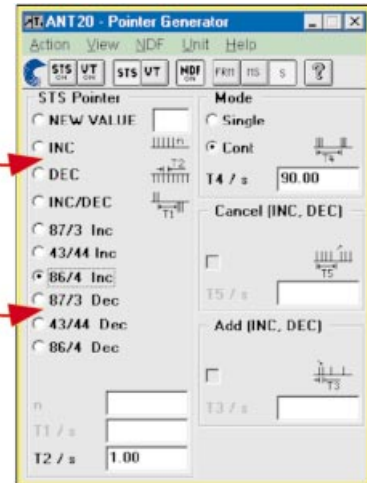


Figure 1:  
Pointer actions.

### Mappings

VT1.5 mapping is included in the basic instrument. Other mappings are added with option "Extended SONET testing".

Content of the selected tributary:

- Framed or unframed DS1 or DS3 test pattern
  - M13 multiplex signal (with M13 MUX/DEMUX option)
  - External DS1 or DS3 signal (with D&I option)
  - Test pattern without stuffing bits (bulk signal to O.181)
- Content of non-selected tributaries. .... 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 STS-1 and VT levels simultaneously.

- Pointer sequences to T1.105.03 with programmable spacing
- Pointer increment/decrement (continuously repeated)
- Single pointer
- Pointer value setting with or without NDF

### Contents of TOH 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 and K2)

### 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

### Error insertion

Error types .....	B1, B2, B3 parity errors, frame alignment signal errors, REI-L, REI-P, bit errors in test pattern, code errors (single errors)
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#### Triggering

Single error or error ratio .....	$2 \times 10^{-3}$ to $1 \times 10^{-10}$
for B1, B3, REI-P .....	$2 \times 10^{-4}$ to $1 \times 10^{-10}$
for bit errors .....	$1 \times 10^{-2}$ to $1 \times 10^{-9}$
Step size for mantissa and exponent .....	1

Burst error: m anomalies in n periods

For FAS, B1, B2, B3, REI-L, REI-P .....	m=1 to $4.86 \times 10^6$ and n = 2 to 8001 frames or 0.2 s to 600 s
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## Alarm generation, dynamic

Alarm types ..... LOS, LOF, AIS-L, RDI-L, LOP-P,  
AIS-P, UNEQ-P, PLM-P, RDI-P, RDIEPP,  
RDIEPS, RDIEPC, PDI-P

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, AIS-L, TIM-L, RDI-L,  
LOP-P, AIS-P, UNEQ-P, PLM-P, TIM-P,  
RDI-P, RDIEPP, RDIEPS, RDIEPC, PDI-P

## DS1, DS2 and DS3 output signals

Signal structures

– Unframed test pattern

– Framed test pattern (only DS1, DS3)

DS1 frame structure ..... SF, ESF

DS3 frame structure ..... M13, C parity

### Error insertion

Bit errors in test pattern ..... error rate, single error

BPV ..... single error

DS1 F bit (LOF) ..... single error, 2 in 4, 2 in 5, 2 in 6

CRC-6 (ESF) ..... single error, error rate

DS3 F bit (LOF) ..... single error, 2 in 2, 2 in 3, 3 in 3, 3 in 15,

3 in 16, 3 in 17

P parity, CP parity, FEBE ..... single error, error rate

Error rate .....  $1 \times 10^{-2}$  to  $2 \times 10^{-9}$

### Alarm insertion

DS1 ..... LOF, AIS, YELLOW

DS3 ..... LOF, AIS, YELLOW, IDLE, FEAC

## FEAC Far-End Alarm and Control Signals

To test that FEAC alarm and status information is correctly transmitted, the relevant signal codes can be selected and inserted into the DS3 C-bit frame format.

## Test patterns

### Pseudo-random bit sequences

PRBS:  $2^{11}-1$ ,  $2^{15}-1$ ,  $2^{20}-1$ , QRSS 20,  $2^{11}-1$  inv.,  $2^{15}-1$  inv.,  $2^{20}-1$  inv.,  $2^{23}-1$  inv.

### Programmable word

Length ..... 16 bits

## Receiver unit

### Digital inputs

Interfaces to ..... Telcordia GR-253, TR-TSY-000499, ANSI T1.102  
75  $\Omega$  coaxial input; adapter jack selectable from Versacon 9 adapter system

Bit rates and line codes

DS1 ..... 1544 kbit/s; B8ZS, AMI, CMI

DS2 ..... 6312 kbit/s; B8ZS, CMI

DS3 ..... 44 736 kbit/s; B3ZS, CMI

STS-1 ..... 51 840 kbit/s; B3ZS, CMI

STS-3 ..... 155 520 kbit/s; CMI

100  $\Omega$  balanced input, Bantam jack

Bit rate and line codes

DS1 ..... 1544 kbit/s; B8ZS, AMI, CMI

Input levels

DS1 ..... DSX-1 compatible

DS3, STS-1 ..... HIGH, LOW, DSX-3

Clock recovery pulling range .....  $\pm 500$  ppm

Selectable input gain, CMI coded ..... 15 to 23 dB

B3ZS, B8ZS, HDB3, AMI coded ..... 15 to 26 dB

Selectable adaptive equalizers for DS3, STS-1 ..... 450 ft

DS1 ..... 1310 ft

Monitor input for STS-3 and STS-12 NRZ signals

See chapter Optical Interfaces for details.

## STS-3 receive signal

(for signal structure, see under generator unit)

The ANT-20 demultiplexes one selectable STS-1 tributary from STS-3 and feeds it to the internal processor for evaluation.

## STS-1, DS1 and DS3 receive signals

Signal structures as for generator unit

## Trigger output

75  $\Omega$  BNC connector, HCMOS signal level

Pulse output for received bit errors, transmit frame trigger, transmit

pattern trigger or 2048 kHz reference clock

## Included mapping

### VT1.5 and STM-o mapping

#### DS1 in STS-1 and 1.5 Mbit/s in STM-o

Modes ..... asynchronous, byte synchronous (floating)

Error insertion and measurement

Additional error types ..... BIP-V, REI-V

Alarm generation, dynamic

Alarm types ..... LOP-V, AIS-V, LOM, UNEQ-V, RDI-V,

RDIEVP, RDIEVS, RDIEVC, RFI-V, PDI-V, PLM-V

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 ..... LOP-V, AIS-V, LOM,

UNEQ-V, PLM-V, TIM-V, RDI-V, RDIEVP,

RDIEVS, RDIEVC, RFI-V

Alarm detection only ..... NDF-V

## 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 asynchronous and STS-N/OC-N signals (GR-253, ANSI T1.102) and the payload contents in channel 1.

### Automatic SCAN function

The SCAN function permits sequential testing of all VT1.5 or VT2 channels in a SONETsignal. The ANT-20SE receiver checks for alarms in the receive signal, the SONETstructure 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.



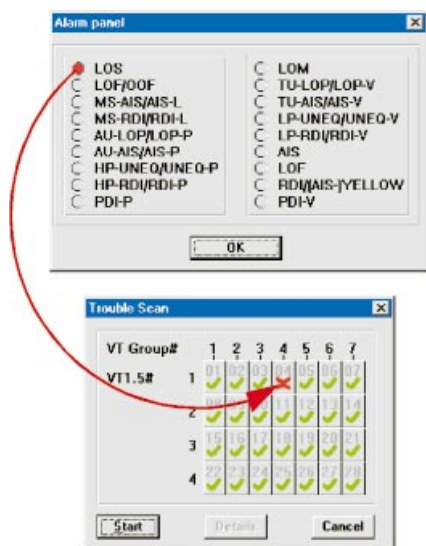


Figure 2: Trouble scan.

### Automatic TROUBLE SCAN function (Figure 2)

The TROUBLE SCAN function permits sequential testing of all VT1.5 or VT2 channels in a SONET signal. The ANT-20SE receiver checks for alarms in the receive signal, the SONET 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. Only the receive channels are switched during a TROUBLE SCAN.

### AutoScan function (Figure 3)

This automatic "AutoScan" function allows you to rapidly check the signal structure, the mapping used, the trace identifier and the payload – even with mixed mapped signals. The ANT-20SE 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.

### 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 (VT1.5 or VT2 with defined PRBS) in the payload of a SONET signal. The ANT-20SE 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.

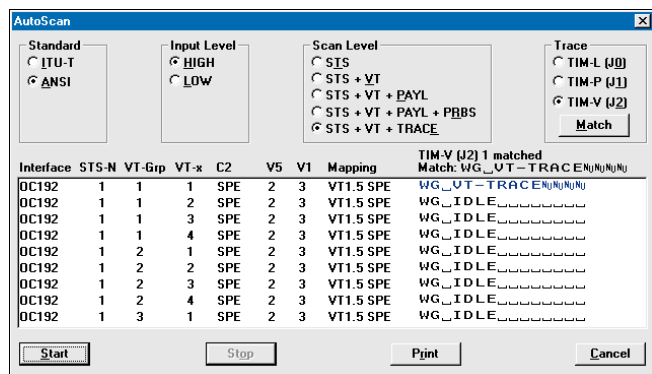


Figure 3: AutoScan.

An OK result indicates that the corresponding channel contains the signal searched for. Only the receive channels are switched during a SEARCH.

## Measurement types

### Error measurements

Error types ..... B1, B2, B3 parity errors, frame errors, REI-L, REI-P, bit errors in test pattern, BPV  
Additionally, for  
DS1 ..... CRC errors  
DS3 ..... P-parity errors, CP-parity errors, FEBE Error Count, Error Rate, Intermediate Errors

### Performance analysis

ES, SES, EFS, SEFS, UAS are evaluated

### In-service measurements (ISM)

Simultaneous ISM of the near-end and far-end of a selected path  
– Near-end ..... B1, B2, B3, BIP-V, CRC-6  
– Far-end ..... REI-L, REI-P, REI-V  
DS1, DS3 events ..... F bit, parity, FEBE, C parity

### Out-of-service measurements (OOS)

OOS evaluation using bit errors in test pattern

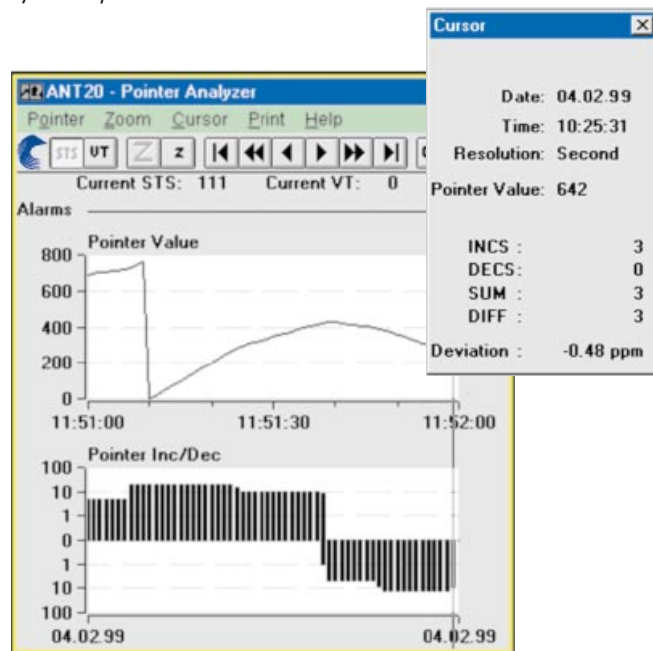
### Analysis of STS-1 and VT pointer actions (Figure 4)

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.

Figure 4: Graphic pointers. Display showing additional evaluation of cursor position.



## Delay measurement

Delay measurements are used for aligning satellite hops and testing the maximum permitted delay times for storage exchange and cross-connect systems and for checking the loop circuits in regenerators. The ANT-20SE measures the time taken to transmit the test pattern from the generator through the section under test and back to the receiver. The measurement is made on the test patterns in a selected channel, or in the tributaries (SONET; bulk signal or asynchronous), or on the selected channel of the lowest hierarchy level of asynchronous multiplex systems.

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

### Measurement range

Bit rates from 34 to 155 Mbit/s ..... 1  $\mu$ s to 1 s  
Bit rate 1.5 Mbit/s ..... 10  $\mu$ s to 5 s

## Alarm detection

All alarms are evaluated and displayed in parallel

Alarm types ..... LOS, OOF, LOF  
Additionally, for STS ..... AIS-L, RDI-L, AIS-P, LOP-P,  
NDF-P, RDI-P, UNEQ-P, TIM-P, PLM-P  
Additionally, for DS1, DS3 ..... LSS, AIS, RAI (YELLOW),  
IDLE (DS3), FEAC (DS3)

## TOH and POH evaluation

- Display of complete TOH 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

## Off-line analysis software

The software runs on standard PCs and permits comprehensive analysis of stored ANT-20SE results. After loading the results, the ANT-20SE 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

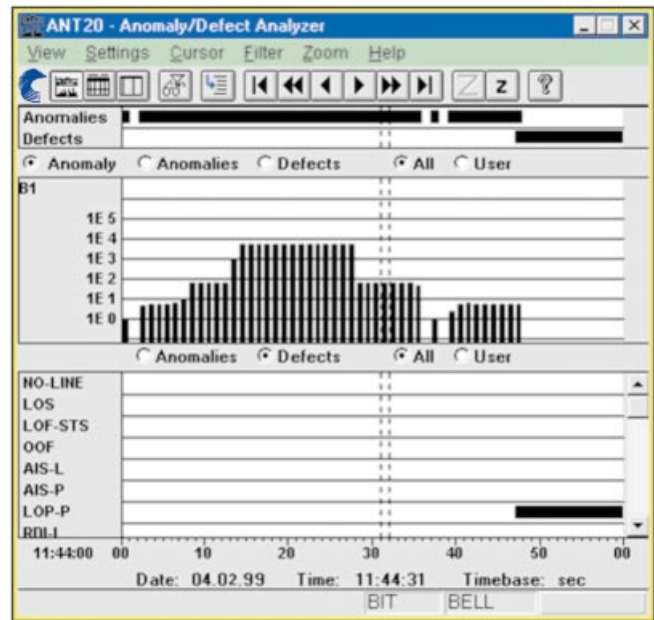


Figure 5: Histogram results display.

## Graphical display (histogram) (Figure 5)

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-20SE 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

## Result export

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

## Instrument operation

ANT-20SE is operated using the standard Microsoft® Windows™ graphical user interface.

Operation is menu-controlled using the touchscreen.

A mouse can also be connected if desired.

## Application selection and storage

ANT-20SE 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-20SE via floppy disk or super disk. Easy to use filter functions allow quick selection of the desired application.

## Touchscreen display

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

Color TFT screen ..... 10.4", 256 colors  
Resolution ..... 640 × 480 pixels (VGA standard)  
The touchscreen allows very easy point and shoot operation.

## Built-in PC

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

RAM capacity ..... 64 MB  
LS-120 drive ..... 3.5", 120 MB  
Hard disk drive ..... 6 GB  
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-20SE 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 (nominal range of use)

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. 500 VA  
Safety class to IEC 1010-1 ..... Class I

### Ambient temperature

Nominal range of use ..... 41° F to 104° F (+5 °C to +40 °C)  
Storage and transport range ..... -4° F to 158° F (-20 °C to +70 °C)

**Dimensions** (w × h × d) in mm ..... approx. 320 × 350 × 280  
in inches ..... approx. 12.6 × 13.8 × 11

**Weight** ..... approx. 15 kg/22 lb

## Options

### Extended SONET testing **BN 3060/90.02**

#### VT6 SPE mapping

(6 Mbit/s unframed/Bulk in STS-1)

#### STS-1 SPE and STM-o mapping

Errors and alarms as for mainframe instrument

#### VT2 SPE and STM-o mapping

E1 in STS-1 and 2 Mbit/s in STM-0  
Modes ..... asynchronous, byte synchronous (floating)  
Error insertion and alarm generation as for VT1.5 SPE mapping.

#### STS-3c mapping

(140 Mbit/s in STS-3c and STM-1)

## Byte capture TOH and POH

To analyze the TOH/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 STS-1/-3/-3c, el. & opt ..... all TOH/POH bytes  
OC-N el. & opt ..... all TOH/POH bytes,  
channel 1 except A1, A2, B1

Storage depth for a byte ..... 266  
K1, K2 ..... 200

Trigger events ..... AIS-L, AIS-V, AIS-P, RDI-L, LOP-P,  
editable value in trigger byte

Capture resolution ..... frame precision

## 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-20SE measures the switch-over time with 1 ms resolution.

The result can be printed.

Criteria for the time measurement ..... AIS-L, AIS-V, AIS-P,  
bit error

Max. measurable switch-over time ..... 2 s  
Resolution ..... 1 ms  
Allowable error rate for user signal .....  $< 2 \times 10^{-4}$

## Add SDH

**BN 3060/90.04**

### BERT (2, 8, 34, 140 Mbit/s)

Signal structure and interfaces for generator and receiver:

Framed and unframed test patterns

Additionally, for coaxial input/output

Bit rate, line code ..... 2048, 8448, 34 368 kbit/s, HDB3

Bit rate, line code ..... 139 264 kbit/s, CMI

Additionally, for balanced input/output

Bit rate, line code ..... 2048 kbit/s, HDB3

### C4 mapping

(140 Mbit/s in STM-1 and STS-3c)

See ANT-20SE SDH datasheet for details.

### C11 mapping

(1.5 Mbit/s in STM-1, AU-3/AU-4)

See ANT-20SE SDH datasheet for details.

### C12 mapping

(2 Mbit/s in STM-1, AU-3/AU-4)

See ANT-20SE SDH datasheet for details.

### C3 mapping

(34 Mbit/s in STM-1, AU-3/AU-4)

### C3 mapping

(45 Mbit/s in STM-1, AU-3/AU-4)

See ANT-20SE SDH datasheet for details.

### C2 mapping

(6 Mbit/s unframed/Bulk in STM-1)

See ANT-20SE SDH datasheet for details.



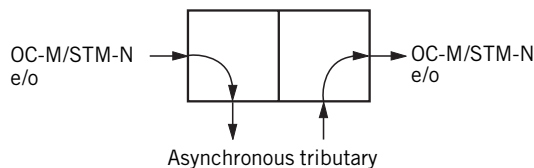
## Drop & Insert

BN 3060/90.10

This option provides the following functions:

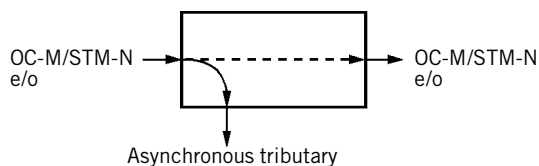
### 1. Generator and receiver operate independently

as mapper and demapper. The DS1/DS3 signal from a selected channel is dropped from the receive signal and output to a connector. An external or internal DS1/DS3 signal is inserted into the transmit signal.



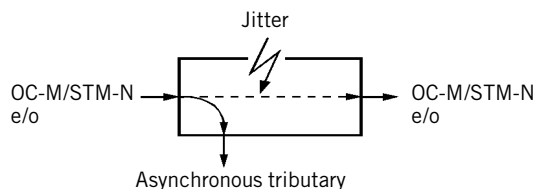
### 2. Through mode:

The received signal is looped through the ANT-20SE and re-transmitted (generator and receiver coupled). The DS1/DS3 signal from a selected channel may be dropped from the receive signal and output to a connector. An internal DS1/DS3 signal may be inserted into the transmit signal. The ANT-20SE can operate here as an active signal monitor without affecting the signal.



### 3. Through mode jittering:

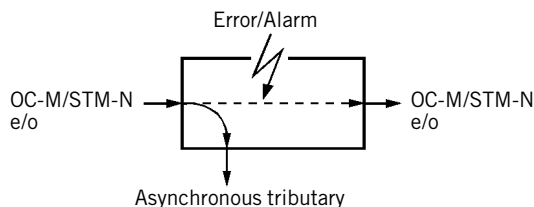
The looped-through DS1/DS3 or SONET signal can also be jittered using the Jitter Generator option. This applies to all jitter frequencies up to 622 Mbit/s depending on the jitter option fitted.



### 4. Error insertion in through mode:

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

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



### 5. Block and Replace (B & R)

For this function, the ANT-20SE is looped into the working fiber of a ring. B&R allows replacement of a synchronous tributary (e.g. STS-1 including TOH, POH and payload) in a OC-N signal. This can then be measured by the ANT-20SE 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  $\Omega$ , 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 3060/90.12

M13 multiplexers are used in North America in hybrid networks and synchronous system cross-connects. This option provides  $n \times$  DS0 to DS3 multiplex and demultiplex functions. The output signal is fed to the electrical interface and is available as payload in mappings (requires options BN 3060/90.02 or BN 3060/90.04). Alarms and errors can be generated and analyzed.

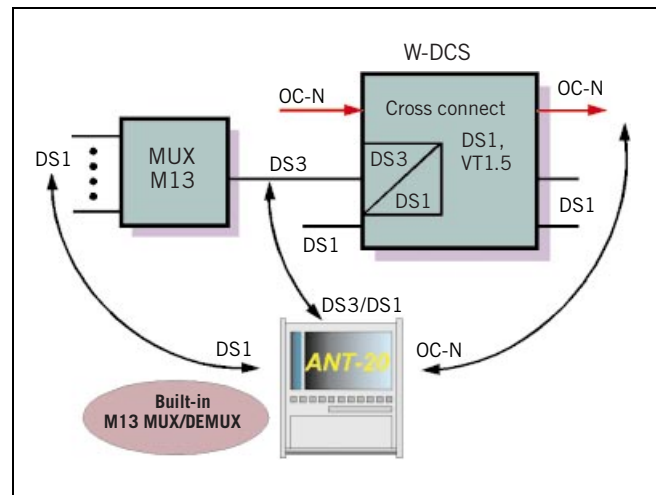


Figure 6: Testing hybrid systems with M13 MUX/DEMUX.

## 64k/140M MUX/DEMUX chain BN 3060/90.11

This option provides  $n \times$  64 kbit/s to 140 Mbit/s multiplex and demultiplex functions. The output signal is fed to the electrical interface (requires option BN 3060/90.04) and is available as payload in mappings (requires option BN 3060/90.04). 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 the option "Add SONET".

## Optical Modules up to 155 Mbit/s

**Optical OC-1/3, STM-0/1, 1310 nm BN 3060/91.01**

**Optical OC-1/3, STM-0/1, 1310 & 1550 nm BN 3060/91.02**

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 Telcordia GR-253, ANSI T1.105.06 (ITU-T Rec. G.957, Tables 2 and 3).  
Classes LR-1, LR-2, LR-3 (L1.1, L1.2 and L1.3) are covered.

There are two 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 Telcordia GR-253, ANSI T1.105.06 (ITU-T Rec. G.957) and fulfills classes IR-1, IR-2 (S1.1 and S1.2).

Wavelength range ..... 1100 to 1580 nm  
Input sensitivity ..... -8 to -28 dBm  
(-8 to -34 dBm typ.)

Display of optical input level  
Resolution ..... 1 dB

155 Mbit/s electrical interface  
for connecting the ANT-20SE 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  $\Omega$

## Optical Modules up to 622 Mbit/s

**Optical OC-1/3/12, STM-0/1/4, 1310 nm BN 3060/91.11**

**Optical OC-1/3/12,  
STM-0/1/4, 1310 & 1550 nm BN 3060/91.12**

Bit rate of TX and  
RX signal ..... 155 520 kbit/s, 622 080 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 Telcordia GR 253, ANSI T1.105.06 (ITU-T Rec. G.957, Tables 2 and 3).  
Classes LR-1, LR-2, LR-3 (L1.1, L1.2, L1.3, L4.1, L4.2 and L4.3) are covered.

There are two 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 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
- one internally generated STS-3c tributary signal with the other three tributaries filled with UNEQ (with STS-3c mapping option or ATM Basic Option BN 3060/90.50).

### 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.

### Contents of the OC-12/STM-4 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 main-frame 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 OC-12 ..... REI-L  
for STM-4 ..... MS-REI

Triggering

Single errors or error ratio .....  $2 \times 10^{-3}$  to  $1 \times 10^{-10}$   
for B1 parity errors .....  $2 \times 10^{-4}$  to  $1 \times 10^{-10}$

Burst error: m anomalies in n periods

For FAS, B1, B2, B3, REI-L, REI-P ..... m = 1 to  $4.8 \times 10^6$  and  
n = 2 to 8001 frames or 0.2 s to 600 s

### Alarm generation, dynamic

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

## Receiver unit

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

Wavelength range ..... 1100 to 1580 nm  
Input sensitivity, OC-1/3/12 STM-1/-4, ..... -8 to -28 dBm  
(-8 to -34 dBm typ.)

Display of optical input level  
Resolution ..... 1 dB

The ANT-20SE demultiplexes one selectable STS-3c/STS-1 or STM-1 tributary from the OC-12/OC-3 or STM-4 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 OC-12 ..... AIS-L, RDI-L, TIM-L  
for STM-4 ..... MS-AIS, MS-RDI, RS-TIM

## 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 Mbit/s electrical interface

For connecting the ANT-20SE to OC-3/STM-1 and OC-12/STM-4 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 Mbit/s

### Option OC-12c/STM-4c BERT BN 3060/90.90

Only in conjunction with BN 3060/91.11 or BN 3060/91.12

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 .....  $1 \times 10^{-2}$  to  $1 \times 10^{-9}$

## Error measurement and alarm detection

Bit errors and AIS in test pattern

## Option OC-12c/STM-4c

### Virtual Concatenation

BN 3060/90.92

Only in conjunction with BN 3060/90.90 or BN 3060/90.91

## 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) .....  $\pm 40$   
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 OC-12c/STM-4c ATM-Testing

BN 3060/90.91

Only in conjunction with BN 3060/90.50 and BN 3060/91.11 or BN 3060/91.12

See chapter “ATM options” for further details.

## Optical Modules up to 2488 Mbit/s

All optical packages include OC-12c/STM-4c Bulk (BN 3060/90.90), OC-48c/STM-16c Bulk (BN 3060/90.93) and 4 optical adapters.

### Optical OC-1/3/12/48,

STM-0/1/4/16, 1310 nm

BN 3060/90.55

### Optical OC-1/3/12/48,

STM-0/1/4/16, 1550 nm

BN 3060/90.56

### Optical OC-1/3/12/48,

STM-0/1/4/16, 1310 & 1550 nm

BN 3060/90.57

### Optical OC-1/-3/-12, 1310 nm,

OC-48, 1550 nm,

STM-0/1/4, 1310 nm,

STM-16, 1550 nm

BN 3060/90.58

## Optical Modules 2488 Mbit/s

Optical OC-48, STM-16, 1310 nm

BN 3060/91.51

Optical OC-48, STM-16, 1550 nm

BN 3060/91.50

Optical OC-48, STM-16,

1310/1550 nm switchable

BN 3060/91.52

One 2.5 Gbit/s module can be fitted in the extension slot of the ANT-20SE.

The optical interfaces meet the specifications of Telcordia TA-NWT-000253 I.6 (Table 4–9, 4–10) and ITU-T Recommendation G.957 (Table 4).

Classes IR-2, LR-2, LR-3 (Telcordia) or S-16.2, L-16.2, L-16.3 (ITU-T) are fulfilled at 1550 nm; classes IR-1, LR-1 (Telcordia) or S-16.1, L-16.1 (G.957) 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) .....  $\geq 0.6$  V  
Connector/impedance ..... SMA/50  $\Omega$

### Clock generator

Internal, accuracy .....  $\pm 2$  ppm  
Offset .....  $\pm 50$  ppm  
Synchronization from external signal as for mainframe

### Generation of OC-48 TX signal

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  $47 \times$  UNEQ/non specific
- 16 identical STS-3c (Option BN 3060/90.02 required)
- One STS-3c tributary (Option BN 3060/90.02 required) and  $15 \times$  UNEQ/non specific
- Four identical STS-12c (Option BN 3060/90.90 required)
- One STS-12c tributary (Option BN 3060/90.90 required) and  $3 \times$  UNEQ/non specific

### 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  $15 \times$  UNEQ/non specific
- Four identical STM-4c (Option BN 3060/90.90 required)
- One STM-4c tributary (Option BN 3060/90.90 required) and  $3 \times$  UNEQ/non specific

### Contents of OC-48/STM-16 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 .....  $2 \times 10^{-5}$  to  $1 \times 10^{-10}$   
B2 .....  $2 \times 10^{-3}$  to  $1 \times 10^{-10}$   
additionally, for OC-48 ..... REI-L  
for STM-16 ..... MS-REI  
Single error or error rate .....  $2 \times 10^{-3}$  to  $1 \times 10^{-10}$

### Alarm generation, dynamic

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

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 OC-48 ..... AIS-L, RDI-L  
for STM-16 ..... MS-AIS, MS-RDI

## Receiver

### Optical interfaces

Wavelength ..... 1260 to 1580 nm  
Line code ..... scrambled NRZ  
Sensitivity .....  $-28$  to  $-8$  dBm  
Input overload .....  $> -8$  dBm

Display of optical input level

Range .....  $-30$  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  $\Omega$

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 OC-48 ..... AIS-L, RDI-L, TIM-L  
for STM-16 ..... MS-AIS, MS-RDI, RS-TIM  
Alarm event resolution ..... 100 ms

### TOH/SOH 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 Mbit/s

### Option OC-48c/STM-16c BERT

BN 3060/90.93

Only in conjunction with BN 3060/91.50 to /91.53

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 .....  $1 \times 10^{-3}$  to  $1 \times 10^{-9}$

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

Solutions for 10 Gbit/s

With the new ANT-10Gig we provide a 10 Gbit/s solution which covers OC-192 as well as STM-64. The ANT-10Gig allows testing at the highest line bit rate and in all mappings below and offers optionally all testing down to n x 64 kbit/s.  
For detailed information please refer to data sheet "ANT-10Gig".  
The ANT-20SE is prepared for upgrades towards STM-64/OC-192.

Further options

Optical Power Splitter (90%/10 %) BN 3060/91.05

The Optical Power Splitter is built into the ANT-20SE.  
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

OLA-15 Optical Attenuator (variable) BN 2239/01



One application of OLA-15 is in line-up of optical links, where line interruptions are simulated for bit error testing. The device is also useful when measuring the sensitivity of optical receivers. With its wide variable attenuation range and highly accurate and reproducible attenuation settings, the OLA-15 is an ideal companion to the ANT-20SE.

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

See OLA-15 data sheet for details.



# Jitter and Wander Options

## Standards

Jitter generation and jitter/wander analysis are in accordance with:

- Telcordia GR-253, GR-499, GR-1244
- ANSI T1.101, T1.102, T1.105.03, T1.403, T1.404, T1.105.09
- 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

## O.172 Jitter/Wander up to 155 Mbit/s

**BN 3060/91.30**

### Jitter generator

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

Bit rates

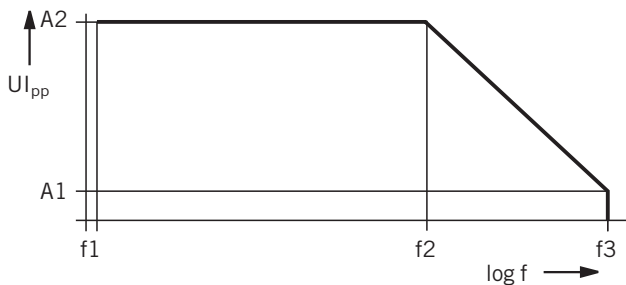
Generates jitter at all bit rates included in the mainframe configuration up to 155 520 kbit/s.

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 3060/91.31

### 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

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 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 ±10<sup>6</sup> s

Measurement accuracy ..... as per O.172

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

## O.172 Jitter/Wander up to 622 Mbit/s

**BN 3060/91.31**

### Jitter Generator

Jitter modulation of STM-4 TX 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.

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

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

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

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

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

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

Balanced 110 $\Omega$ connector .....	Bantam
Clock input voltage (sine or square wave) .....	1.0 to 6.5 V <sub>pp</sub>
HDB3/B8ZS input voltage .....	$\pm 3\text{ V} \pm 10\%$

Coaxial 75 $\Omega$ connector	BNC
Clock input voltage (sine or square wave)	1.0 to 5 V <sub>pp</sub>
HDB3/B8ZS input voltage	$\pm 2.37 \text{ V} \pm 10\%$

Meas. range I	80 Hz
Meas. range II	10 Hz

**Measuring modes** ..... see Jitter Analysis

### Demodulator output

75  $\Omega$ , BNC socket

Output voltage

Meas. range I (0 to 2 UIpp) ..... 1 V/UIpp

Meas. range II (0 to 32 UIpp) ..... 62.5 mV/UIpp

**Automatic tests** ..... like jitter meter up to 622 Mbit/s

Tolerance masks at

MTJ/F-MTJ ..... ANSI T1.105.03, Telcordia GR-253,  
ITU-T G.825

JTF ..... Telcordia GR-253, ANSI T1.105.03 type A,  
ITU-T G.958

### Wander Generator

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

Amplitude range ..... up to 200 000 UI

Frequency range ..... 10  $\mu$ Hz to 10 Hz

Accuracy ..... as per O.172

Resolution ..... 1  $\mu$ Hz

### Wander Analyzer

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 .....  $\pm 1$  ns to  $\pm 10^6$  s

Measurement accuracy ..... as per O.172

### Evaluation capabilities

see Wander Analysis

### Reference signal input

75  $\Omega$ , BNC socket

Frequencies ..... 1.544, 2.048, 5, 10 MHz

Input voltage ..... 0.5 to 5 Vpp

Input signal monitoring

(Loss of Timing Input) ..... LTI

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

## Jitter Analysis

Current values (continuous measurement)

Peak jitter value ..... in UIpp

Positive peak value ..... in UI+p

Negative peak value ..... in UI-p

Maximum value (gated measurement)

Maximum peak jitter value ..... in UIpp

Maximum positive peak value ..... in UI+p

Maximum negative peak value ..... in UI-p

Result averaging (switchable) ..... 1 to 5 s

The ANT-20SE 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

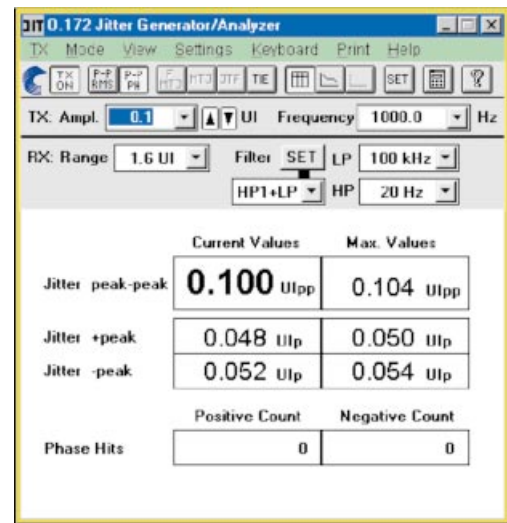


Figure 7: Jitter peak-to-peak/RMS measurement.

### 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, correlations between  
events can be quickly identified.

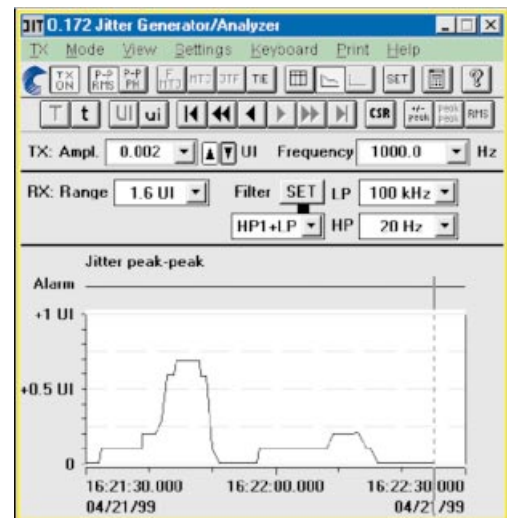


Figure 8: Jitter versus time display.

### Clock jitter measurement

The ANT-20SE 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 Mbit/s can be measured.

### RMS measurement

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

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.

## Wander Analysis

### Time Interval Error (TIE)

to O.172 .....numerical and graphical  
Sampling rates ..... see under O.172 Wander Analyzer  
for up to 622 Mbit/s

MTIE is additionally determined as a continually updated numerical value.

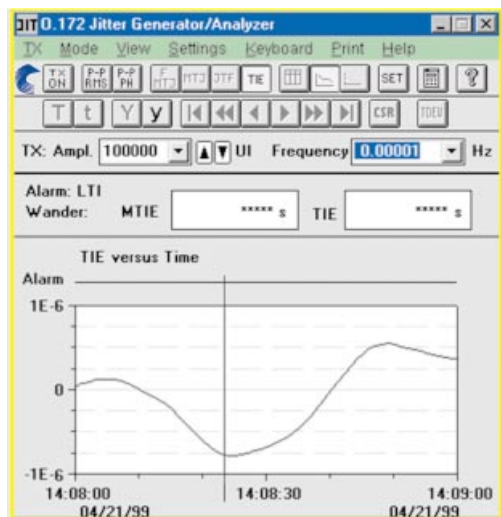


Figure 9: On-line wander testing (TIE).

To prevent data loss or premature termination of long term measurements, the ANT-20SE 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 Evaluation Software

This software provides extended off-line statistical analysis facilities for the results of wander measurements.

TIE values results obtained using the ANT-20SE are analyzed according to ANSI T1.101, Telcordia GR-1244, ETSI ETS 300 462, EN 302 084, ITU-T O.172, G.810 to G.813.

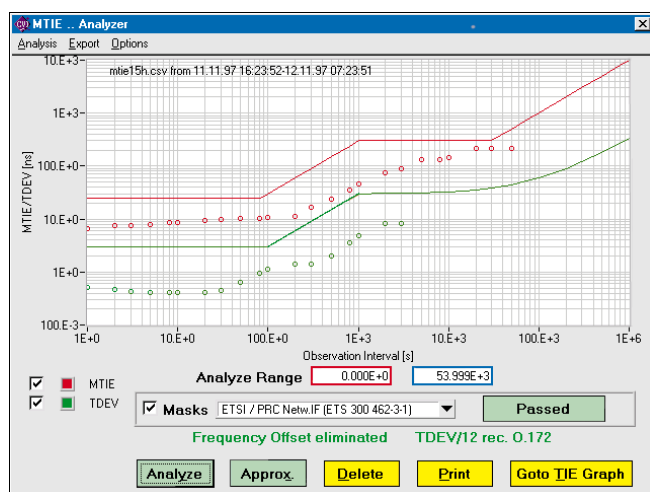


Figure 10: Display of MTIE/TDEV results and comparison against masks.

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-20SE determines the following over the selected measurement interval:

Frequency offset ..... in ppm  
Frequency drift rate ..... in ppm/s

### 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

Standard frequency source ..... 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 Mbit/s.

### Automatic determination of selective Jitter Transfer Function, JTF

Telcordia GR-499, GR-253, ANSI T1.105.03, ITU-T G.958

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-20SE 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 T1.105.03 and GR-253 or G.735 to G.739, G.751, G.758. 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-20SE 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.

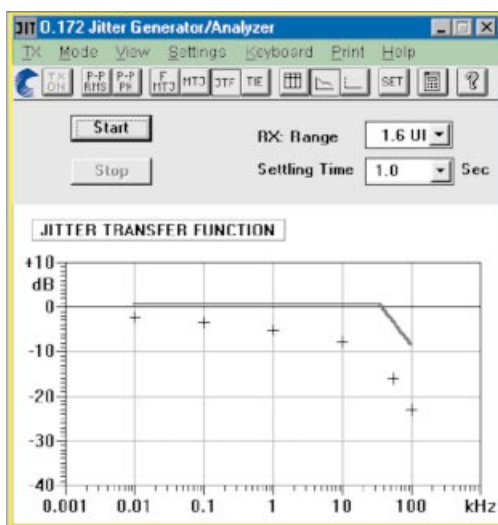


Figure 11: Jitter transfer testing results.

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

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

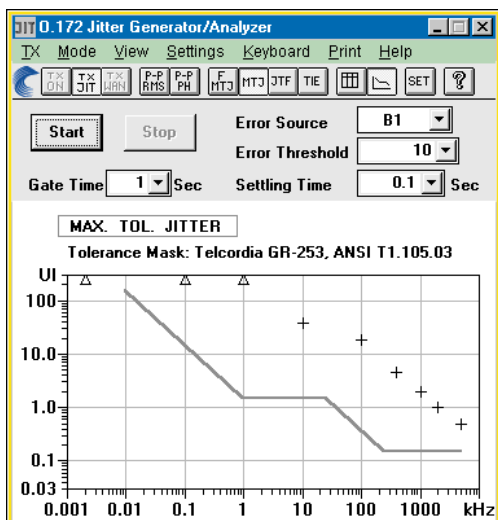


Figure 12: Maximum Tolerable Jitter testing.

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".

### Automatic determination of Maximum Tolerable Jitter, MTJ

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

The ANT-20SE 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 999 s

The maximum permissible jitter amplitude is determined precisely and quickly using a successive method.

The ANT-20SE 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-20SE 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, T1.105.03 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-20SE 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-20SE 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.

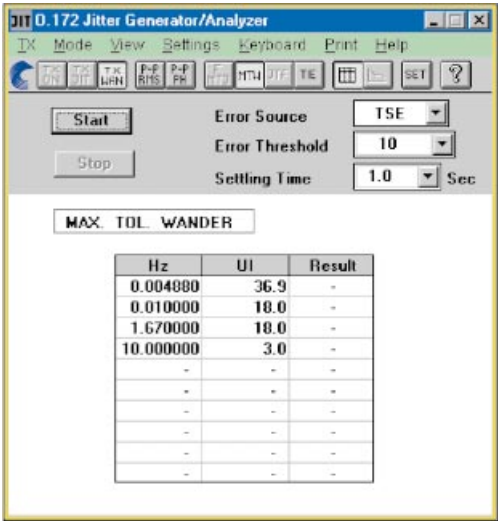


Figure 13: Maximum tolerable wander result display.

Accessory

Acterna TSR-37  
Rubidium Timing Signal Reference

DA 3700/00

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 25 °C:  $+5 \times 10^{-11}$  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 & lightweight
- External autocalibration input
- Input for GPS or Cesium reference

See Acterna TSR-37 data sheet for details.

# ATM Options

## ATM Basic

BN 3060/90.50

### General

#### Adjustable test channel from 0 to 150 Mbit/s

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-20SE is set on-line. Settings are made directly with a control (Figure 15) 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-20SE 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-20SE 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.

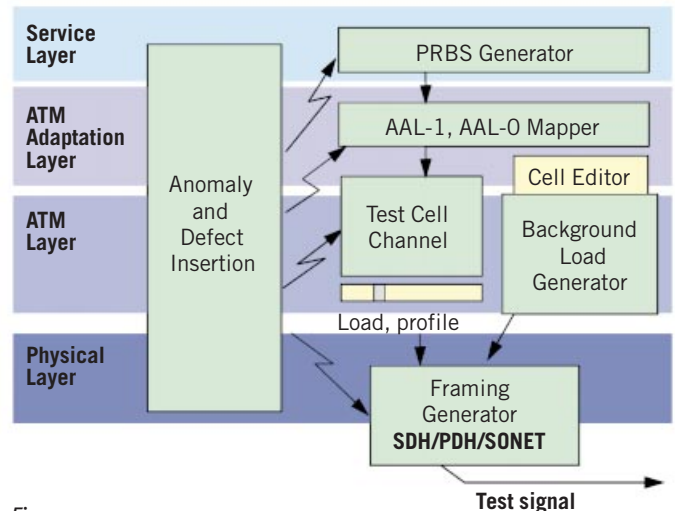


Figure 14:  
ATM-BERT generator configuration.

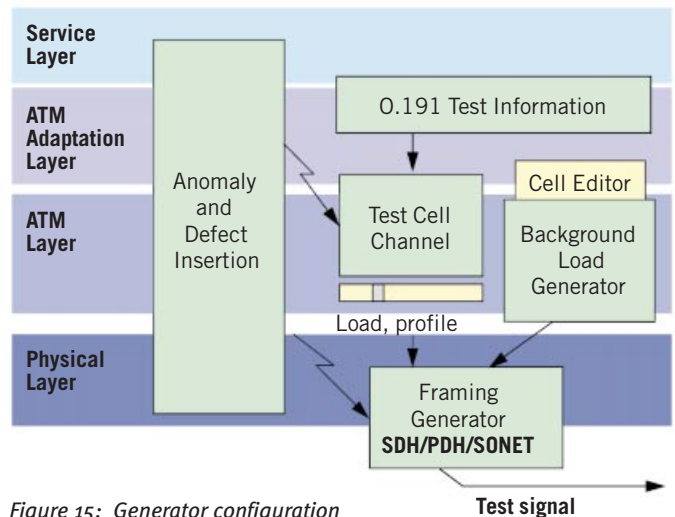


Figure 15: Generator configuration  
for performance measurement.

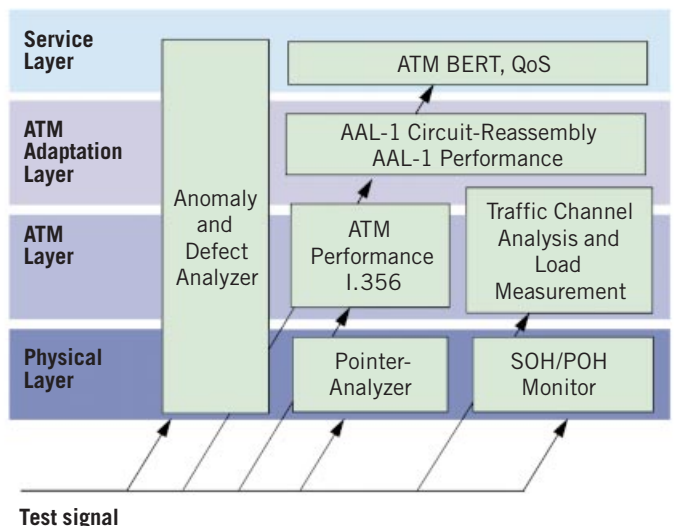


Figure 16: Analyzers in the ANT-20SE – A hierarchical overview.

## 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
- STS-3c/STM-1 with C4 ATM mapping, ANSI T1.105/107, ITU-T G.707
- 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 Mbit/s  
Cell scrambler  $X^{43}+1$  (ITU-T) ..... can be switched on and off

## Test cell channel

Adjustable from ..... 0 to 149.760 Mbit/s  
Header setting ..... editor  
Load setting in ..... Mbit/s, 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-20SE 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 kbit/s,  
2048 kbit/s with PCM30 frame structure  
ATM channel segmentation ..... AAL-1, ITU-T I.363

## Receiver unit

Bit rates of framed cell streams ..... 155.520 Mbit/s  
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  $\mu$ s

### Alarm detection (defects)

Physical layer as with ANT-20SE 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 ..... Mbit/s, 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 kbit/s,  
2048 kbit/s with PCM30 frame structure

includes the function of ATM BASIC BN 3060/90.50 and Broadband Analyzer Generator Module (BAG)

### 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-20SE 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.

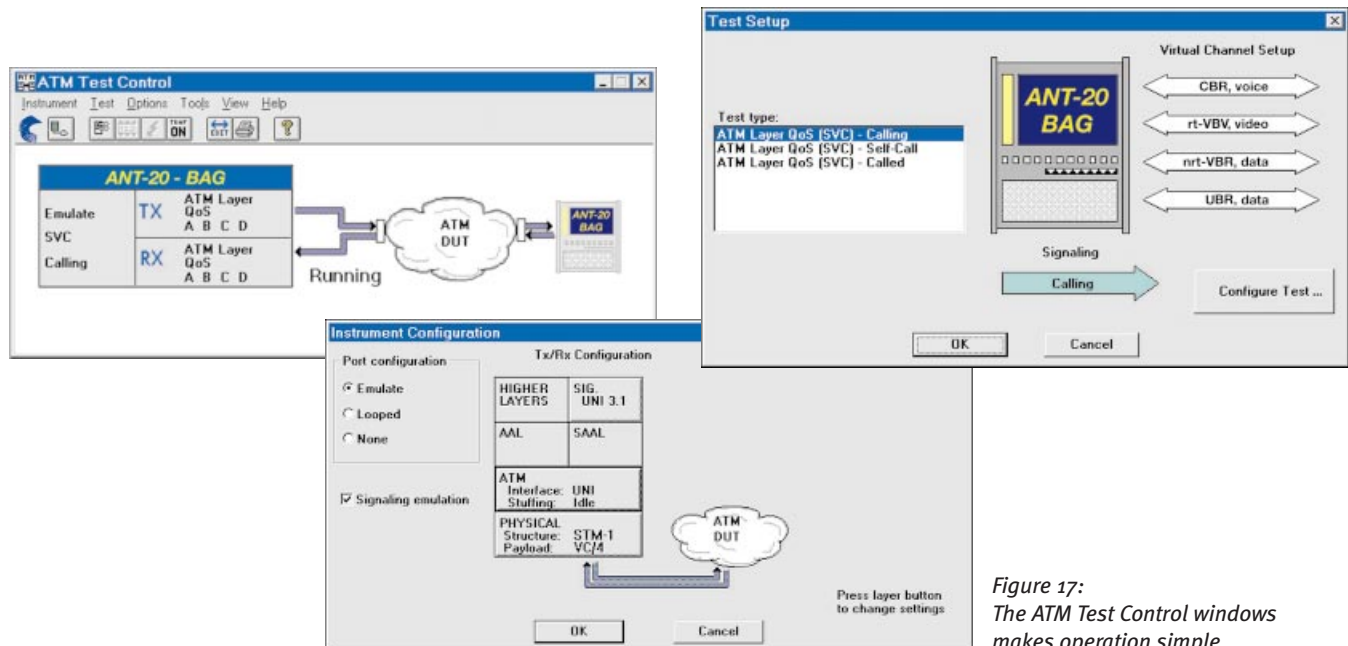


Figure 17:  
The ATM Test Control windows  
makes operation simple.

### 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-20SE 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.

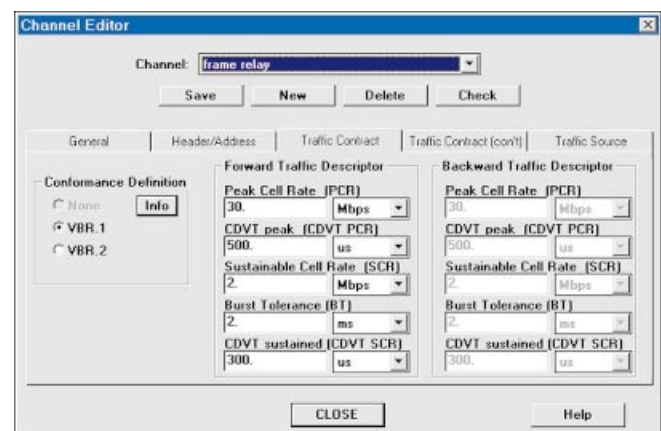


Figure 18: Channel Editor: Setting the traffic descriptor.

## ATM QoS test with four different SVCs

The ANT-20SE with BAG can perform SVC and PVC tests on up to four 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.

## Signalling analysis

Sequence errors in the signalling 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-20SE 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.

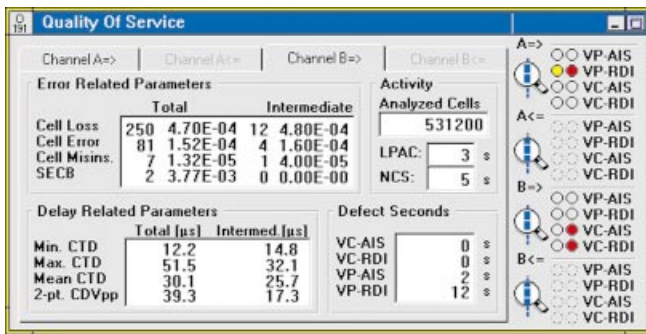


Figure 19: ATM test results for a real-time measurement on channel A.

## 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.

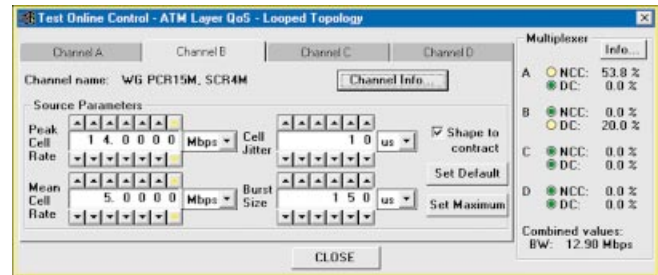


Figure 20: Soft-LED indication of multiplex results.

## Professional record of results

The ANT-20SE 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-20SE 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
- STS-3c/STM-1 with C4/SPE ATM mapping to ANSI T1.105/107 and ITU-T G.707, I.432

## ATM test controller

### Instrument port configurations

Emulation..... SVCs, PVCs  
Looped signal..... PVCs

### Test cell channels

Four test channels

settable from ..... 0 to 149.760 Mbit/s

Header setting..... via editor

Load setting in ..... kbit/s, Mbit/s, 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

## Signalling 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





### E3 (34 Mbit/s) ATM mapping

Bit rate ..... 34 368 kbit/s

### E1 (2 Mbit/s) ATM mapping

Bit rate ..... 2048 kbit/s

### STM-1/VC3 ATM mapping

Bit rate ..... 155 520 kbit/s

## OC-12c/STM-4c ATM testing BN 3060/90.91

Only in conjunction with BN 3060/90.50 and BN 3060/91.11 or  
BN 3060/91.12

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 Mbit/s  
Header setting ..... editor  
Load setting in ..... Mbit/s, 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-20SE 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 Mbit/s

#### Circuit emulation

Generation of asynchronous channels:  
1.544, 2.048, 6.312, 8.448, 34.368, 44.736 kbit/s,  
2.048 kbit/s 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  $\mu$ s

#### 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 ..... Mbit/s, 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 kbit/s, 2.048 kbit/s with  
PCM30 frame structure

# AUTO – Remote

## ANT-20SE 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

**GPIO (PCMCIA) Remote Control Interface**      **BN 3035/92.10**  
Remote control of instrument functions using SCPI command structure. A GPIO adapter card for the ANT-20SE PCMCIA interface is supplied with this option  
Interface ..... GPIO

**TCP/IP Remote Control Interface**      **BN 3035/92.11**  
Remote control of instrument functions using SCPI command structure  
Interface ..... 10/100 Mbit/s Ethernet

**LabWindows driver**      **BN 3038/95.99**  
Simplifies creation of remote-control programs for automated testing using LabWindows.  
The drivers can be used with options BN 3035/91.01 and BN 3035/92.10.

## 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-20SE (CATS = Computer Aided Test Sequence). 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

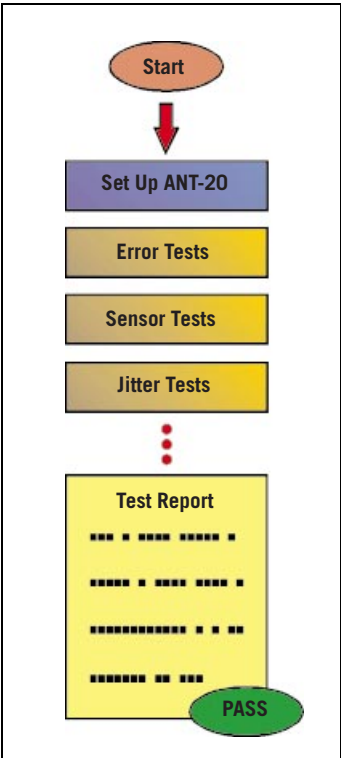


Figure 21: Automatic test sequences with the ANT-20SE.

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 predefined 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 ‘System under Test’ into an automated setup.  
The CATS PROFESSIONAL package is designed to make it easy to integrate the ANT-20SE 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.

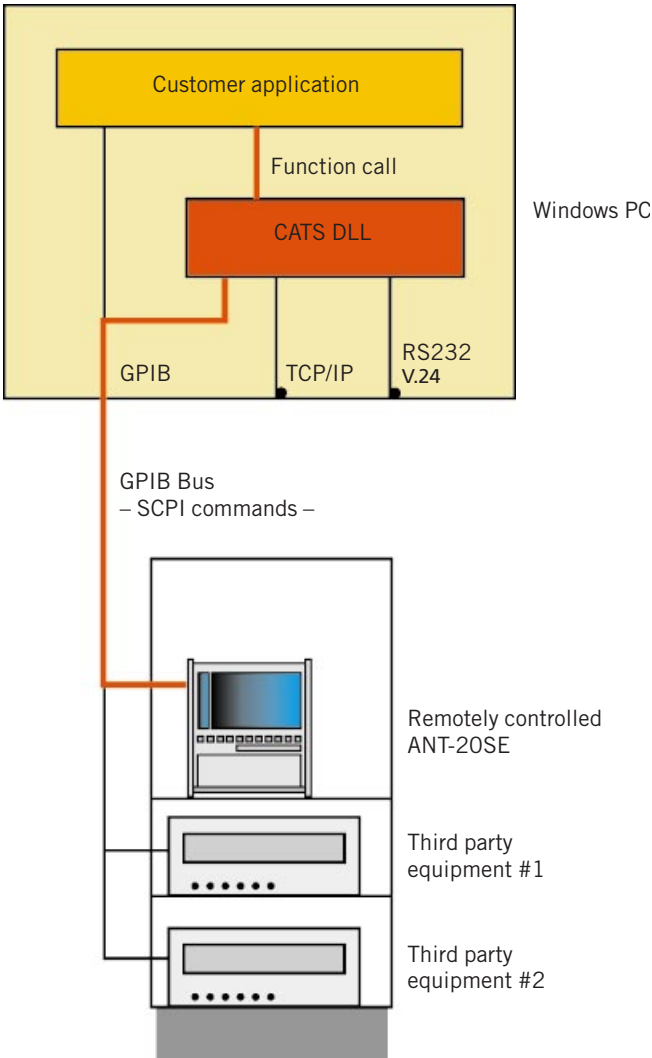


Figure 22: CATS DLL controls via GPIO an ANT-20SE.

## CATS DLL

The CATS DLL runs on the calling PC (under Windows 2000, Me, NT or WIN95/98) and communicates with the ANT-20SE via a standard remote control interface (RS232, GPIB or TCP/IP). The customer software runs on the same PC and communicates directly with the DLL.

## CATS ANT-20 remote controlled via TCP/IP

CATS TCP/IP is a different way of controlling the ANT-20SE in an automated environment. It is a special version of the CATS Test Sequencer that runs on the ANT-20SE itself. The customer's automation software can send commands to execute complete CATS test-cases and receive results via an Ethernet socket connection. This approach comes in handy in a UNIX based environment where DLLs don't work.

The option includes the functionality of Test Sequencer CATS BASIC.

## Remote Operation

BN 3035/95.30

These options allow operation of the ANT-20SE from a Windows PC. The complete ANT-20SE 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 troubleshooting 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 an Ethernet socket.

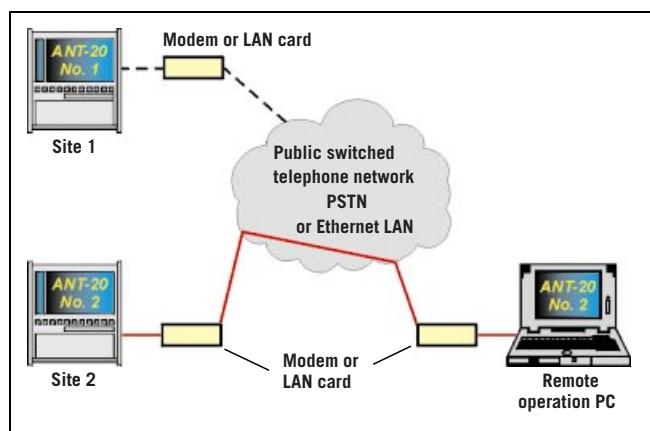


Figure 23: Remote operation of the ANT-20SE.

# Ordering Information

## ANT-2oSE Advanced Network Tester, SONET version **BN 3060/02**

(Includes STS VT1.5 SPE mapping;  
CPU RAM extension to 32 MB;  
menu in English or German.)  
With color TFT display touchscreen

### Options

#### Extended SONET testing **BN 3060/90.02**

STS-1/STM-0 mappings:  
VT6 SPE (6 Mbit/s in STS-1)  
STS-1 SPE / STM-0 (DS3 in STS-1)  
VT2 SPE / STM-0 (E1 in STS-1)  
STS-3c SPE (E4 in STS-3)  
APS, TCM Analysis  
OH capture, OH sequencing

#### Add SDH **BN 3060/90.04**

STM-1 mappings  
C12 (2 Mbit/s in STM-1, AU-3/AU-4)  
C3 (34 Mbit/s in STM-1, AU-3/AU-4)  
C4 (140 Mbit/s in STM-1)  
C11 (1.5 Mbit/s in STM-1, AU-3/AU-4)  
C3 (45 Mbit/s in STM-1, AU-3/AU-4)  
C2 (6 Mbit/s in STM-1, AU-3/AU-4)  
BERT (2, 8, 34, 140 Mbit/s)

#### Drop & Insert **BN 3060/90.10**

#### M13 Mux/Demux chain **BN 3060/90.12**

#### PDH 64k/140M Mux/Demux chain **BN 3035/90.11**

#### Add BERT SDH (2, 8, 34, 140 Mbit/s) **BN 3060/90.33**

### Optical Interfaces

The following options BN 3060/91.01 to /91.12 are alternatives.

Optical OC-1/3, STM-0/1, 1310 nm	BN 3060/91.01
Optical OC-1/3, STM-0/1, 1310 & 1550 nm	BN 3060/91.02
Optical OC-1/3/12, STM-0/1/4, 1310 nm	BN 3060/91.11
Optical OC-1/3/12, STM-0/1/4, 1310 & 1550 nm	BN 3060/91.12
The options BN 3060/91.50 to /91.52 are alternatives.	
Optical OC-48, STM-16, 1310 nm	BN 3060/91.50
Optical OC-48, STM-16, 1550 nm	BN 3060/91.51
Optical OC-48, STM-16, 1310/1550 nm switchable	BN 3060/91.52

### OC-12c/STM-4c Options

OC-12c/STM-4c Bit Error Tester	BN 3060/90.90
Requires Optical Module BN 3060/91.11 or /91.12	
OC-12c/STM-4c ATM Testing	BN 3060/90.91
Requires Optical Module BN 3060/91.11 or /91.12 and ATM BASIC BN 3060/90.50	
OC-12c/STM-4c Virtual Concatenation	BN 3060/90.92
Requires BN 3060/90.90 or /90.91	

### OC-48c/STM-16c Option

OC-48c/STM-16c Bit Error Tester (Bulk)	BN 3060/90.93
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### Optical Packages

Include optical interfaces from 52 Mbit/s to 2488 Mbit/s and four optical adapters – please select; include OC-48c/STM-16c Bulk, OC-12c/STM-4c BULK

Optics OC-1/3/12/48, STM-0/1/4/16, 1310 nm	BN 3060/90.55
Optics OC-1/3/12/48, STM-0/1/4/16, 1550 nm	BN 3060/90.56
Optics OC-1/3/12/48, STM-0/1/4/16, 1310 & 1550 nm	BN 3060/90.57
Optics OC-1/3/12, STM-0/1/4, 1310 nm	
Optics OC-48, STM-16, 1550 nm	BN 3060/90.58

### Optical Attenuator (plug-in)

SC-PC, 1310 nm, 15 dB	BN 2060/00.61
FC-PC, 1310/1550 nm, 15 dB	BN 2229/90.33

### Optical Power Splitter (90%/10%)

includes 3 optical adapters – please select	BN 3060/91.05
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### 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

O.172 JitterWander Paket up to 155 Mbit/s	BN 3060/91.30
Includes MTIE/TDEV offline analysis	
O.172 Jitter/Wander Packet up to 622 Mbit/s	BN 3060/91.31
Includes MTIE/TDEV offline analysis	
O.172 Jitter/Wander Packet up to 2488 Mbit/s	BN 3060/91.32
Includes MTIE/TDEV offline analysis	
O.172 Jitter/Wander at only 2488 Mbit/s	BN 3060/91.33
Includes MTIE/TDEV offline analysis	
O.172 Jitter at only 2488 Mbit/s	BN 3060/91.34

### ATM Functions

#### ATM Basic for STM-1/STS-3c

BN 3060/90.50
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#### ATM Comprehensive

Includes ATM Basic and BAG	BN 3060/90.51
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### Add ATM SDH

Requires ATM module BN 3060/90.50 or BN 3060/90.51	BN 3060/90.52
E4 (140 Mbit/s) ATM mapping	
E3 (34 Mbit/s) ATM mapping	
E1 (2 Mbit/s) ATM mapping	
VC-3 ATM mapping in STM-1 (AU-3/AU-4)	

### Add ATM SONET

Requires ATM module BN 3060/90.50 or BN 3060/90.51	BN 3060/90.53
STS-1 (51 Mbit/s) ATM mapping	
DS3 (45 Mbit/s) ATM mapping	
DS1 (1.5 Mbit/s) ATM mapping	

### OC-12c/STM-4c ATM Testing

Requires Optical Module BN 3060/91.11 or /91.12	BN 3060/90.91
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## Remote Control Interfaces

V.24/RS232 Remote Control Interface	BN 3035/91.01
GPIO Remote Control Interface	BN 3035/92.10
TCP/IP Remote Control Interface	BN 3035/92.11
LabWindows CVI driver	BN 3038/95.99

## Remote Operation

Remote operation	BN 3035/95.30
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## Test Automation

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

## Calibration report

(Calibration is carried out in accordance with quality management system certified to ISO 9001.)	BN 3060/94.01
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## Accessories

Transport case for ANT-20SE	BN 3035/92.03
External keyboard (UK/US)	BN 3035/92.04
Decoupler (–20 dB, 1.6/5.6 jack plug)	BN 3903/63
TKD-1 probe, 48 to 8500 kbit/s	BN 822/01

## Training courses

Location: 72800 Eningen u.A., Germany

Information about availability and other locations available on request.

“SDH/SONET troubleshooting”	BN 3035/89.01
“Synchronization”	BN 3035/89.02
“Solving Jitter Problems”	BN 3035/89.03
“SDH/SONET Quality of Service”	BN 3035/89.04
“Optimizing Your SDH/SONET Network”	BN 3035/89.05
“Turning up ATM Services”	BN 3035/89.30
“ATM Traffic Management”	BN 3035/89.31
“ATM Quality of Service”	BN 3035/89.32



**ANT-20SE** – combination and parallel operation of all bit rates up to OC-48 with jitter/wander up to 2.5 Gbit/s and ATM in a single unit. Now also with OC-192 optical interfaces.



**ANT-10Gig** is a subset of the ANT-20SE. This test solution handles OC-192c/STM-64c, taking you one step further into the future. It offers access to all standard interfaces from 1.5 Mbit/s up to 10 Gbit/s.



**ANT-20** – Compact and handy for field work. It offers one extension slot for OC-48, Jitter up to OC-12 or Comprehensive ATM testing.

## Regional Sales Headquarters

### Global Headquarters

20400 Observation Drive  
Germantown, Maryland 20876-4023  
USA

Toll Free 1-800-638-2049  
Tel. +1-301-353-1550  
Fax +1-301-444-8468

[www.acterna.com](http://www.acterna.com)

### North America

20400 Observation Drive  
Germantown, Maryland 20876-4023  
USA

Toll Free 1-800-638-2049  
Tel. +1-301-353-1550  
Fax +1-301-444-8468

### Latin America

Av. Eng. Luis Carlos Berrini,  
936-8/9. Andar  
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

### East Europe, Middle East & Africa

Elisabethstrasse 36  
PO Box 13  
2500 Baden  
Austria  
Tel. +43 2252 85521 0  
Fax +43 2252 80727

1<sup>st</sup> Neoplimovskiy Per. 15/7 (4<sup>th</sup> floor)  
119121 Moscow  
Russia  
Tel. +7 095 248 2508  
Fax +7 095 248 4189



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