



## Acterna ANT-5

### SDH Access Tester STM-1/-4 ATM

Before operators can implement converged multimedia services on networks originally built for POTS, they must first ensure that the existing network infrastructure can support the delivery of high-speed, high-bandwidth services to an expanding base of business and residential customers. This process, however, must be completed quickly so as not to delay operators' ability to turn up new services and carry more data traffic. Compounding the pressure are corporate mandates that call for reduced expenses and the need to equip field technicians, who are tasked with installing, verifying, maintaining, and troubleshooting these high-speed, high-bandwidth network services in the access and metro networks, with the appropriate instruments and training.

Field technicians, who are tasked with installing and maintaining these networks, must learn how to test a wide variety of technologies while they strive to reach new levels of productivity. To perform these tasks, technicians need an increased amount of equipment and additional training to operate each device effectively. In addition, operators must be able to manage the conflicting demands of technicians, who need the proper equipment and training to do their jobs, and executives, who are keeping close control on capital expenses and operating costs.

#### **The ANT-5 rises to the challenge**

The rugged, battery-powered, lightweight Acterna ANT-5 SDH Access Tester contains all the powerful features and functions that technicians need to test a range of SDH/SONET/PDH and ATM digital links both on site and from a remote location. Its price/performance benefits extend to both operators and technicians by enabling more tests to be performed on multiple technologies with less equipment and lower costs.

#### **Highlights**

- Smallest and lightest test solution for DS1/E1 to 622 Mbps testing at 1310 nm and 1550 nm
- Optical layer testing at dual wavelengths at STM-1/OC-3 and STM-4/OC-12 and electrical testing at DS1/E1/E3/DS3/E4 interfaces
- Full analysis of concatenated mappings with SDH/SONET signals VC-4-4C/OC-12C
- In depth PDH analysis with Sabit generation and flexible MUX/DEMUX test configuration
- ATM analysis for service verification of ATM and 3G/UMTS networks testing new ATM services carried over PDH, SDH/SONET

### The portable solution

The ANT-5's compact, robust design is ideal for field and central office applications. The convenient, built-in stand and comfortable carry strap enable hands-free testing in any location. And its extended battery life means testing can be undertaken even when AC power is not on hand.

Optional carry cases protect the ANT-5 when technicians travel between sites and provide a safe and convenient place for storing cables and accessories.

### Easiest handheld to learn and use

Access technicians need a tester that can simplify their key tasks without extensive training. With its large color screen, graphical user interface, and ergonomic keypad, the ANT-5 is the easiest to learn and use handheld on the market. Other features include:

- Labelled LEDs that show current and historical alarms
- OK results summary and pass/fail results screen displays
- Autosave of test results
- Fast store and recall of key network configurations
- Automatic tests

### Access technicians' tool of choice

The ANT-5 provides all the transmission test functions required in today's access network:

- Optical power measurement
- Bit error rate testing
- G.821, G.826, G.828, G.829, M.2100, M.2101 analysis
- Received signal offset measurement
- Transmit signal offset and generation
- Tabular and graphical event recording

### Extensive SDH/SONET features

The ANT-5 is packed with SDH and SONET test features covering all the installation and maintenance tasks up to 622 Mbps:

- STM-1e/STS-3 interface
- STM-1/OC-3 to STM-4/OC-12 optical ports
- 1310 nm and 1550 nm wavelengths
- Anomaly and defect generation and analysis
- APS measurement
- RTD test
- SOH and POH analysis and manipulation
- Path trace generation and analysis
- Tandem connection monitoring (TCM)
- Automatic tributary scanning
- Pointer analysis

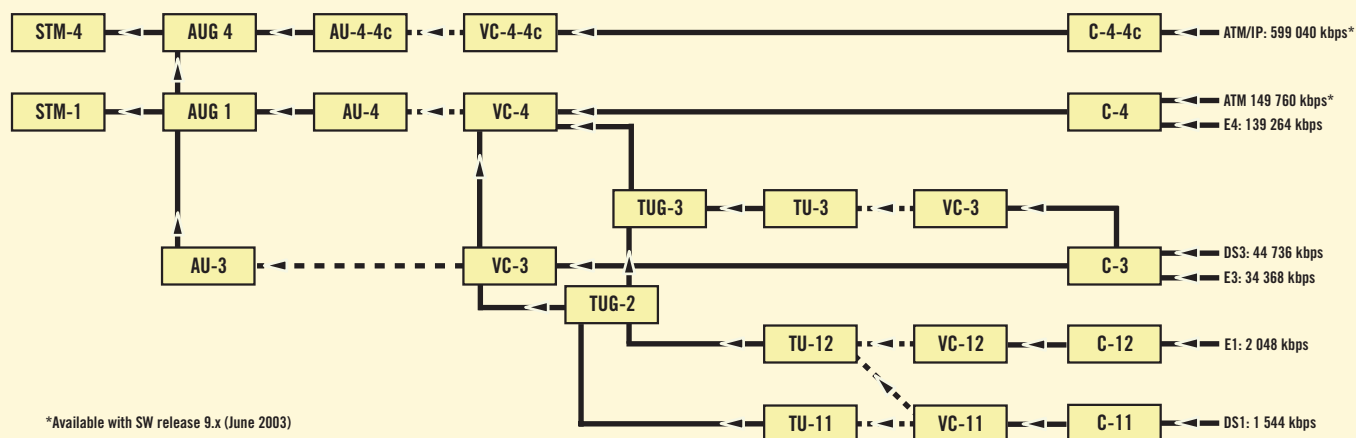


figure 1 STM mapping structure (SDH systems)

### Full PDH support

From 1.5 Mbps to 140 Mbps including Nx64 Kbps, the ANT-5 can test all PDH tributaries and legacy PDH hierarchy transmission systems using high-level functions that include E1 Sa bit generation and display.

### ATM service verification

UMTS network rollout and ADSL growth is increasing the use of ATM in the access network. The ANT-5 enables the installation and maintenance of ATM carried over PDH, SDH, and SONET networks that include:

- E1, E3 (G.832), DS3, E4
- VC-4/OC-12

PVC cells can be generated over UNI and NNI with CBR and VBR traffic load profiles up to STM-4c rates.

Service quality can be checked using BER or O.191 measurements. Link and channel performance can be monitored while traffic statistics are recorded.

### Simple test and results management

Thanks to its built-in Ethernet port, CompactFlash memory card port, and printer port, the ANT-5 can integrate more effectively and more simply with day-to-day operations.

- Export standard test setups to other ANT-5s or PCs via the CompactFlash card
- Exchange results over LANs using Windows-based PCs
- Print test reports

### Advanced remote testing capability

The ANT-5 provides out-of-the-box remote testing capability over Ethernet and dial up lines. As a result, technicians can poll instruments remotely from their offices, simplifying long-term commissioning and maintenance tests and dramatically reducing travel time and costs. Test results can be saved to any network hard disk or printed from any network printer for convenient analysis.

### Flexible, cost-effective platform

The ANT-5's flexible design enables it to be adapted quickly to operators' changing requirements. And its field upgradeable capability, provided by the CompactFlash port, enables technicians in the field to install software in minutes.

Hardware upgrades can be purchased to add optical bandwidths or wavelengths. This protects the initial investment and reduces additional training expenses while allowing operators to match capital expenditures to network rollout plans.

This Acterna offering is an industry-leading access tester that sets new standards for portability, ease of use, and adaptability. The ANT-5 is the ideal device for field technicians who need to test a range of SDH, PDH, SONET, and ATM digital links both on site and from a remote location. As a result, the ANT-5 provides a significant advantage for companies that wish to optimize quality of service using a cost-effective, industry-proven solution.

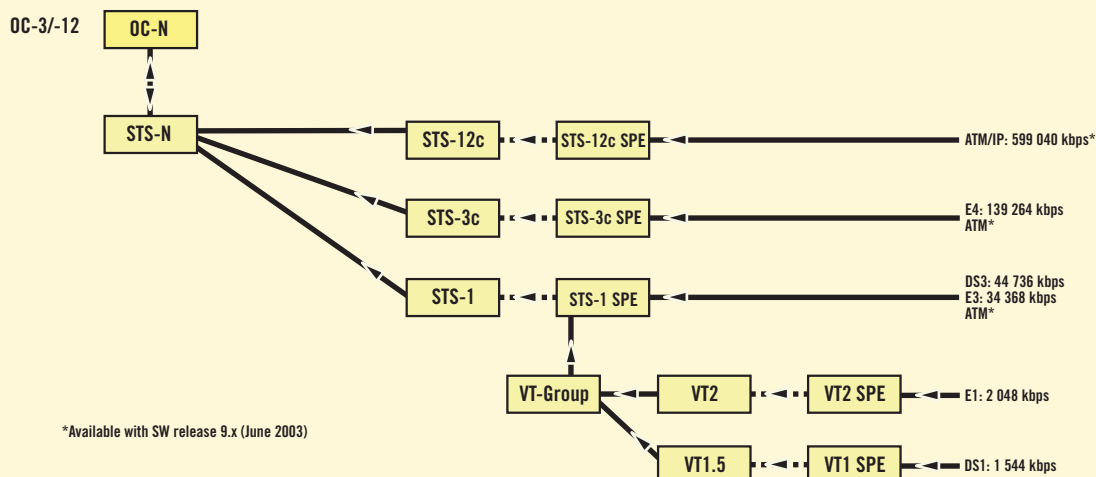


figure 2 STS mapping structure (SONET systems)

## Technical specifications

### G.703 transmitters

#### BNC 75 $\Omega$ unbalanced outputs

Bit rates and line codes

|                             |      |
|-----------------------------|------|
| – 2048, 34368 Kbps          | HDB3 |
| – 44736 Kbps <sup>(1)</sup> | B3ZS |
| – 139264, 155520 Kbps       | CMI  |

#### RJ48 120 $\Omega$ balanced output

Bit rate and line codes

|             |      |
|-------------|------|
| – 2048 Kbps | HDB3 |
|-------------|------|

### G.703 receivers

#### BNC 75 $\Omega$ unbalanced inputs

Bit rates and line codes

|                             |      |
|-----------------------------|------|
| – 2048, 34368 Kbps          | HDB3 |
| – 44736 Kbps <sup>(1)</sup> | B3ZS |
| – 139264, 155520 Kbps       | CMI  |

#### RJ48 120 $\Omega$ balanced input

Bit rate and line codes

|             |      |
|-------------|------|
| – 2048 Kbps | HDB3 |
|-------------|------|

### Clock recovery

– Pulling range as G.703

#### Selectable input gain

|                                   |       |
|-----------------------------------|-------|
| – 155520 Kbps                     | 20 dB |
| – 2048, 34368, 44736, 139264 Kbps | 26 dB |

### PDH T1 interface (requires option T1 adapter)

|                 |              |
|-----------------|--------------|
| Connectors      | Bantam       |
| Input impedance | 100 $\Omega$ |
| Bit rate        | 1544 Kbps    |
| Line Code       | B8ZS         |

### G.957 optical transmitter and receiver (options)

– Class 1 laser product

#### Connectors

– FC-PC connectors

#### Transmitter wavelengths

– 1310 nm and 1550 nm

#### Line bit rates

– 155.52 Mbps

– 622.08 Mbps

Line code

scrambled NRZ

#### Option

#### Output levels

#### Input sensitivity

|                                  |                             |                 |
|----------------------------------|-----------------------------|-----------------|
| BN4565/00.01 STM-1 1310 nm       | –8 to –15 dBm / –           | –28 dBm         |
| BN4565/00.02 STM-1 1550 nm       | – / 0 to –5 dBm             | –28 dBm         |
| BN4565/00.03 STM-1 1310+1550nm   | –8 to –15 dBm / 0 to –5 dBm | –28 dBm         |
| BN4565/00.14 STM-1/4 1310+1550nm | –8 to –15 dBm / 0 to –5 dBm | –28 dBm         |
| BN4565/00.64 STM-1/4 1310 nm LR  | +3 to –2 dBm / –            | –28 dBm         |
| Optical overload                 |                             | –1 to –2 dBm    |
| Receiver wavelength range        |                             | 1100 to 1600 nm |

### Transmit clock synchronization

|                    |               |
|--------------------|---------------|
| Internal stability | $\pm 3.6$ ppm |
| Tx Bit Rate offset | $\pm 100$ ppm |
| Step size          | 0.1 ppm       |

### External clock (SDH transmitter)

|                  |                                                        |
|------------------|--------------------------------------------------------|
| Connector        | BNC 75 $\Omega$<br>(120 $\Omega$ via external adapter) |
| Reference clock  | 2048 kHz                                               |
| Reference signal | 2048 Kbps (HDB3)                                       |



<sup>(1)</sup>ANSI T1.101 compliant

### **Mappings (to ITU G.707)**

The following mappings are provided as standard with the instrument

- C12 mapping (2 Mbps in STM-1, AU-4, asynchronous mode)
- C3 mapping (34 Mbps in STM-1, AU-4)
- C3 mapping (45 Mbps in STM-1, AU-4)
- C4 mapping (140 Mbps in STM-1)

### **SDH output signals**

**STM-1 signal consists of one VC-n container with**

- Framed or unframed PDH test pattern
- Test pattern without stuffing bits (bulk signal to 0.181)

**Content of nonselected containers**

- STM-1 PRBS  $2^{11}-1$  (framed/unframed as per selected container)

**STM-4 signal consists of one VC-n container with**

- Framed or unframed PDH test pattern or test pattern without stuffing bits (bulk signal to 0.181)
- three VC-4 containers each filled with a fixed pattern of 11100110

### **SDH and PDH generation**

**The content of all bytes, with the exception of A1/A2, B1/B2/B3 and H1 to H4, is programmable with any byte.**

- Selectable synchronization messages (S byte)
- Selectable signal labels (C byte)
- Trace identifier
- J0 programmable 1 byte hexadecimal or 16 byte ASCII sequence with CRC
- J1, J2 programmable 16 byte ASCII sequence with CRC or 64 byte ASCII sequence

### **PDH output signals**

**Signal structures for all bit rates**

- Unframed test pattern
- Framed test pattern (to ITU-T 0.150)

**– Frame types**

- 1544 Kbps unframed, SF, ESF
- 2048 Kbps unframed, PCM31, PCM31CRC,
- PCM30, PCM30 CRC (to ITU G.704)
- 34368 Kbps unframed, framed G.751, framed G.832
- 44736 Kbps unframed, framed C-parity, framed M13
- 139264 Kbps unframed, framed G.751

### **Test patterns**

Test patterns may be generated and measured for any of the provided bit rates either directly at the SDH/PDH interface or within the STM-4/STM-1 substructure. Additionally, test patterns can be generated and measured at 64 Kbps and nx64 Kbps rates within an E1 frame.

PRBS:  $2^{15}-1$ ,  $2^{20}-1$ ,  $2^{23}-1$ ,  $2^{31}-1$ ,  
 $2^{15}-1$  inv.,  $2^{20}-1$  inv.,  
 $2^{23}-1$  inv,  $2^{31}-1$  inv.

Programmable word 16 bits

### **Anomaly and defect insertion**

**Defect generation**

Static ON/OFF

**Anomaly generation**

single or at a continuous error ratio of  $1 \times 10^{-n}$  where the range of n is as indicated below

### **Payload**

Bit errors (TSEs):  $n=2-9$

### **SDH structure**

**Anomalies**

B1, B3  $n=4-9$   
MS-REI, LP-BIP (except C4),  
LP-REI (except C4)  $n=3-10$   
B2  $n=3-9$   
HP-REI  $n=4-10$

SDH anomaly burst generation anomalies:

B1, B2, MS-REI, B3, HP-REI, LP-BIP, LP-REI

Anomalies are injected in n consecutive frames every m frames or seconds

**Defects**

LOS, LOF, RS-TIM, MS-AIS, MS-RDI, AU-LOP, AU-AIS, HP-UNEQ, HP-RDI, HP-TIM, HP-PLM, TU-LOP, TU-AIS, TU-LOM, LP-UNEQ, LP-RDI, LP-TIM, LP-PLM, LP-RFI

### **PDH structure**

**Anomalies**

FAS  $n=3-10$   
EBIT (framed 2 Mbps only)  $n=3-10$   
CODE (framed 2 Mbps only)  $n=3-8$   
CRC (framed 2 Mbps and 1.5 Mbps  
ESF only)  $n=3-9$   
P-BIT (framed 45 Mbps only)  $n=4-8$

**Defects**

AIS, LOF, RDI  
Yellow, idle (45 Mbps only)

SDH and PDH receive signals

Signal structures as for generator unit

### **Error measurements**

**Error types**

B1, B2, B3, MS-REI, HP-REI, LP-REI, TSE, LP-BIP, PDH, FAS-45, FAS-34, FAS-2, FAS-1.5, REI-45, CP-BIT, EBIT-2, CRC-2, code errors (2 Mbps), HP-IEC, LP-IEC, HP-OEI, HP-TC-DIFF, HP-TC-REI

### **Alarm detection**

All alarms are monitored and detected simultaneously.

### **Alarm types**

LOS, OOF, LOF, MS-AIS, MS-RDI, RS-TIM, AU-AIS, AU-LOP, AU-NDF, HP-RDI, HP-UNEQ, HP-TIM, HP-PLM, TU-AIS, TU-LOP, TU-LOM, LP-RDI, LP-PLM, LP-UNEQ, LP-TIM, LSS, LP-RFI, PDH-AIS, PDH-RDI, Idle, yellow (45 Mbps only)

### **Receive signal frequency measurement**

Receive signal frequency is displayed and deviation from nominal shown in ppm.

Resolution 0.1ppm

### **OK summary display**

Display of large OK for error free circuits for fast and simple installation checks. Upon detection of any anomaly or defect the OK is removed and replaced with a hierarchical list of events – allowing easy diagnosis of problems. Display of signal structure with BER or BLER displayed simultaneously.

### **LED event history**

On screen soft LEDs and defect panel alarms can be set to display historical events. These are displayed yellow to easily distinguish them from current alarms that are displayed red.

### **Performance analysis**

#### **ITU-T recommendation G.821**

ES, EFS, SES, DM and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. Evaluation for higher bit rates (up to 140 Mbps) is obtained using a multiplex factor as per annex D of G.821. Measurements can be made using the following events: bit errors (TSEs), FAS-2, CRC-4 and E bit and code errors (2 Mbps), FAS-34, FAS-140.

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**ITU-T recommendation G.826**

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EB, BBE, ES, EFS, SES, and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. The SES and UAS thresholds can be set by users.

**In-service measurement (ISM)**

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

Measurements can be made using the following events: RSOH B1, MSOH B2, HP B3, FAS-140, FAS-34, FAS-2, CRC and code errors (2 Mbps), LP-BIP.

**Out-of-service measurement (OOS)**

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

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**ITU-T recommendation G.828 Results**

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ES, EFS, SES, BBE, SEP, UAS

Pass/fail assessment based on path allocation of 1 to 100%.

The SES and UAS thresholds can be set by users.

**Hierarchy**

RSOH B1, MSOH B2, HP B3, LP-BIP, TSE.

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**ITU-T recommendation G.829 Results**

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ES, EFS, SES, BBE, UAS

The SES threshold can be set by users.

**Hierarchy**

RSOH B1, MSOH B2, TSE.

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**ITU-T recommendation M.2100**

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ES, EFS, SES and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. The UAS and BISO (bringing into service objectives) thresholds can be set by users.

**PDH systems**

Measurements can be made using the following events: TSEs, FAS-2, FAS-34, FAS-140, CRC, and code errors (2 Mbps).

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**ITU-T recommendation M.2101**

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ES, EFS, SES, BBE, SEP, and UAS are evaluated. Pass/fail assessment based on line length allocation of 1 to 100%. The UAS and BISO (bringing into service objectives) thresholds can be set by users. ISM simultaneously for near end and far end of a selected path:

Measurements can be made using the following events: TSE, LP-BIP, HP-B3, MSOH-B2, RSOH-B1.

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**Defect panel**

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On-screen hierarchical LED indication of defects.

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**Event log**

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Tabular display of time stamped events.

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**Anomaly count**

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Table of all anomalies with measured count and ratio.

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**Graphical display (histogram)**

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Display of errors and alarms as bar graphs versus time.

Zoom function allows display resolution of seconds, minutes, hours and days.

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**SOH and POH evaluation**

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Display of complete SOH and POH in hex, binary and ASCII formats.

Text decode of S and C bytes for the trace identifier.

J0 display of 16 byte ASCII sequence.

J1, J2 display of 16 or 64 byte ASCII sequence.

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**Tandem connection monitoring (TCM)**

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Analysis of N1 and N2 bytes

Monitoring/display of:

TC-IEC, TC-AIS, TC-REI, TC-OEI, TC-UNEQ, LTC, TC-AIS, TC-RDI, TC-ODI, TC-REI

Online display of TCM access point identifier

TCM error measurement

Incoming B3/computed BIP comparison

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**Auto protection switching (APS)**

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Operates on SDH and PDH interfaces

**Measurement triggers**

MS-AIS, AU-AIS, TU-AIS, or bit error

**Pass/fail user specified time limit**

– 10 to 2000  $\mu$ s

– 1  $\mu$ s resolution

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**Round trip delay (RTD)**

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Resolution +/- 1  $\mu$ s

Except for:

E1 PDH +/- 100  $\mu$ s

E1 SDH VC12 +/- 100  $\mu$ s

E2 (when carried within PDH E3 or E4) +/- 10  $\mu$ s

VC11/12bulk +/- 10  $\mu$ s

Measurement range 10 s

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**Pointer analysis**

Pointers analysed AU, TU

Current pointer values displayed

Displays counts of:

– pointer increments

– pointer decrements

– increments and decrements, sum and difference

– new data flags (NDFs)

Average deviation (in ppm) of AU and TU

User selectable recording of pointer events into the event log.

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**Repetitive BER test**

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BER evaluation over user definable period 1-99 seconds

Automatically repeating feature

Progress bar displays the current test period

Large character display of BER result

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**VC-12 tributary scan**

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Enables sequential BER testing of C12 channels using configured test pattern. Automatically scans selected VC-12 containers for defects and anomalies.

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**Concatenated mappings option (BN4565/00.59)**

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Enables measurements of contiguous concatenated signals:

VC-4-4c (valid only with option BN4565/00.14)

STS-12c (valid only with option BN4565/00.14 and BN4565/00.62)

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**PDH mux/demux option (BN4565/00.58)**

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For testing of legacy PDH systems. Generates structured signals from nx64 Kbps to 140 Mbps. Output signal hierarchy 2, 34, 140 Mbps. Structure depth nx64 Kbps, 2, 8, 34 Mbps. E1 Sa bit Tx generation and Rx display

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**SONET STS-1/STS-3c/OC12c(3) mapping option (BN4565/00.62)**

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Enables to generate and receive STS-3/OC3 and OC12 signals. Transmitter and receiver specifications as defined. Signal structures and measurements as defined for SDH above. The following mapping is provided:

- 599040 Kbps via STS-12c SPE
- E4 via STS-3c SPE
- DS3/E3 via STS-1 SPE

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**SDH AU-3/SONET VT mapping option (BN 4565/00.53)**

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AU-3 mapping function enables testing of DS-1, E1, E3 and DS3 tributaries mapped into STM-1 signal via VC-3/AU-3:

|           |                                   |
|-----------|-----------------------------------|
| VC11/TU11 | (1544Kbps in STM-1 via TU11, AU3) |
| VC11/TU12 | (1544Kbps in STM-1 via TU12, AU3) |
| VC12      | (2048Kbps in STM-1 via TU12, AU3) |
| VC3       | (34368Kbps in STM-1 via VC3, AU3) |
| VC3       | (44736Kbps in STM-1 via VC3, AU3) |

The VT mapping function enables testing of DS-1 and E1 tributaries mapped into an STS-1 SPE via VT-1.5 and VT2 SPEs (requires option BN 4565/00.62 SONET STS-1/STS-3c/OC12c mapping)

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**ATM (option)**

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For testing of ATM services carried over PDH, SDH, and SONET

- Tests ATM over E1, E3, DS3, E4, VC-4/OC12 and VC-4c/OC12c
- CBR and VBR traffic generation
- Full cell header editing
- Cell BER tests
- 0.191 QoS measurements
- ATM link and channel statistics
- OAM cell generation and analysis for VC/VP AIS and RDI
- ATM Channel Explorer

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**Remote operation option (BN4565/00.60)**

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Enables ANT-5 to be remotely operated via V.24 or Ethernet from a s/w emulation of the instrument GUI running on a Windows PC.

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**Remote control option (BN4565/00.61)**

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Enables ANT-5 to be remotely controlled over V.24 using SCPI command set.

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**Measurement timers**

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Variable 1 second to 99 days  
Measurement start manual or delayed start timer  
Measurement stop manual or automatic timer  
Display of elapsed time hh:mm:ss

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**Results memory**

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Resolution of error events 1 second  
Alarm resolution 100 ms  
Memory capacity up to 10,000 entries (approx. seven days at one entry per minute)

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**Alarm notification**

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Anomalies and defects are indicated via LEDs, on-screen graphic icons and via an audio beeper.

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**Printing**

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Setups and measurement results can be printed using printers compatible with DeskJet, Thinkjet, Epson 9, and Epson 24 print drivers.

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**Printer/remote interface**

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- Serial V.24/RS 232
- Parallel using adapter cable K1589

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**Result export**

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Results can be exported to PC in .CSV format using V.24, Ethernet (requires remote operation option BN4565/00.60) or a CompactFlash card. These can be processed using standard PC software, such as Excel™, Word™.

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**Result evaluation (off line)**

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Results (ANT-5 format) can be loaded, analyzed and printed by any Windows™-based PC using the ANT-5 Off-line Viewer SW.

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**Ethernet Port**

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Connector  
RJ-45  
10BaseT  
TCP/IP

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**Display**

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Color TFT LCD screen  
Resolution 320 x 240 pixels

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**Languages**

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The user interface can be displayed in the following languages:  
English, German, French, Spanish, Portuguese, and Chinese

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**CompactFlash Card Slot**

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CompactFlash card  
– Type I and II

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**Power outage function**

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In the event of an AC line power failure during a measurement, continues to perform measurements using its internal batteries.

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**General specifications**

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**Power supply**

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AC line voltage using series specific adapter  
100 to 240 V  
AC line frequency  
50/60 Hz  
Typical operating time on batteries  
3 hours  
Safety class to IEC 1010-1 Part 1  
(for connection to SELV only)  
Pollution environment degree 2  
Installation category II (indoor use)  
Ambient temperature  
Nominal range of use  
+5° C to +45° C  
Storage and transport range  
–20° C to +60° C

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**Weight and dimensions (L x W x H)**

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– 275 mm x 197 mm x 76 mm  
– Weight 2.2 kg

**Ordering information**

|               |            |
|---------------|------------|
| ANT-5 STM-1/4 | BN 4565/10 |
|---------------|------------|

**Options**

|                             |              |
|-----------------------------|--------------|
| STM-1 optical FC/PC 1310 nm | BN4565/00.01 |
|-----------------------------|--------------|

|                             |              |
|-----------------------------|--------------|
| STM-1 optical FC/PC 1550 nm | BN4565/00.02 |
|-----------------------------|--------------|

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|--------------------------------------|--------------|
| STM-1 optical FC/PC 1310 and 1550 nm | BN4565/00.03 |
|--------------------------------------|--------------|

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|----------------------------------------|--------------|
| STM-1/4 optical FC/PC 1310 and 1550 nm | BN4565/00.14 |
|----------------------------------------|--------------|

|                                       |              |
|---------------------------------------|--------------|
| STM-1/4 optical FC/PC 1310 long reach | BN4565/00.64 |
|---------------------------------------|--------------|

|                       |              |
|-----------------------|--------------|
| Concatenated mappings | BN4565/00.59 |
|-----------------------|--------------|

|               |              |
|---------------|--------------|
| PDH mux/demux | BN4565/00.58 |
|---------------|--------------|

|                  |              |
|------------------|--------------|
| Remote operation | BN4565/00.60 |
|------------------|--------------|

|                |              |
|----------------|--------------|
| Remote control | BN4565/00.61 |
|----------------|--------------|

|                                   |              |
|-----------------------------------|--------------|
| SONET STS-1/STS-3c/OC-12c mapping | BN4565/00.62 |
|-----------------------------------|--------------|

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|-----------------------------------------|--------------|
| SDH AU3/SONET VT mapping factory fitted | BN4565/93.53 |
|-----------------------------------------|--------------|

|                                             |              |
|---------------------------------------------|--------------|
| SDH AU3/SONET VT mapping customer installed | BN4565/95.53 |
|---------------------------------------------|--------------|

|                           |              |
|---------------------------|--------------|
| ATM option factory fitted | BN4565/93.54 |
|---------------------------|--------------|

|                               |              |
|-------------------------------|--------------|
| ATM option customer installed | BN4565/95.54 |
|-------------------------------|--------------|

**Accessories**

|                                |              |
|--------------------------------|--------------|
| CF card (16 Mbyte) and adapter | BN4565/00.42 |
|--------------------------------|--------------|

|               |       |
|---------------|-------|
| Printer cable | K1524 |
|---------------|-------|

|             |       |
|-------------|-------|
| Modem cable | K1550 |
|-------------|-------|

|                                  |       |
|----------------------------------|-------|
| Serial to parallel printer cable | K1589 |
|----------------------------------|-------|

|                    |              |
|--------------------|--------------|
| Hard carrying case | BN4565/00.76 |
|--------------------|--------------|

|                    |              |
|--------------------|--------------|
| Soft carrying case | BN4518/00.08 |
|--------------------|--------------|

|                      |               |
|----------------------|---------------|
| T1 adapter for ANT-5 | BN 4565/00.78 |
|----------------------|---------------|

**Singlemode optical cables**

|             |       |
|-------------|-------|
| FC-PC/FC-PC | K1605 |
|-------------|-------|

|             |       |
|-------------|-------|
| FC-PC/SC-PC | K1606 |
|-------------|-------|

|                |       |
|----------------|-------|
| DIN47256/FC-PC | K1607 |
|----------------|-------|

|              |       |
|--------------|-------|
| FC-PC/E-2000 | K1608 |
|--------------|-------|

|                  |       |
|------------------|-------|
| FC-PC/E-2000 APC | K1609 |
|------------------|-------|

|             |       |
|-------------|-------|
| FC-PC/ST-PC | K1610 |
|-------------|-------|

|                  |       |
|------------------|-------|
| FC-PC/RADIAL VFO | K1611 |
|------------------|-------|

|              |       |
|--------------|-------|
| FC-PC/FC-APC | K1612 |
|--------------|-------|

|               |       |
|---------------|-------|
| FC-APC/FC-APC | K1613 |
|---------------|-------|

**Electrical cables**

|               |      |
|---------------|------|
| BNC/BNC (2 m) | K169 |
|---------------|------|

|              |       |
|--------------|-------|
| RJ-48/2 x cf | K1597 |
|--------------|-------|

|             |       |
|-------------|-------|
| RJ-48/RJ-48 | K1598 |
|-------------|-------|

|                           |       |
|---------------------------|-------|
| RJ-48/RJ-48 (M)/RJ-48 (F) | K1599 |
|---------------------------|-------|

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