

Acterna ANT-20SE

Advanced Network Tester “Speed Evolution” – SDH



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 GSM, 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 STM-16 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 STM-64/OC-192 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 E1 to STM-64c
- Modular platform offering PDH, SDH, SONET and ATM capabilities
- Built-in Pentium PC and Windows 98 user interface for easy processing of test results
- Complemented by a lot of easy-access, automated test features
- Large, color touchscreen plus graphical results presentation
- Prepared for STM-64 upgrade

Edition: July 2001



ACTERNA™
The Keepers of Communications

| | | | |
|------------------------------------|--|---------------|--------------------------|
| | ANT-20SE – SDH – mainframe | BN 3060/01 | <input type="checkbox"/> |
| SDH page 3–9 | Extended SDH testing | BN 3060/90.01 | <input type="checkbox"/> |
| | Add SONET | BN 3060/90.03 | <input type="checkbox"/> |
| | Drop & Insert/Through mode | BN 3060/90.10 | <input type="checkbox"/> |
| | Mux/Demux 64k/140M | BN 3060/90.11 | <input type="checkbox"/> |
| | M13 Mux/Demux | BN 3060/90.12 | <input type="checkbox"/> |
| | Add SONET BERT only | BN 3060/90.34 | <input type="checkbox"/> |
| Optic page 10–13 | STM-0/1, 1310 nm | BN 3060/91.01 | <input type="checkbox"/> |
| | STM-0/1, 1310/1550 nm | BN 3060/91.02 | <input type="checkbox"/> |
| | STM-0/1/4, 1310 nm | BN 3060/91.11 | <input type="checkbox"/> |
| | STM-0/1/4, 1310/1550 nm | BN 3060/91.12 | <input type="checkbox"/> |
| | STM-0/1/4/16*, 1310 nm + Concatenated | BN 3060/90.55 | <input type="checkbox"/> |
| | STM-0/1/4/16*, 1550 nm + Concatenated | BN 3060/90.56 | <input type="checkbox"/> |
| | STM-0/1/4/16*, 1310/1550 nm + Concatenated | BN 3060/90.57 | <input type="checkbox"/> |
| | STM-0/1/4, 1310 nm + STM-16 1550 nm + Conc. | BN 3060/90.58 | <input type="checkbox"/> |
| CONC page 11–13 | STM-4c BERT | BN 3060/90.90 | <input type="checkbox"/> |
| | STM-4c ATM | BN 3060/90.91 | <input type="checkbox"/> |
| | STM-4c Virtual Concatenated | BN 3060/90.92 | <input type="checkbox"/> |
| | STM-16c BERT | BN 3060/90.93 | <input type="checkbox"/> |
| Jitter page 14–19 | Jitter/Wander up to 155 Mbit/s | BN 3060/91.30 | <input type="checkbox"/> |
| | Jitter/Wander up to 622 Mbit/s | BN 3060/91.31 | <input type="checkbox"/> |
| | Jitter/Wander up to 2.5 Gbit/s | BN 3060/91.32 | <input type="checkbox"/> |
| ATM page 20–25 | ATM Basic | BN 3060/90.50 | <input type="checkbox"/> |
| | ATM Comprehensive (PVC + SVC) | BN 3060/90.51 | <input type="checkbox"/> |
| | Add ATM SDH | BN 3060/90.52 | <input type="checkbox"/> |
| | Add ATM SONET | BN 3060/90.53 | <input type="checkbox"/> |
| AUTO – Remote page 26–27 | Test Sequencer CATS BASIC | BN 3035/95.90 | <input type="checkbox"/> |
| | Test Sequencer CATS PROFESSIONAL | BN 3035/95.95 | <input type="checkbox"/> |

* For STM-16 only see chapter Optical Interface

ANT-20SE Mainframe

BN 3060/01

Includes:

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

Generator unit

Digital outputs

Interfaces to ITU-T Recommendation G.703

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

Bit rates and line codes

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

120 Ω balanced output, Lemosa jack

Bit rate and line codes

2048 kbit/s HDB3, CMI

Bit rate offset. ± 500 ppm

Step size 0.001 ppm

Clock

Internal clock generation

at all of the bit rates listed above.

Clock stability ± 2 ppm

Synchronisation to external signals

via 75 Ω unbalanced input, BNC jack:

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

Clock outputs

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

2048 kHz reference clock output via trigger output

STM-1 output signal

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

Mappings

The C12 mapping is included in the basic instrument. Other mappings can be added as needed.

Content of the selected container:

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

Content of non-selected containers framed PRBS 2¹¹-1

The various mappings are described along with the options.

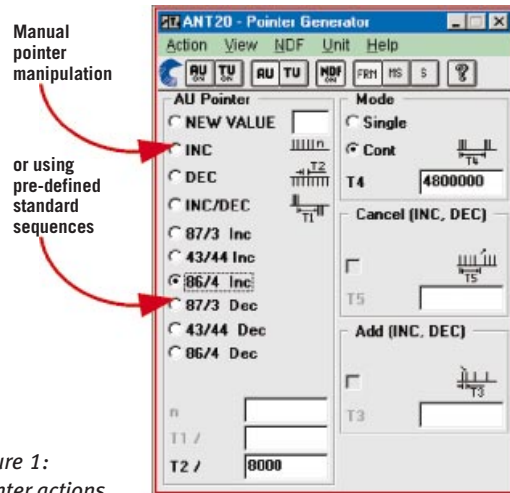


Figure 1:
Pointer actions

Generation of Pointer actions (Figure 1)

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

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

Trigger types: Single or continuous repeat

Contents of SDH and POH bytes

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

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

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

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, MS-REI,
HP-REI, bit errors in test pattern,
code errors (single errors)

Triggering

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

Burst error: m anomalies in n periods

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

Alarm generation, dynamic

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

m alarms in n frames $m = 1$ to $n-1$, $n_{\max} = 8000$
or
t1 alarm active,
t2 alarm passive $t1 = 0$ to 60 s, $t2 = 0$ to 600 s

Alarm generation, static (on/off)

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

PDH output signals

Signal structures for all bit rates:

- Unframed test pattern
- Framed test pattern (to ITU -T O.150);
 CRC-4 selectable for 2 Mbit/s

Error insertion

Error types bit errors, FAS errors,
 code errors (single errors)

Trigger types: Single error or

error rate 1×10^{-2} to 1×10^{-9}
 Step size for mantissa and exponent 1

Alarm generation, dynamic

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

Alarm generation, static (on/off)

Alarm types LOS, LOF, AIS, RDI

Test patterns

Pseudo-random bit sequences

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

Programmable word

Length 16 bits

Receiver unit

Digital inputs

Interfaces to ITU-T Recommendation G.703

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

Bit rates and line codes

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

120 Ω balanced input, Lemosa jack

Bit rate and line codes

2048 kbit/s HDB3, CMI

Clock recovery pulling range ± 500 ppm

Selectable input gain

CMI coded 15 to 23 dB

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

Selectable adaptive equalizers for 1544, 2048, 34 368, 44 736, 51 840,

139 264 and 155 520 kbit/s

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

STM-1 and PDH receive signals

Signal structures as for generator unit

Trigger output

75 Ω BNC connector, HCMOS signal level

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

Included mapping

C12 mapping

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

Modes asynchronous,
 byte synchronous (floating)

Error insertion and measurement

Additional error types BIP2, B3 parity errors,
 LP-REI, LP-BIP

Alarm generation, dynamic

Alarm types TU-LOP, TU-AIS, LP-PLM,
 TU-LOM, LP-UNEQU, LP-RDI, LP-RDIEP,
 LP-RDIES, LP-RDIEC, LP-RFI

m alarms in n frames $m = 1$ to $n-1$, $n_{max} = 8000$
 or

t1 alarm active,

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

Alarm generation, static (on/off) and evaluation

Alarm types TU-LOP, TU-AIS, TU-LOM,
 LP-UNEQU, LP-PLM, LP-TIM, LP-RDI, LP-RDIEP,
 LP-RDIES, LP-RDIEC, LP-RFI

Alarm detection only TU-NDF

Automatic modes

Autoconfiguration

Automatically sets the ANT-20SE to the input signal.

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

Automatic SCAN function

The SCAN function permits sequential testing of all C11 or C12 channels via AU-3 or AU-4 in a SDH signal.

The ANT-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.

The generator runs simultaneously and can be used to stimulate the device under test.

Automatic TROUBLE SCAN function (Figure 2)

The TROUBLE SCAN function permits sequential testing of all C11 or C12 channels via AU-3 or AU-4 in a SDH signal.

The ANT-20SE receiver checks for alarms in the receive signal, the SDH structure and all channels. The results (OK/not OK) for each channel are entered in a matrix.

A detailed alarm history can be displayed by selecting a channel from the matrix.

The alarm status of individual channels can be displayed following the measurement.

Only the receive channels are altered during a TROUBLE SCAN.

AutoScan function (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. Delay time 1 to 10 s.

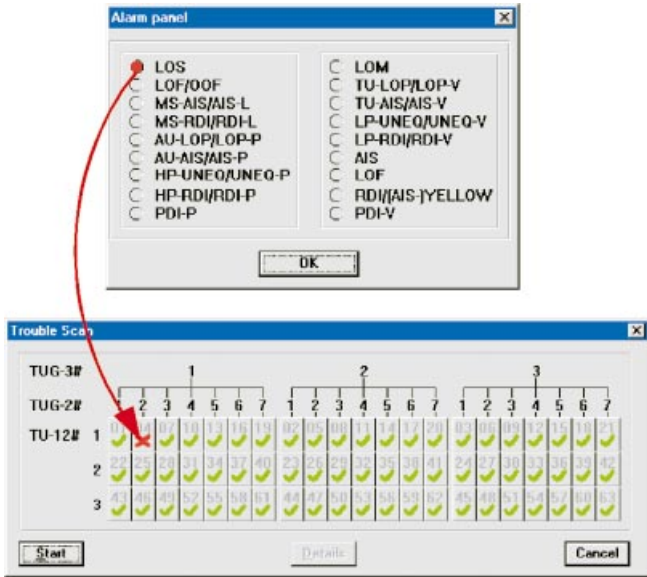


Figure 2: Trouble scan

Automatic SEARCH function

Channel shifts in the payload may occur when measuring complex network elements, depending on the configuration of the device under test. The SEARCH function permits rapid automatic location of the test channel (C11 or C12 with defined PRBS) in the payload of a SDH signal.

The ANT-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.

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

Measurement types

Error measurements

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

Analysis of AU and TU pointer actions (Figure 4)

Display of

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

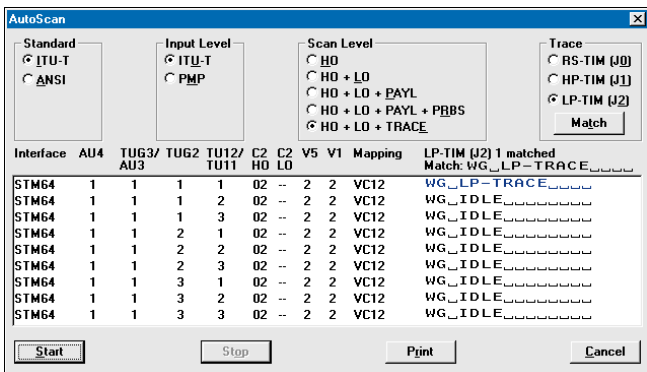


Figure 3: AutoScan

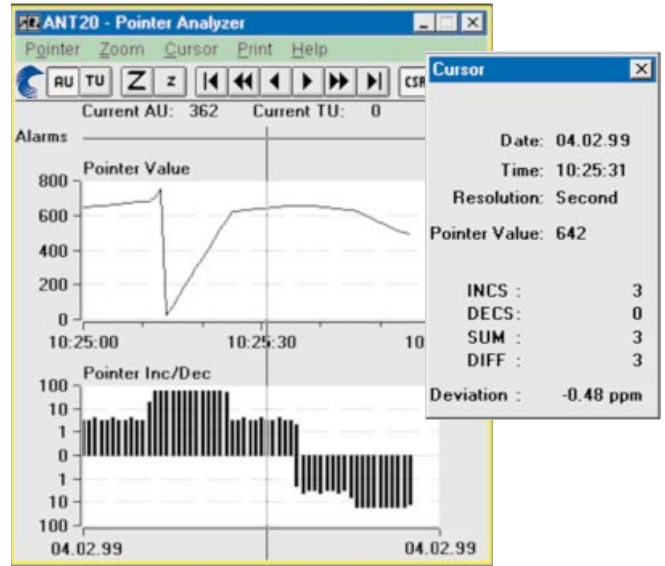


Figure 4: Graphic pointers. Display showing additional evaluation of cursor position

Clock frequency measurement

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

Alarm detection

All alarms are evaluated and displayed in parallel

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

SOH and POH evaluation

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

For the bytes E1, E2, F1, F2 and byte groups D1 to D3 and D4 to D12:

- BERT using test pattern from the generator unit
- Output of the data signal via the V.11 interface (also for K1, K2, K3, N1 and N2)

For the Trace Identifier

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

Measurement interval

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

Measurement stop manual or automatic timer (user setting)

Memory for errors, pointer operations and alarms

Resolution of error events and pointers 1 s
Alarm resolution. 100 ms

| G.828: MSOH | NEAR END: B2SUM | FAR END: MS-REI |
|-------------|-----------------|-----------------|
| ES | 0 0.00000 % | 0 0.00000 % |
| EFS | 28 100.00000 % | 28 100.00000 % |
| SES | 0 0.00000 % | 0 0.00000 % |
| BBE | 0 0.00000 % | 0 0.00000 % |
| SEP | 0 0.00000 % | 0 0.00000 % |
| UAS | 0 0.00000 % | 0 0.00000 % |
| VERDICT | Accepted | Accepted |

| | |
|-----------------|------------|
| PATH ALLOCATION | 18.50000 % |
| PATH UAS | * |

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

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

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

Measurements can be made using the following events:
 PDH systems bit errors, FAS2, FAS8, FAS34, FAS140, CRC and E-bit errors
 SDH systems payload bit errors (PDH and bulk), overhead bytes E1, E2, F2, D1 to D3, D4 to D12

Evaluation to ITU-T Recommendation G.826

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

In-Service Measurement (ISM)

Simultaneous in-service measurement of near end and far end of a selected path:

- Near end: B1, B2, HP-B3, LP-B3, BIP2, FAS at 140/34/8 or 2 Mbit/s, CRC-4
- Far end: HP-REI, LP-REI, E-bit at 2 Mbit/s

Out-of-Service measurement (OOS)

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

Evaluation of SDH systems to ITU-T Recommendation G.828 and G.829 (Figure 5)

The G.828 defines error performance parameters and objectives for international synchronous paths.
 ES, EFS, SES, BBE, SEP and UAS are evaluated.
 Pass/fail assessment based on line length allocation of 0.1 to 100%.
 The SES and UAS thresholds are user-settable. The SEP can be switched off for assessment.

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

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

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

ISM simultaneously for near end and far end of a selected path:
 PDH systems, near end bit errors, FAS2, FAS8, FAS34, FAS140, CRC-4
 far end E-bit at 2 Mbit/s
 SDH systems payload bit errors (PDH and bulk), overhead bytes E1, E2, F2, D1 to D3, D4 to D12

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

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

This recommendation provides limits for bringing-into-service and maintenance of interantional SDH paths and multiplex sections.
 ES, EFS, SES, BBE, SEP and UAS are evaluated.
 Pass/fail assessment based on line length allocation of 0.1 to 100%.
 The UAS and BISO (bringing into service objectives) thresholds are user-settable.
 ISM simultaneously for near end and far end of a selected path:
 PDH systems, near end B1, B2SUM, B3, BIP8, BIP2, bit errors (TSE)
 far end MS-REI, HP-REI, LP-REI

Delay measurement

A delay measurement is used to line-up satellite hops, to test the maximum permitted latency in storage exchanges and cross-connect systems and to check the loop circuits of regenerators. The ANT-20SE measures the time taken for the test pattern to be transmitted from the generator back to the receiver via the path under test.
 The measurement is made on the test patterns in the selected channel, in the containers (bulk or PDH) for SDH or in the selected channel at the lowest hierarchy level of PDH multiplex systems.
 To avoid ambiguities in the measurement, two measurement times are provided.

Measurement range

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

Off-line analysis software

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

Graphical display (histogram) (Figure 6)

Display of errors, pointer operations/values and alarms as bargraphs vs. time
 Units, time axis seconds, minutes, 15 minutes, hours, days

Tabular display

Display of all alarm and error events with time stamp

Result printout

ANT-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

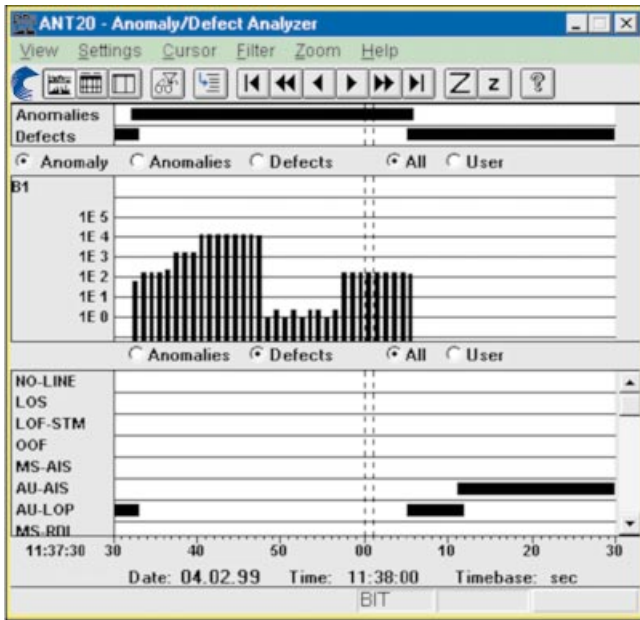


Figure 6: Histogram result display

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 Superdisk. Easy to use filter functions allow quick selection of the desired application.

Display

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

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

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

AC line voltage, automatic switching 100/127 V and 220/240 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 +5 to +40 °C
Storage and transport range -20 to +70 °C

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

Weight approx. 15 kg/33 lb

Options

Extended SDH testing

BN 3060/90.01

C3 mapping

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

Error insertion and measurement

Additional error types LP-B3, LP-REI

Alarm generation, dynamic

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

Alarm generation, static (on/off) and evaluation

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

C4 mapping

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

Errors and alarms as for mainframe instrument

C11 mapping

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

Selectable via TU-11 or TU-12

Errors and alarms as for C12 mapping
(2 Mbit/s in STM-1)

C3 mapping

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

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

C2 mapping

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

Extended Overhead Analysis

Byte capture SOH and POH

To analyze the SOH/POH functions, it is necessary to capture individual bytes vs. time, allowing detection of errors or short-term changes with frame level precision.

The Capture function is started by a selectable trigger.

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

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

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

The results can be printed or exported.

Capture bytes for STM-0/1, el. & opt all SOH/POH bytes
 STM-N el. & opt all SOH/POH bytes,
 channel 1 except A1, A2, B1

Storage depth for a byte 266
 K1, K2 200

Trigger events MS-AIS, AU-AIS, MS-RDI, AU-LOP,
 editable value in trigger byte

Capture resolution frame precision

Tandem Connection Monitoring (TCM) (Figure 7)

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

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

Capture TCM frames all N1/N2 bytes,
 TC-IEC, TC-AIS, TC-REI, TC-OEI

Trigger events Start of TCM frame (TCM FAS word)
 Storage depth 266 bytes (3.5 TCM frames)

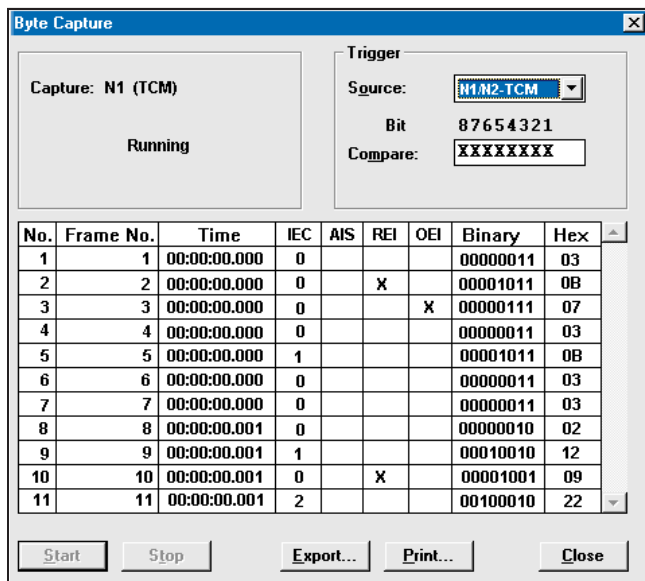
On-line monitoring of alarms and trace identifier.

Display of actual and history values TC-UNEQ, LTC,
 TC-AIS, TC-RDI, TC-ODI, TC-REI, TC-OEI

On-line display of TCM Access Point Identifier

TCM error measurement

Error types TC-IEC, TC-DIFF, TC-REI, TC-OEI



Overhead Sequencer

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

APS time measurement

In synchronous networks, a defined maximum switch-over time is necessary for the traffic in case of a fault.

To verify compliance with this requirement, the ANT-20SE measures the switch-over time with 1 ms resolution.

The result can be printed.

Criteria for the time measurement TU-AIS, MS-AIS,
 AU-AIS, bit error

Max. measurable switch-over time 2 s

Resolution 1 ms

Allowable error rate for user signal $< 2 \times 10^{-4}$

Add SONET

BN 3060/90.03

STM-0 and VT2 SPE mapping

(2 Mbit/s in STM-0 and E1 in STS-1)

See ANT-20SE SONET datasheet for details

STM-0 and VT1.5 SPE mapping

(1.5 Mbit/s in STM-0 and DS1 in STS-1)

See ANT-20SE SONET datasheet for details

Mapping VT6 SPE

(6 Mbit/s in STS-1)

See ANT-20SE SONET datasheet for details

STM-0 and STS-1 SPE mapping

(34/45 Mbit/s in STM-0 and DS3 in STS-1)

See ANT-20SE SONET datasheet for details

BERT (1.5/6/45 Mbit/s)

Signal structure and interfaces for generator and receiver:
 Framed and unframed test patterns (6 Mbit/s unframed)

Additional test pattern QRSS 20

Additionally, for unbalanced digital signal input/output

Bit rate, line code 1544 kbit/s, 6312 kbit/s, B8ZS, AMI

Bit rate, line code 44 736 kbit/s, B3ZS

Additionally, for balanced digital signal input/output

Bit rate, code 1544 kbit/s, B8ZS

Figure 7: Capture with TCM trigger and interpretation

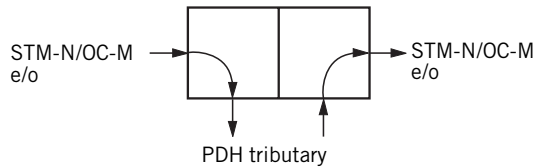
Drop & Insert

BN 3060/90.10

This option provides the following functions:

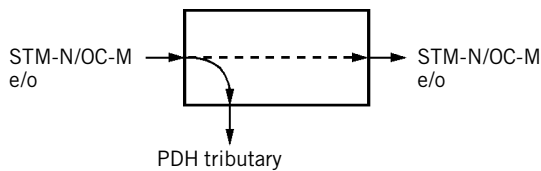
1. Generator and receiver operate independently

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



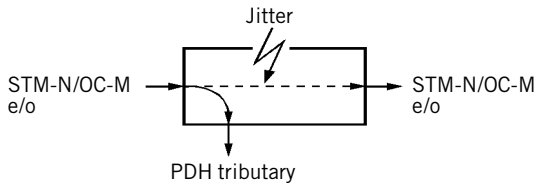
2. Through mode:

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



3. Through mode jittering:

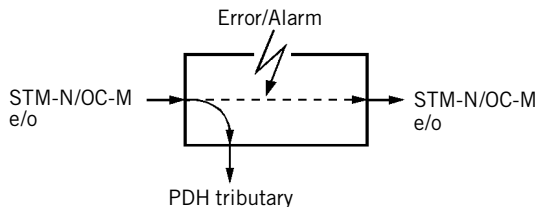
The looped-through PDH or SDH signal can also be jittered using the Jitter Generator option. This applies to all jitter frequencies up to 622 Mbit/s depending on the jitter option fitted.



4. Error insertion in through mode:

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

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



5. Block and Replace (B & R)

For this function, the ANT-20SE is looped into the working fiber of a ring. B & R allows replacement of a synchronous tributary (e.g. STM-1 including SOH, POH and payload) in a STM-N signal. This can then be measured by the ANT-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 Ω, coaxial BNC; line codes as for mainframe instrument

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

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 and is available as payload in mappings.

For STM-0 mappings please select the option “Add SONET”. Alarms and errors can be generated and analyzed.

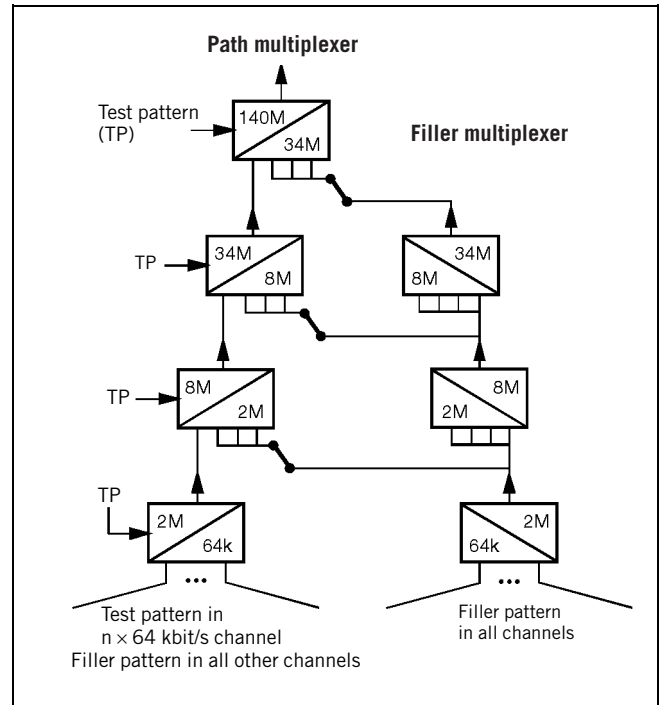


Figure 8: Output signal structure. Framed and unframed pseudo-random bit sequences are available as test patterns (TP) from 2 to 140 Mbit/s.

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 option “Add SONET”).

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

Optical STM-0/1, OC-1/3, 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 ITU-T Rec. G.957, Tables 2 and 3 (Telcordia GR-253, ANSI T1.105.06).

Classes L1.1, L1.2 and L1.3 (LR-1, LR-2, LR-3) are covered.

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

Wavelength range 1100 to 1580 nm
 Input sensitivity -8 to -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 Ω

Optical Modules up to 622 Mbit/s

Optical STM-0/1/4, OC-1/3/12, 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 ITU-T Rec. G.957, Tables 2 and 3 (Telcordia GR-253, ANSI T1.105.06).

Classes L1.1, L1.2, L1.3, L4.1, L4.2 and L4.3 (LR-1, LR-2, LR-3) are covered.

There are 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 STM-4 TX signal

in instruments with STM-1 mappings

The STM-4 TX signal consists of

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

Generation of OC-12 TX signal

in instruments with STS-1 mappings

The OC-12 TX signal consists of

- one internally generated STS-1 tributary signal with the other 11 tributaries filled with UNEQ or
- one internally generated STS-3c tributary signal with the other three tributaries filled with UNEQ (with STS-3c mapping or ATM Basic Option BN 3060/90.50).

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

For all bytes except B1, B2 and H1 to H3:

- the content of each byte is statically programmable or a user defined byte-sequence p in m in n (p frames in m frames and the entire sequence repeated n times) can be inserted.

For the E1, E2, F1 bytes and the DCC channels

D1 to D3 and D4 to D12:

- Transmission of a test pattern with bit error insertion (see 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 STM-4 MS-REI
 for OC-12 REI-L

Triggering

Single errors or error ratio 2×10^{-3} to 1×10^{-10}
 for B1 parity errors 2×10^{-4} to 1×10^{-10}

Burst error: m anomalies in n periods

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

Alarm generation, dynamic

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

Alarm generation, static (on/off)

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

Receiver unit

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

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

Display of optical input level
Resolution 1 dB

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

Measurement types

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

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

Overhead evaluation

- Display of the complete overhead of a selectable STM-1/STS-1/STS-3c signal

For the E1, E2, F1 bytes and the DCC channels D1 to D3 and D4 to D12:

- BERT using a test pattern from the generator unit
- Output of the data signal via the V.11 interface

For the K1, K2, N1, N2 bytes:

- Data signal output via the V.11 interface

For the J0 byte:

- Display of 15-byte sequences in ASCII.

155/622 Mbit/s electrical interface

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

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

Concatenated Mappings 622 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 1×10^{-2} to 1×10^{-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) ± 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 STM-16/OC-48, 1310 nm

BN 3060/91.51

Optical STM-16/OC-48, 1550 nm

BN 3060/91.50

Optical STM-16/OC-48,

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 ITU-T Recommendation G.957 (Table 4) and Telcordia TA-NWT-000253 I.6 (Table 4-9, 4-10).

Classes S-16.2, L-16.2, L-16.3 (ITU-T) or IR-2, LR-2, LR-3 (Telcordia) are fulfilled at 1550 nm; classes S-16.1, L-16.1 (G.957) or IR-1, LR-1 (Telcordia) are fulfilled at 1310 nm.

Generator

Optical interfaces

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

Electrical interfaces

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

Clock generator

| | |
|---|----------|
| Internal, accuracy | ± 2 ppm |
| Offset | ± 50 ppm |
| Synchronization from external signal as for mainframe | |

Generation of STM-16 TX signal

in instruments with STM-1 mappings

The STM-16 signal consists of one or more internally generated tributaries plus several tributaries filled with UNEQ (or non-specific UNEQ)

- 16 identical STM-1
- one STM-1 tributary and 15 × UNEQ/non specific
- 4 identical STM-4c (Option BN 3060/90.90 required)
- one STM-4c tributary (Option BN 3060/90.90 required) and 3 × UNEQ/non specific

Generation of OC-48 TX signals

in instruments with STS-1/STS-3c mappings

The OC-48 signal consists of one or more internally generated tributaries plus several tributaries filled with UNEQ (or non-specific UNEQ)

- 48 identical STS-1
- one STS-1 tributary and 47 × UNEQ/non specific
- 16 identical STS-3c (Option BN 3060/90.03 required)
- one STS-3c tributary (Option BN 3060/90.03 required) and 15 × UNEQ/non specific
- 4 identical STS-12c (Option BN 3060/90.90 required)
- one STS-12c tributary (Option BN 3060/90.90 required) and 3 × UNEQ/non specific

Contents of STM-16/OC-48 overhead bytes

For all bytes except B1, B2 and H1 through to H3:

- the contents of the bytes in all SOH/TOH are statically programmable

For the bytes E1, E2, F1 and the DCC channels D1 to D3 and D4 to D12:

- Transmission of a test pattern and bit error insertion (see mainframe for pattern selection)
- Insertion of an externally-generated data signal (via V.11 interface)

For the K1, K2, N1, N2 bytes:

- Insertion of an external data signal via the V.11 interface

For the J0 byte:

- Transmission of a 16-bit sequence with CRC

Error insertion

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

Alarm generation, dynamic

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

Alarm generation, static (on/off)

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

Receiver

Optical interfaces

| | |
|--------------------------------|-----------------|
| Wavelength | 1260 to 1580 nm |
| Line code | scrambled NRZ |
| Sensitivity | -28 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 Ω |

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

Error measurement

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

Alarm detection

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

SOH/TOH evaluation

Display of complete overhead

For the bytes E1, E2, F1 and the DCC channels D1 to D3 and D4 to D12:

- BERT using test pattern from generator unit
- Output of the data signal via the V.11 interface

For the K1, K2, N1, N2 bytes:

- Data signal output via the V.11 interface

For the J0 byte:

- Display of 15-byte sequences in ASCII format

Concatenated Mapping 2488 Mbit/s

Option OC-48c/STM-16c BERT

BN 3060/90.93

Only in conjunction with BN 3060/91.50 to /91.53

Contiguous concat. signal structure to ANSI T1.105.02 and G.707.

Error measurement to O.150

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

Error insertion

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

| | |
|------------------|--|
| Alarm generation | AU-AIS, AIS-C1...AIS-C16, AU-LOP, LOP-C1...LOP-C16 |
|------------------|--|

| | |
|---------------------------------------|----------------------------|
| Error measurement and alarm detection | AU-AIS, AU-LOP, Bit errors |
|---------------------------------------|----------------------------|

Automatic Protection Switching

Sensor: MS-AIS, AU-AIS

Solutions for 10 Gbit/s

With the new ANT-10Gig we provide a 10 Gbit/s solution which covers STM-64 as well as OC-192. The ANT-10Gig allows testing at the highest line bit rate and in all mappings below and offers optionally all testing down to $n \times 64$ 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:
- ITU-T G.783, G.823, G.824, G.825, O.171, O.172
 - ETSI ETS 300 462-1 to -6, ETS 300 417-1-1, EN 302 084
 - Telcordia GR-253, GR-499, GR-1244
 - ANSI T1.101, T1.102, T1.105.03, T1.403, T1.404, T1.105.09

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

BN 3060/91.30

Jitter generator

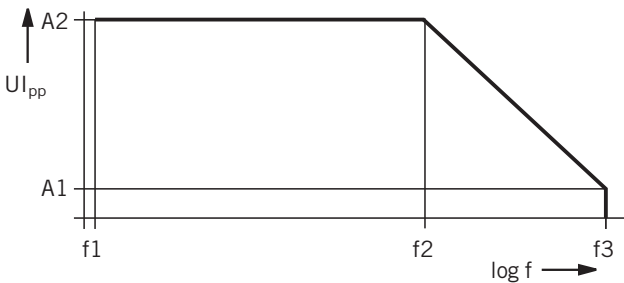
Fully complies with or exceeds the requirements of ITU-T O.172.

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 |

* Requires option BN 3060/91.31

Modulator input

75 Ω, BNC socket
 Voltage required 0 to 2 V_{pp}

Error limits as per O.172

Jitter Analyzer

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

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

High-pass filters 0.1, 2, 4, 10, 20, 40, 100, 200, 400, 500, 700 Hz,
 1, 3, 8, 10, 12, 18, 20, 30, 65, 80, 250 kHz

Low-pass filters 40, 60, 100, 400, 800, 1300, 3500, 5000 kHz
 Filter characteristics as per ITU-T O.172

Measurement ranges

Peak-peak
 Range I/Resolution 0 to 1.6 UI_{pp}/1 mUI_{pp}
 Range II/Resolution 0 to 20 UI_{pp}/10 mUI_{pp}
 Range III/Resolution 0 to 200 UI_{pp}/100 mUI_{pp}
 RMS
 Range I/Resolution 0 to 0.8 UI_{pp}/1 mUI_{pp}
 Range II/Resolution 0 to 10 UI_{pp}/10 mUI_{pp}
 Range III/Resolution 0 to 100 UI_{pp}/100 mUI_{pp}

Measurement accuracy as per O.172

Demodulator output

75 Ω, BNC socket
 Range I (0 to 1.6 UI_{pp}) 1 V/UI_{pp}
 Range II (0 to 20 UI_{pp}) 0.1 V/UI_{pp}
 Range III (0 to 200 UI_{pp}) 0.01 V/UI_{pp}

Wander Generator

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

Bit rates

Wander generation at all implemented bit rates up to 155 Mbit/s according to the equipment level of the instrument.

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

Wander Analyzer

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

For all bit rates up to 155 Mbit/s according to the equipment level of the instrument.

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

Sampling rate – Low-pass filter –
 Test duration 1/s - 0.1 Hz - 99 days
 30/s - 10 Hz - 99 h
 60/s - 20 Hz - 99 h
 300/s - 100 Hz - 5000 s

Amplitude range ± 1 ns to ± 1 μs
 Measurement accuracy as per O.172

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

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.

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.

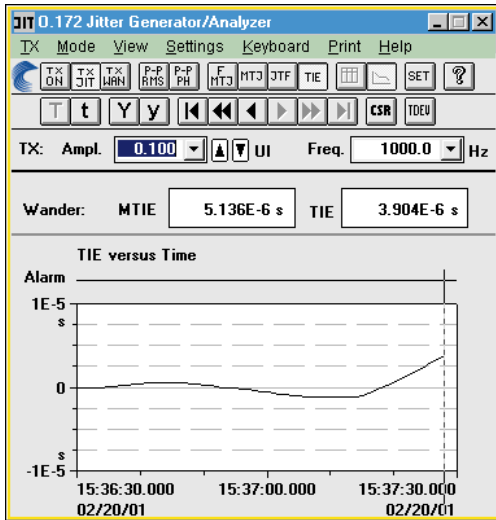


Figure 11: On-line wander testing (TIE)

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 ETSI ETS 300 462, EN 302 084, ITU-T O.172, G.810 to G.813, ANSI T1.101, Telcordia GR-1244.

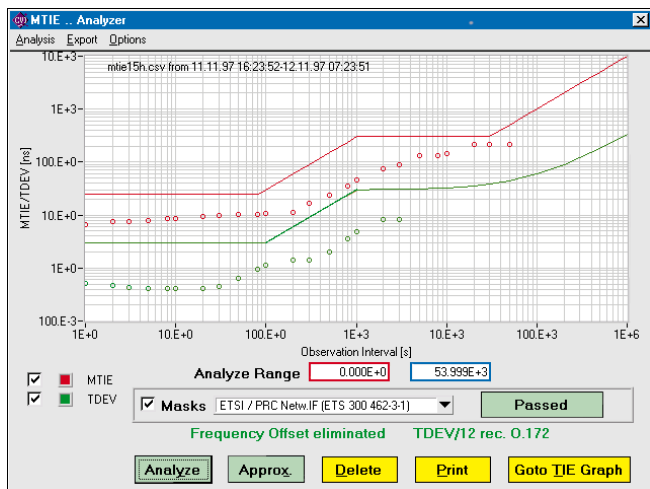


Figure 12: Display of MTIE/TDEV results and comparison against masks.

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

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

The jitter transfer function indicates the ratio of the jitter amplitude at the output of the device under test to that at the input at various frequencies.

This determines whether the device under test reduces or amplifies input jitter and at which frequencies. After a calibration measurement to minimize intrinsic errors, the ANT-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 G.735 to G.739, G.751, G.758 or T1.105.03 and GR-253. The distance of the measurement points from the tolerance masks indicates the degree to which the device under test meets the requirements of the standard.

Tolerance mask violations during the measurement are indicated in the numerical table.

Freely programmable tolerance masks

The existing tolerance masks for the ANT-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.

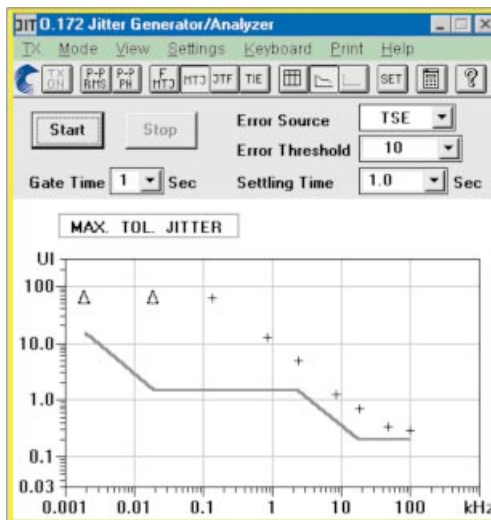


Figure 14: Maximum Tolerable Jitter testing

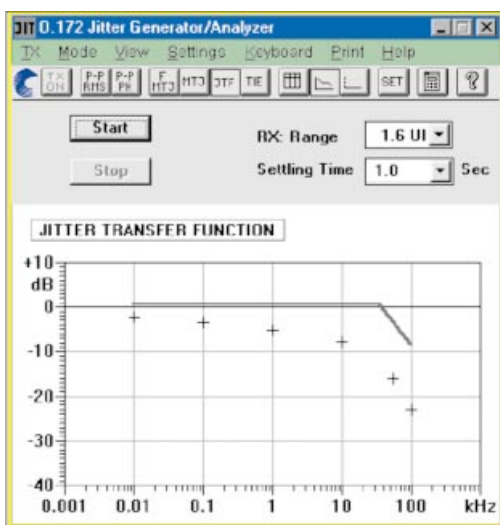


Figure 13: Jitter Transfer testing results

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

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

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

Jitter frequencies up to 10 fixed frequencies corresponding to standard tolerance mask

Detection criteria TSE (bit error), code error, B2, B3, REI, RDI

Error threshold 0 to 999 999 errors

Settling time 0.1 to 99.9 s

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

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

Automatic determination of Maximum Tolerable Jitter, MTJ

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

- The ANT-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, ITU-T G.783 defines various pointer sequence scenarios for testing combined jitter (mapping and pointer jitter) at network elements.

These sequences are normally selected manually and the jitter measured. ANT-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.

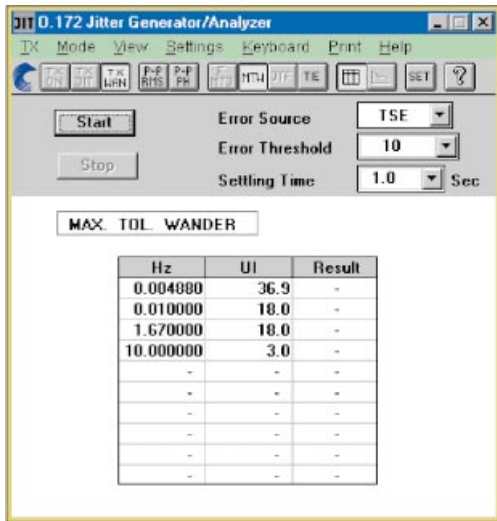


Figure 15: Maximum Tolerable Wander result display

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 17) which shows the bandwidth in Mbit/s, Cells/s or %. This makes it easy to simulate CBR (Constant Bit Rate) sources. For each interface, the load setting has a range from 0.01% to 100%. This corresponds to the load conditions which can occur in the real world.

Load profiles

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

Background load generator

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

Determining Cell Delay Variation

The ANT-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.

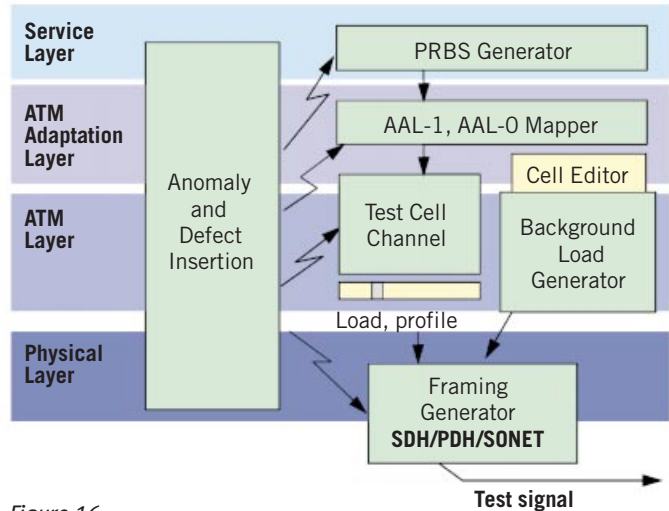


Figure 16: ATM-BERT generator configuration

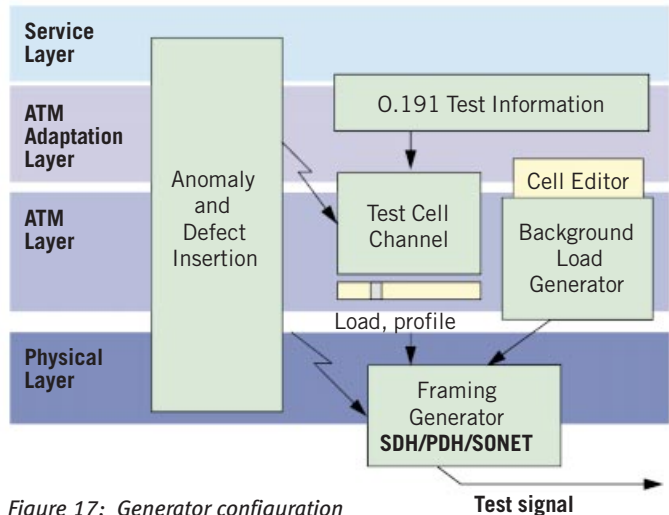


Figure 17: Generator configuration for performance measurement

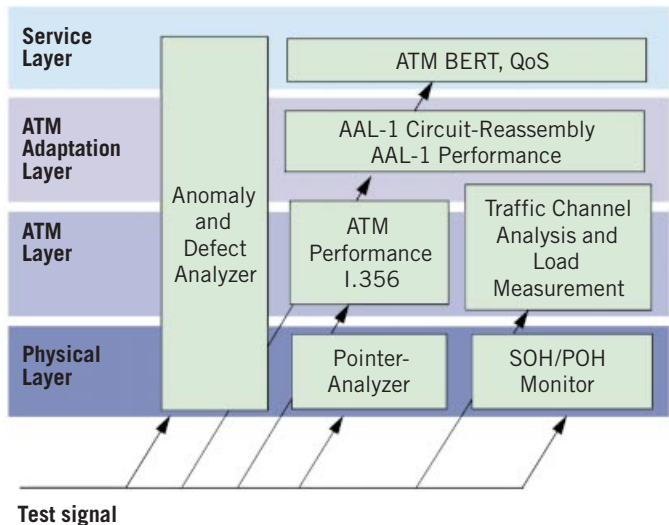


Figure 18: Analyzers in the ANT-20SE – A hierarchical overview

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
- STM-1/STS-3c with C4 ATM mapping, ITU-T G.707, ANSI T1.105/107
- F4/F5 fault management OAM flow for AIS and RDI as per ITU-T I.610, ATM forum UNI 3.1

Generator unit

Bit rates of the framed cell streams 155.520 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 μ 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.

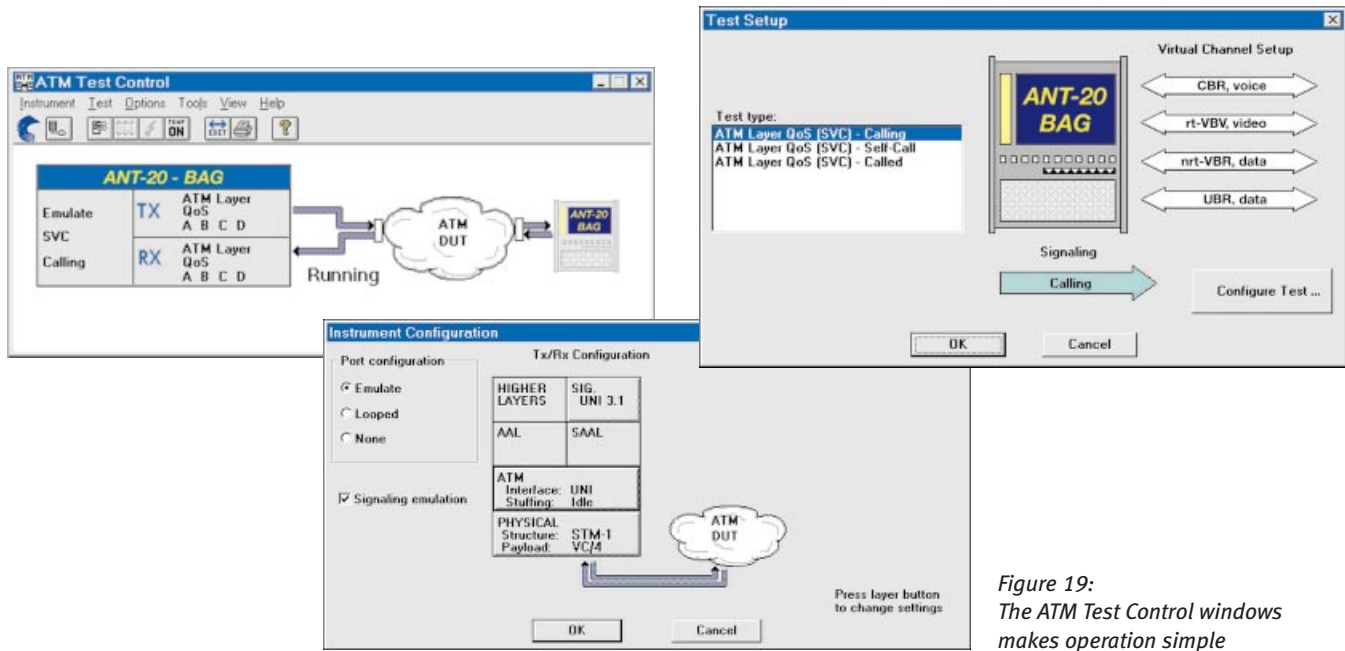


Figure 19: The ATM Test Control windows makes operation simple

Direct testing of all contract parameters

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

For such applications, the Broadband Module includes an editor that permits all of the contract parameters for the various ATM services to be set for the first time.

For terminal emulation, all contract characteristics and of the traffic model used for the test can be defined with the Channel Editor.

After starting the measurement, the ANT-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.

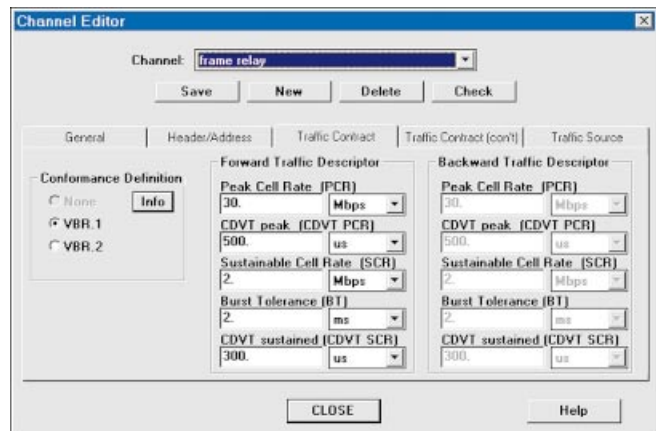


Figure 20: Channel Editor: Setting the traffic descriptor

ATM QoS test with 4 different SVCs

The ANT-20SE with BAG can perform SVC and PVC tests on up to 4 circuits simultaneously. Multi-channel services, such as those used for multimedia applications, can thus be simulated.

Any channel type can be selected from the database or newly defined for each channel.

Real-time measurements conform to the ITU-T O.191 standard which defines the test cell format and the test algorithm. Important source parameters can be regulated on-line during the test.

The results are clearly displayed, with graphics elements used to indicate defects or highlight status information.

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.

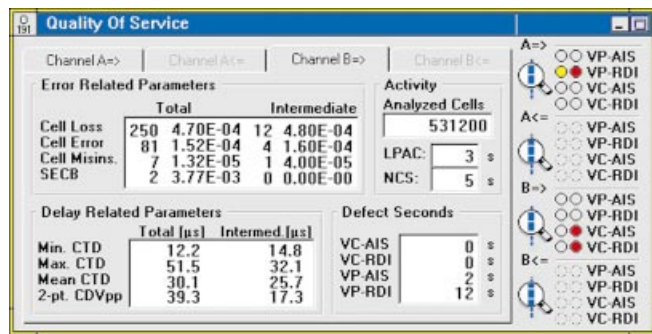


Figure 21: ATM test results for a real-time measurement on channel A

Traffic management and contract optimization

Traffic shaping (single/dual leaky bucket) can be switched on for each ATM channel, even on-line during the measurement.

In addition, the following are displayed per channel with soft LEDs:

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

Using this information it is possible to check whether the UPC (Usage Parameter Control) functions of the network are working and are implemented in compliance with the standard.

At the same time, the degree of utilization of the traffic contracts can be determined.

Using the facilities for simulating all relevant source parameters with up to four competing channels, it is possible to optimize the contract parameters in the network.

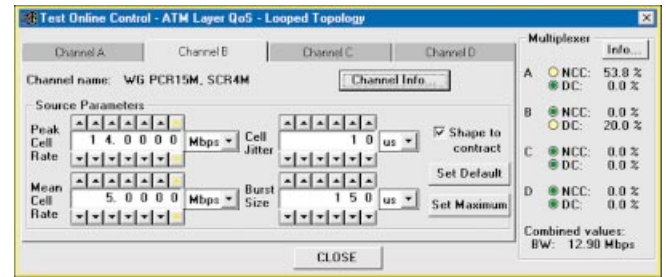


Figure 22: Soft-LED indication of multiplex results

Professional record of results

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

ATM test controller

Instrument port configurations

Emulation SVCs, PVCs
 Looped signal PVCs

Test cell channels

4 test channels
 settable from 0 to 149.760 Mbit/s
 Header setting, via editor
 Load setting in 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

DS3 (45 Mbit/s) ATM mapping and STS-1 DS3 ATM mapping

PLCP-based mapping
HEC-based mapping
Bit rate 44 736 kbit/s

DS1 (1.5 Mbit/s) ATM mapping

Bit rate 1544 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 one 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 μ 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

GPIB (PCMCIA) Remote Control Interface BN 3035/92.10

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

TCP/IP Remote Control Interface BN 3035/92.11

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

LabWindows driver BN 3038/95.99

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

LabView driver

The CATS Professional Package, BN 3035/95.95, makes it easy to include all existing CATS test cases into any environment that can work with DLLs (Dynamic Link Libraries).
LabView, hpVEE, Tcl/Tk are examples for such environments, so the ideal solution for a LabView user is the above mentioned option.

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 Sequencer). This saves time where repetitive tests are required in the production, installation

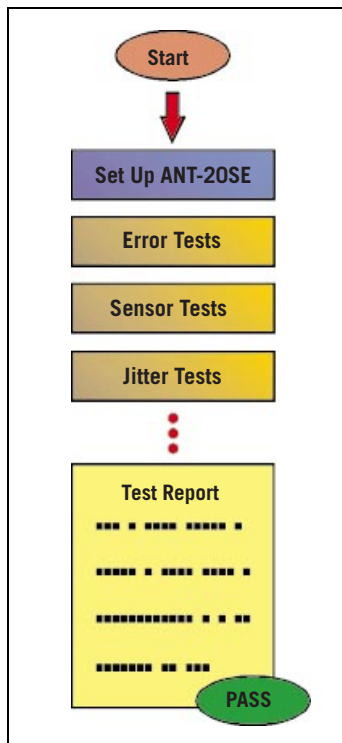


Figure 23: Automatic test sequences with the ANT-20SE

and monitoring of SDH, SONET and ATM network elements. The comprehensive test case library includes solutions for various applications, such as BERTs, alarm sensor tests, jitter, offset and pointer tests and monitoring ATM quality of service (QoS) parameters. Once created, test sequences are started with a single mouse click. A report in ASCII format for documentation purposes is compiled during the measurement. All test cases are pre-defined and ready to run. They can also be easily customized.

The Test Sequencer is part of the Acterna CATS range (Figure 23).

More information is found in the CATS data sheet.

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.

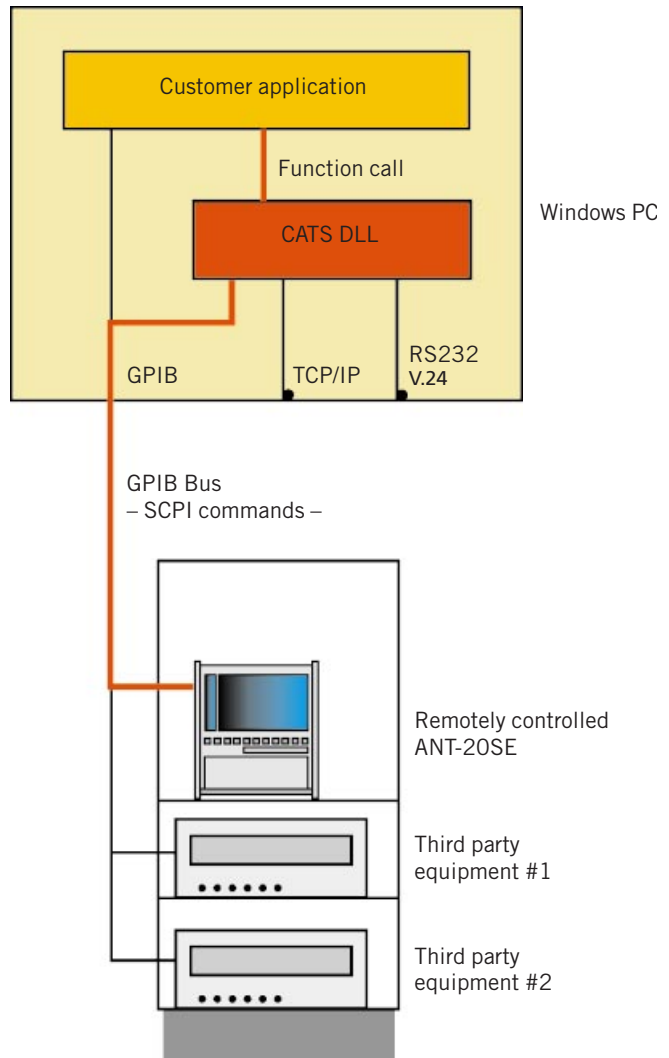


Figure 24: CATS DLL controls via GPIB an ANT-20SE

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 CATS Test Sequencer 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.

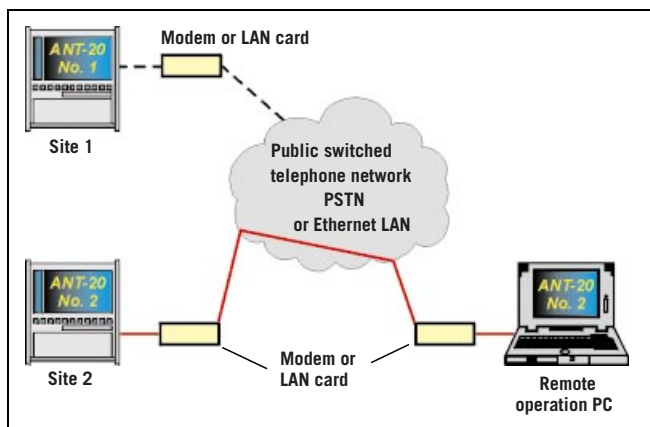


Figure 25: Remote operation of the ANT-20SE

The package provides remote operation via a PCMCIA or external modem (V.24/RS232) which must be purchased separately or provides remote operation via a Ethernet socket.

NEXT – Network Expert Test Software

ANT-20 NEXT Network Expert Diagnostics System

BN 3035/95.40

Complete software package for characterization of SDH/PDH lines for 2 Mbit/s and STM-1

Requirements:

Mux/Demux Chain option

BN 3060/90.11

Extended SDH testing

BN 3060/90.01

If jitter measurements and MTJ measurements are also required, the following is needed:

O.172 Jitter/Wander up to STM-1

BN 3060/91.30

Network operators must bring into service and maintain a growing number of lines, including leased lines and those used for corporate internal purposes. The only way to assure the quality and availability of delivered transmission capacity is through conscientious measurements, which are, quite simply, a job for experts.

Ordering Information

ANT-20SE Advanced Network Tester, SDH version

(Includes STM-1 VC-12 mapping; menu in English or German.)
With color TFT display touch screen

BN 3060/01

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

Optical Attenuator (plug-in) BN 2060/00.61
SC-PC, 1310 nm, 15 dB

Optical Power Splitter (90%/10%) BN 3060/91.05
includes 3 optical adapters – please select

Options

Extended SDH testing BN 3060/90.01
C3 (34 Mbit/s in STM-1)
C4 (140 Mbit/s in STM-1)
C11 (1.5 Mbit/s in STM-1)
C3 (45 Mbit/s in STM-1)
C2 (6 Mbit/s in STM-1)
APS, TCM Analysis
OH capture, OH sequencing

Add SONET BN 3060/90.03
STM-0 mappings
STM-0 and VT2 SPE (2 Mbit/s)
STM-0 and VT1.5 SPE (1.5 Mbit/s)
VT6 SPE (6 Mbit/s)
STM-0 and STS-1 SPE (34/45 Mbit/s)
BERT (1.5/6/45 Mbit/s)

Add SONET BERT only BN 3060/90.34

Drop & Insert BN 3060/90.10

M13 Mux/Demux chain BN 3060/90.12

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

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 /91.53 are alternatives.
Optical STM-16, OC-48, 1310 nm BN 3060/91.50
Optical STM-16, OC-48, 1550 nm BN 3060/91.51
Optical STM-16, OC-48, 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

Optical Packages

include optical interfaces from 52 Mbit/s to 2488 Mbit/s and four optical adapters – please select; include STM-16c/OC-48c Bulk, STM-4c/OC-12c Bulk
Optics STM-0/1/4/16, OC-1/3/12/48, 1310 nm BN 3060/90.55
Optics STM-0/1/4/16, OC-1/3/12/48, 1550 nm BN 3060/90.56

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 Jitter/Wander Packet 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

ATM Comprehensive BN 3060/90.51
includes ATM Basic and BAG

Add ATM SDH

requires ATM module BN 3060/90.50 or BN 3060/90.51
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) BN 3060/90.52

Add ATM SONET

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

OC-12c/STM-4c ATM Testing

requires Optical Module BN 3060/91.11 or /91.12 BN 3060/90.91

Remote Control Interfaces

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

Remote operation

Remote operation BN 3035/95.30

Test automation

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

Calibration report

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

ANT-20 NEXT

| | |
|------------------------------|---------------|
| Network Expert Test Software | BN 3035/95.40 |
|------------------------------|---------------|

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 STM-16 with jitter/wander up to 2.5 Gbit/s and ATM in a single unit. Now also with STM-64 optical interfaces.



ANT-10Gig is a subset of the ANT-20SE. This test solution handles OC-192/STM-64, 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 STM-4, Jitter up to STM-4 or Comprehensive ATM testing.

Note: Specifications, terms and conditions are subject to change without prior notice.

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