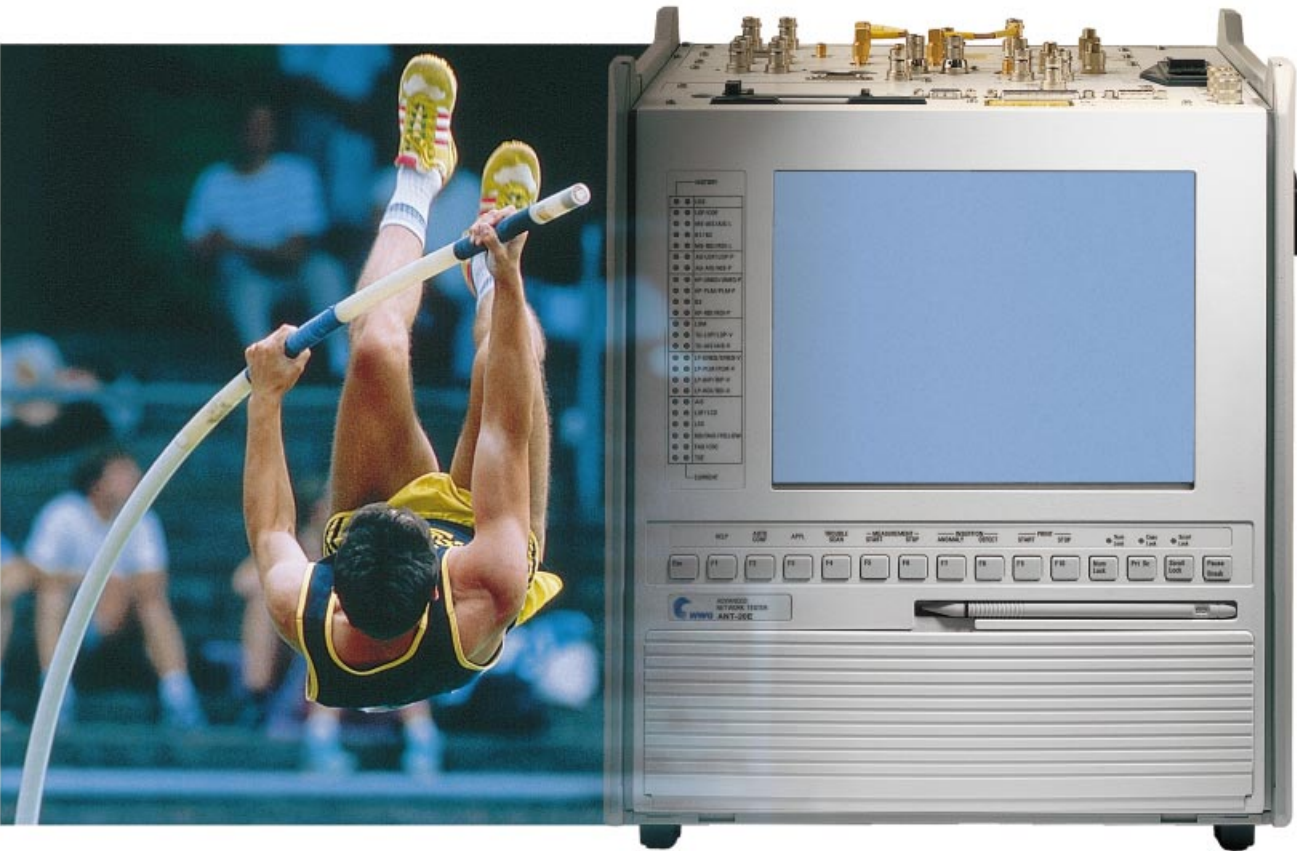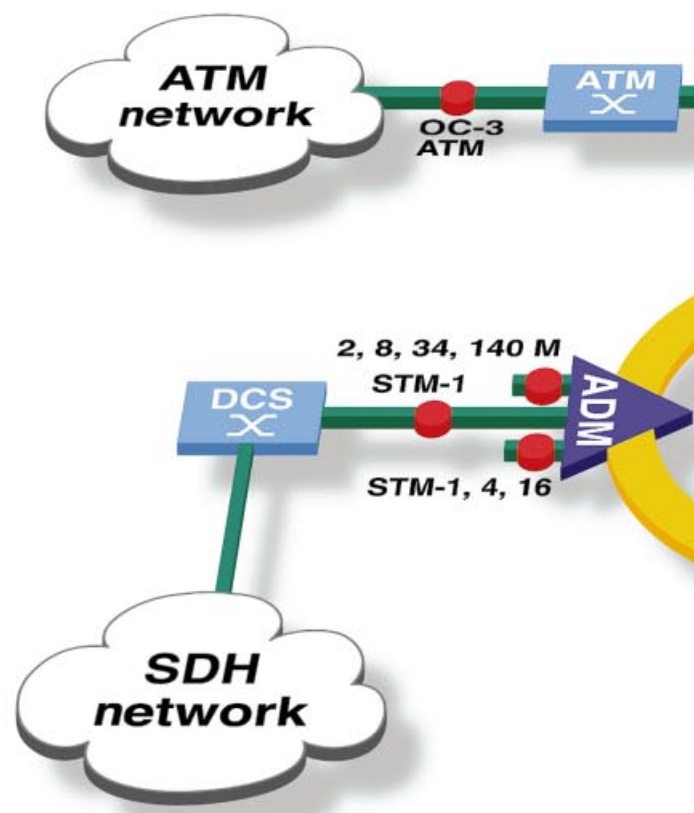# SONET

ANT-20:
The Flexible,
High-Performance Platform

WAVETEK
WANDEL
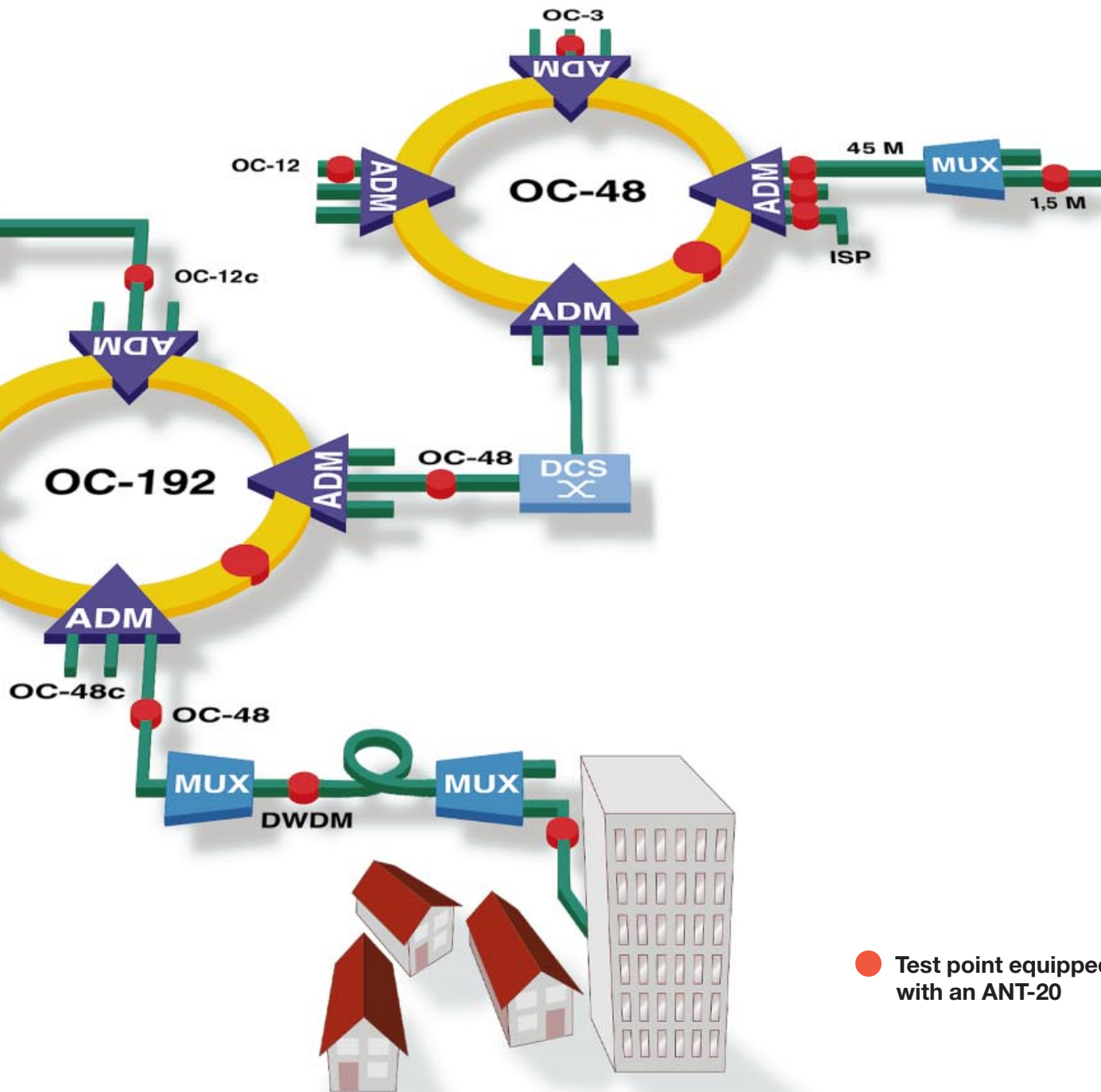**GOLTERMANN**
Communications Test Solutions

ANT-20:
At the forefront
with Advanced
Network Testing

A permanent challenge
Competition is fierce in the expanding telecommunications market. Nowadays, customers demand next-to-perfect network availability, and top-notch transmission quality has become a given.

The number of service providers is growing too, and not just due to providers merging across borders. Different networks such as Cellular, CATV and the Internet are converging too.

To survive on this playing field, you have to be among the best in both technological and economic terms. Our objective is to be your expert partner as you strive to meet these challenges.

OC-3

ADM

OC-12

ADM

OC-48

45 M

MUX

1,5 M

ISP

OC-12c

ADM

OC-192

ADM

OC-48

DCS

ADM

OC-48c

OC-48

MUX

DWDM

MUX

● **Test point equipped with an ANT-20**

A design future-proofed for success
Technologies are developing rapidly. The ANT-20's flexible platform lets you keep cool in the face of immense change. Whether you are dealing with DSn, SONET, SDH and/or ATM, the ANT-20 keeps you on the safe side, always ready for new standards, higher bit rates and the intelligent system components of the future.

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

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

ANT-20: Making it easy with a familiar work environment

Detailed parameter settings and test results, or simple operation? DSn, SONET, SDH 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! The ANT-20 delivers sophisticated, precision test capabilities that are easy to use for *all* of the above bit rates *and* for ATM.
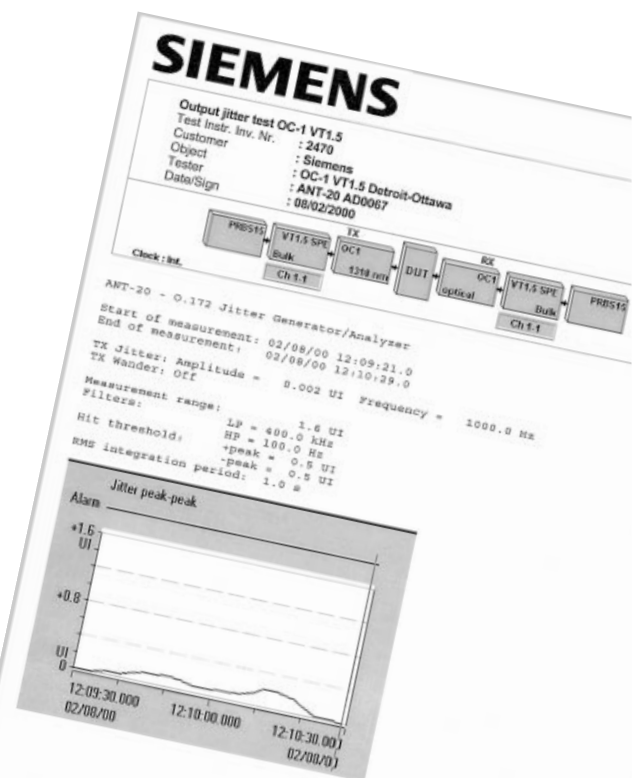
Clear results presentation

You can view all results at a glance, numerically as a complete list of error values or graphically as a histogram. The Zoom function is useful for examining results from a longer test interval with different resolutions. The day or hour resolution gives you an overview, and the minute or second resolution lets you analyze critical phases. To assure the best possible accuracy, the duration of all alarms is saved with 100 ms resolution!

Familiar environment

The built-in PC makes the ANT-20 compatible with your usual work environment. The Windows-based design makes it easier to get familiar with the software and opens up possibilities that are inconceivable with conventional test instruments. Test results are saved internally in the ANT-20 or on diskette, and can be printed in report format on any standard printer. For documentation purposes, you can use PC software such as Microsoft Excel™ or Word™. If you have a question, the built-in Help functions come in handy, delivering the technical background information you need.

Sample customer-specific test report Jitter measurement

4

Large, color touchscreen
The large color screen gives you a structured overview of all test results and helps prevent faulty settings. You can keep several windows open at once to keep everything at a glance, with no switching between menu screens. The touchscreen is ideal for field use since you can directly operate the ANT-20 with a pen or your finger right on the screen.

**A New Synonym for Simple Operation: Instant Access Buttons**
Instant Access Buttons let you directly (i.e. quickly) launch the ANT-20 with commonly used settings. Particularly when installing and accepting SONET/SDH networks, certain measurements tend to occur over and over. Using the instant access buttons, the ANT-20 makes it easy to tackle such measurements.

The ANT-20's design lets you store an almost unlimited number of instrument settings. You can now launch eight of your favorite applications directly from the ANT-20 desktop.

You can link the individual buttons to stored settings for the ANT-20 or CATS test sequencer. Or you can link the user manual stored by the instrument in PDF format to one of the buttons, or any other useful document you look at frequently.

Now a single click on the button you defined will cause the ANT-20 to start measuring with the predefined setting. It doesn't get any easier when you're working with a sophisticated instrument!

5
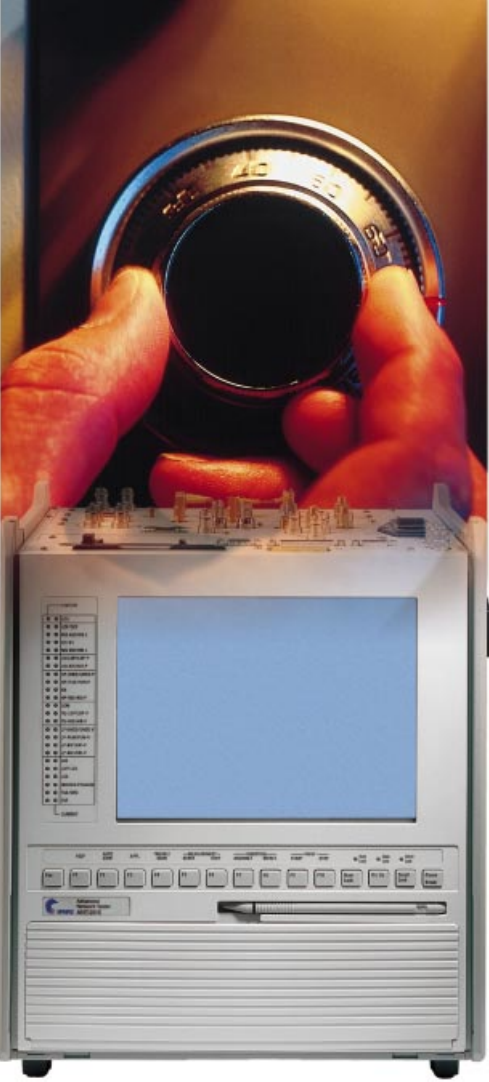
ANT-20:
Modular design
allows user
customization

High-performance computer
built into ANT-20 (fixed module)
with mouse port,
PCMCIA interfaces A and B,
external keyboard port,
external monitor port,
external printer port
and RS-232 interface.

DSn/SONET up to OC-12:
Electrical and optical interfaces
for DSn and SONET up to OC-12
(fixed module, various
configurations possible)

SONET OC-48:
Electrical and optical
interfaces for
2.488 Mbit/s

Jitter/wander at OC-48:
Jitter/wander generation
and analysis at 2.488 Mbit/s
as per ITU-T O.171 and
O.172

ATM BAG:
Easy to operate BAG broadband analyzer/ generator module (SVC) with ATM test controller for accepting, installing, testing and maintaining ATM systems (switched and permanent virtual connections)
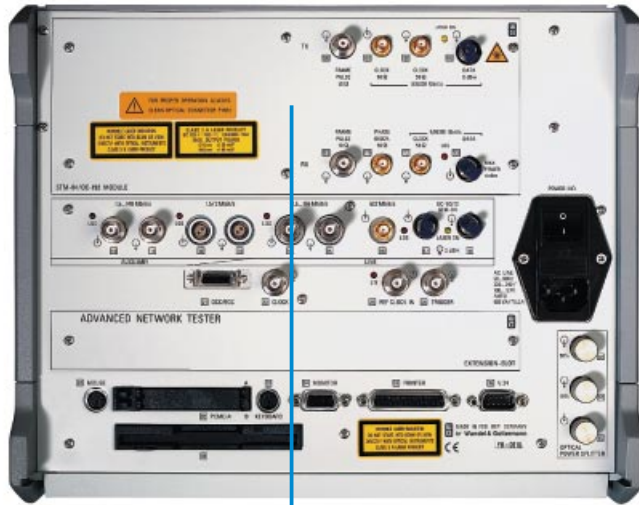
Jitter/wander up to OC-12:
Jitter/wander generation and analysis at all bit rates up to 622 Mbit/s as per ITU-T O.171 and O.172

SONET OC-192:
Optical interfaces for 9.953 Mbit/s.
In preparation:
– OC-192c BERT
– Jitter/Wander as per O.172
– Electrical interface
– Through mode

Power splitter:
Optical power splitter for external protected monitor point

ANT-20 – Compact and handy for field work
Free slot for OC-48 or jitter. SONET and SDH mappings, even in combination with ATM real-time analysis work on SONET/SDH/DSn interfaces from 1.5 Mbit/s to 2.5 Gbit/s.

ANT-20SE – Everything you need, in a portable unit
With four free slots. ANT-20SE can do more than the ANT-20 and is ready for future combinations of different tests.
The most unique feature is the combination and parallel operation of all bit rates up to OC-48/STM-16 with jitter/wander up to 2.5 Gbit/s and ATM in a single unit.


ANT-10Gig – Equipped for future developments
With its OC-192/STM-64 optical interface, ANT-10Gig extends the capabilities of the ANT-20SE to handle the higher bit rates of 10 Gbit/s systems. This enables access to all common interfaces from 1.5 Mbit/s to 10 Gbit/s and covers all standardized mappings. **An integrated solution for jitter and wander measurements at 10 Gbit/s is under development.**

The ANT-20 has everything you need to optimize your network. Some of the many possibilities are as follows.

Assure proper APS operation

Delayed ring switching? This can cause entire ring span or even whole rings to be taken out of operation. The ANT-20 makes it easy to measure the switch-over time from "working line" to "protection line". If faults occur, the instrument enables detailed analysis of the APS protocol procedures so you can immediately detect faulty commands.

APS
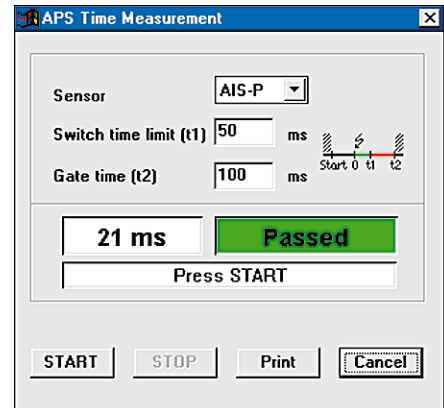
Sample results from a switch-over time measurement

ANT-20: Innovative functions offer ideal support

Assess quality on OC-12c/OC-48c/OC-192c* lines

OC-48c can now be used to provide uniform bandwidths for IP and ATM. The previous limit was right around 600 Mbit/s, implemented using OC-12c. OC-48c quadruples the payload capacity to 2.4 Gbit/s. This technology is used primarily to link high-speed data networks.

* OC-192c in preparation

OC-48c

However, a large bandwidth is no use if data packets have to be continually retransmitted due to transmission errors. Faulty channels are not profit-makers for service providers.
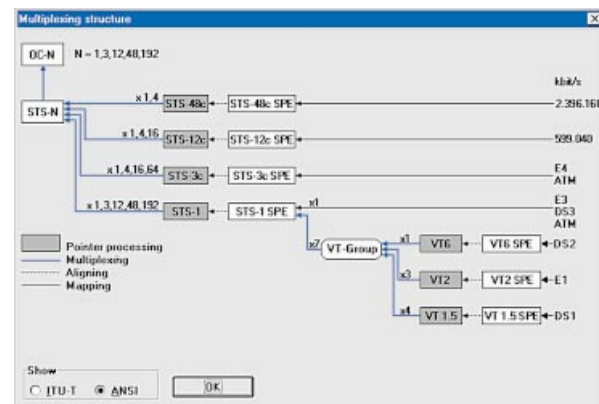The ANT-20 supports this new technology to help you to quickly track down problems.

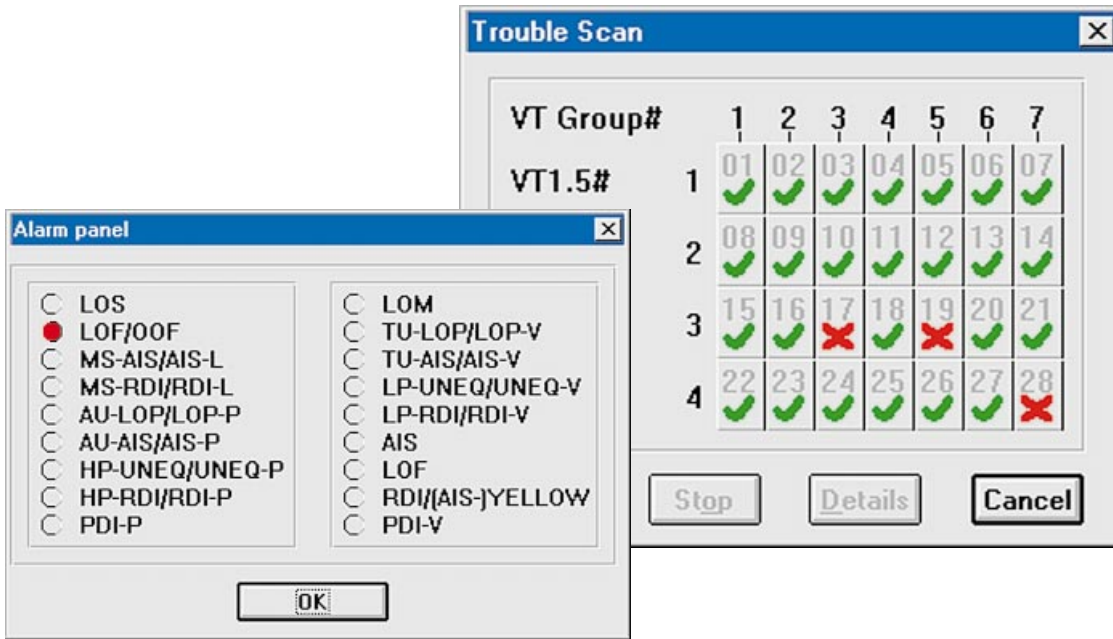When equipped with the OC-12c, OC-48c and OC-192c* options, the ANT-20 becomes a full-featured "concatenation tester".

8

Trouble Scan

VT Group#	1	2	3	4	5	6	7
VT1.5# 1	01 ✓	02 ✓	03 ✓	04 ✓	05 ✓	06 ✓	07 ✓
2	08 ✓	09 ✓	10 ✓	11 ✓	12 ✓	13 ✓	14 ✓
3	15 ✓	16 ✓	17 ✗	18 ✓	19 ✗	20 ✓	21 ✓
4	22 ✓	23 ✓	24 ✓	25 ✓	26 ✓	27 ✓	28 ✗

Alarm panel

- ○ LOS
- ● LOF/OOF
- ○ MS-AIS/AIS-L
- ○ MS-RDI/RDI-L
- ○ AU-LOP/LOP-P
- ○ AU-AIS/AIS-P
- ○ HP-UNEQ/UNEQ-P
- ○ HP-RDI/RDI-P
- ○ PDI-P

- ○ LOM
- ○ TU-LOP/LOP-V
- ○ TU-AIS/AIS-V
- ○ LP-UNEQ/UNEQ-V
- ○ LP-RDI/RDI-V
- ○ AIS
- ○ LOF
- ○ RDI/(AIS-)YELLOW
- ○ PDI-V

SCAN mode: The ANT-20 checks all channels for proper connection, synchronization and alarms in the incoming signals.

Save time and avoid errors with automatic test functions
Unknown signal structure? Improper configuration? Looking manually for the right channel? The ANT-20 has automatic test modes to simplify test start-up and to provide a fast overview of four-channel systems. Using multi-stage analysis, you can view the status of individual channels with a click of the mouse.

Autoconfiguration	Searches for signal and unknown content
SCAN	Tests for error-free connection of all SONET channels
Trouble SCAN	Checks all incoming SONET channels for errors/alarms
Search	Searches for test channels in SONET signals
Auto SCAN	Analyzes the structure of an SONET signal up to OC-192

Check and optimize quality of service in your ATM network
You can use the ANT-20 to effectively test your ATM network and/or network elements for proper operation and quality of service (QoS). Depending on the application, the ANT-20 has test solutions for permanent virtual circuits (PVC) and switched virtual circuits (SVC).
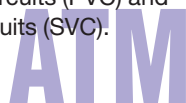
The major applications are as follows:
- Signaling emulation as per ATM Forum UNI 3.0/3.1 and ITU-T Q.2931/Q.2961
- SVC and PVC testing
- Automatic end-to-end testing of SVCs
- Real-time measurement of ATM QoS on four channels simultaneously
- Tests of all traffic contract parameters
- ATM terminal simulation for dial-up circuits
- Graphical evaluation using load charts

CBR VBR DBR SBR UBR

This means you can remotely operate any software installed on the ANT-20, such as the CATS test sequencer. You can control complicated and time-consuming tests from the office or from your home.

This is the basis for some time-saving applications:

- Operation of several ANT-20s from a central office, e.g. for point-to-point measurements.

- Help with on-site test problems. A specialist in the main office can monitor the user interface of the ANT-20 in parallel and give the local operator suggestions on how to solve the problem.

- Using an external test point scanner, you can switch between prepared test points from anywhere, at any time, in order to perform interactive measurements or test sequences.

ANT-20:
Simple remote operation, interactive or fully automated

Remote operation is easy with the ANT-20. All you need is a laptop and a modem or LAN connection. Thanks to the Windows-based design, you can run the same software on the ANT-20 and the laptop. The user interface you see on the laptop is identical to the one on the ANT-20.
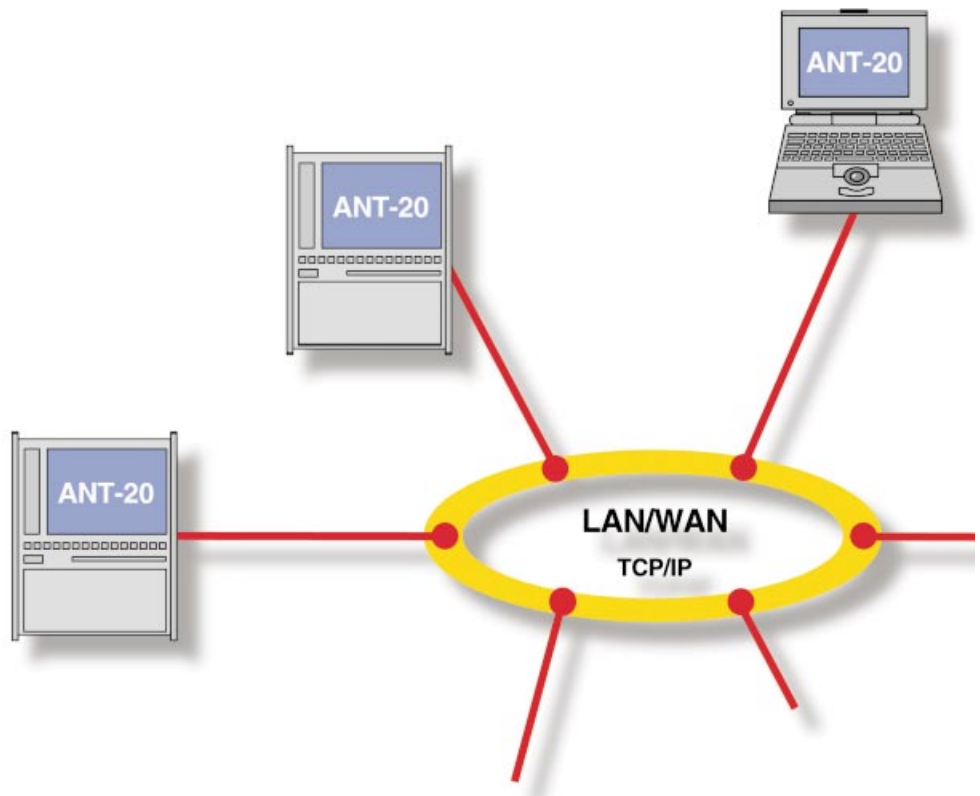
## Save time and money through automation

The CATS* test sequencer is a test automation software package that runs on the ANT-20's built-in PC. It is the ideal tool for automating repetitive test procedures. It provides support in handling standard tests.

Without any programming background, you can still easily create test sequences to meet your own specific needs. A number of predefined, user-modifiable test steps are provided for your immediate use.

Test automation is particularly important when commissioning network elements and/or lines. The various measurements can be performed in sequence and documented.

The ANT-20 CATS test sequencer is just as effective for acceptance measurements and in development and production of network elements.

Once created, a test sequence can be recalled at any time. Each run of a sequence generates a file with all result data and a clear PASS/FAIL for each test step and the overall sequence.
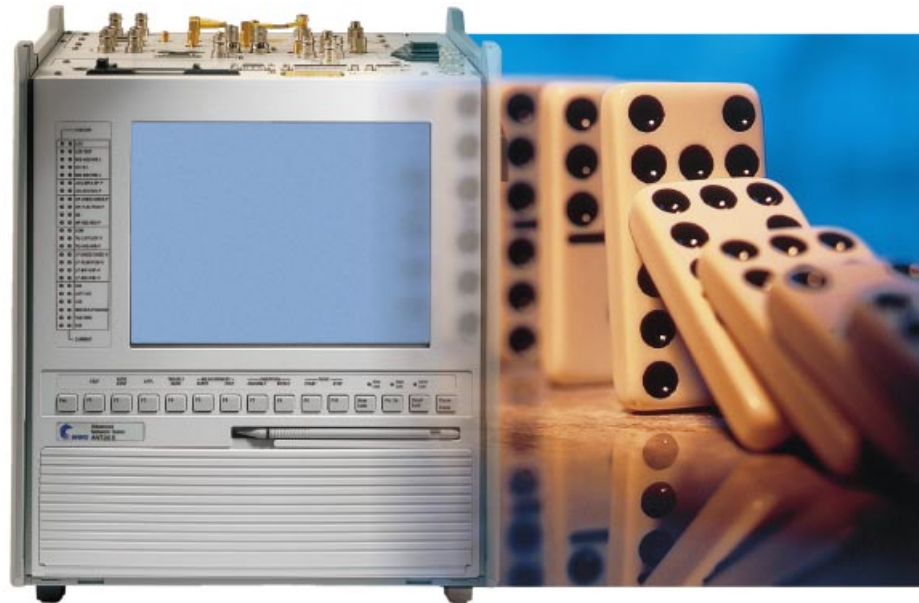
ANT-20:
Automated test
sequences with
reproducible results

Sample test sequence for commissioning 2 Mbit/s leased lines:

| Basic settings	TX 1.5 Mbit/s	Set TX signal structure
	RX 1.5 Mbit/s	Set RX signal structure
Test of parameters	View Alarm	Check for no alarms
	Continuity Check	BERT in channel
	Pulling Range	Check pulling range (offset)
	Check LOS	Set LOS, wait for AIS
	Jitter Measurement	Measure intrinsic jitter
	Jitter Tolerance	Measure jitter tolerance
	Delay Measurement	Measure signal delay
Test end	Thank You	End of test

* CATS CVI Application Test Sequencer

ANT-20:
A reliable solution
for jitter and wander

Tight standards for synchronization
Higher bit rates, combined with synchronous technology, are making greater demands of the clock quality within networks. For quality assurance purposes, international standards have defined stringent limits for jitter and wander.
Precision test equipment lets you know immediately whether the outgoing clock quality meets these standards and how network elements respond to poor clock quality.
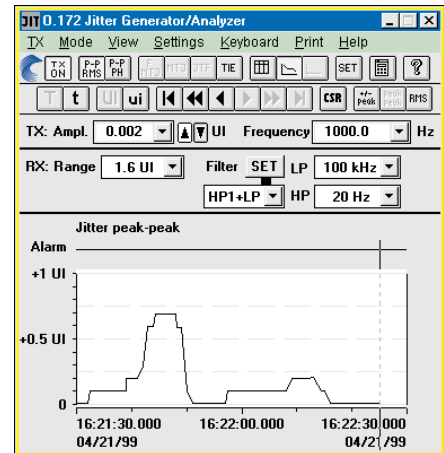
Wondering how the output jitter varies over time? The "Jitter vs. time" display provides an excellent overview.

A comprehensive solution for jitter and wander
The ANT-20 can generate and analyze jitter and wander for bit rates from 1.5 Mbit/s to 2488 Mbit/s and is fully compatible with ITU-T Recommendation O.172, making the instrument the ideal solution for handling diverse tests and delivering insightful, comparable and precise results.

You can measure the following:
● Output jitter
● Maximum tolerable jitter (MTJ)
● Jitter transfer function (JTF)
● Mapping and pointer jitter
  (combined jitter)
● Peak-to-peak jitter, RMS jitter
  and jitter vs. time
● Wander generation and analysis
● MTIE/TDEV offline analysis

Additional functions to keep you ahead
Some other cleverly conceived functions allow the ANT-20 to perform fast and reliable wander analysis. Wander analysis results are as follows:
● Time interval error (TIE)
● Maximum time interval error (MTIE),
  based on TIE data.

With MTIE/TDEV offline analysis, you can evaluate wander results measured and stored by the ANT-20 and graphically display these results and compare them with standardized masks.
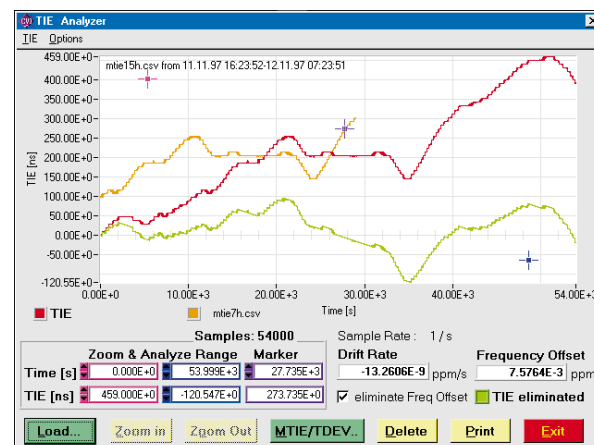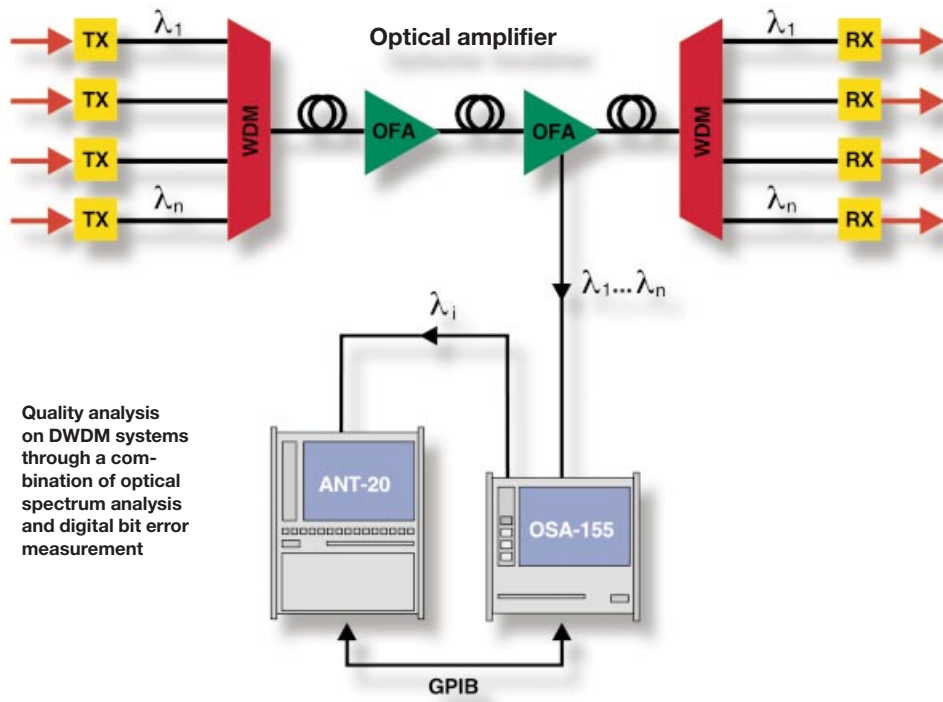
You can automate all of the jitter and wander applications using the CATS test sequencer, jitter tests being an important component of acceptance procedures.

Does clock quality fulfil the norm?
MTIE/TDEV analysis provides the answer.

Quality analysis on DWDM systems through a combination of optical spectrum analysis and digital bit error measurement

The complete solution for DWDM systems

When combined, the ANT-20 and the OSA-155 Optical Spectrum Analyzer enable complete quality analysis of transparent DWDM systems. The OSA-155 has an external monitor output for this purpose. It selects a single DWDM channel from the whole spectrum, which is then analyzed by the ANT-20 at the digital signal level. You can easily analyze errors at the bit, frame and alarm levels and perform jitter measurements, all in a selected channel of a multicarrier system.

Test solutions for quality monitoring

It is time-consuming to manually setup, start and evaluate the various measurements with the OSA-155 and ANT-20. What is needed is a way to automate the individual test procedures. The CATS DWDM automation software running on the ANT-20 now handles control of the complete test procedure. Each channel is selected in sequence, the optical/transmission parameters measured and the results documented in a test report.

You can edit the relevant parameters for the individual measurements as required.

The OSA-155 DWDM Spectrum Analyzer

ANT-20:
Access to
DWDM systems
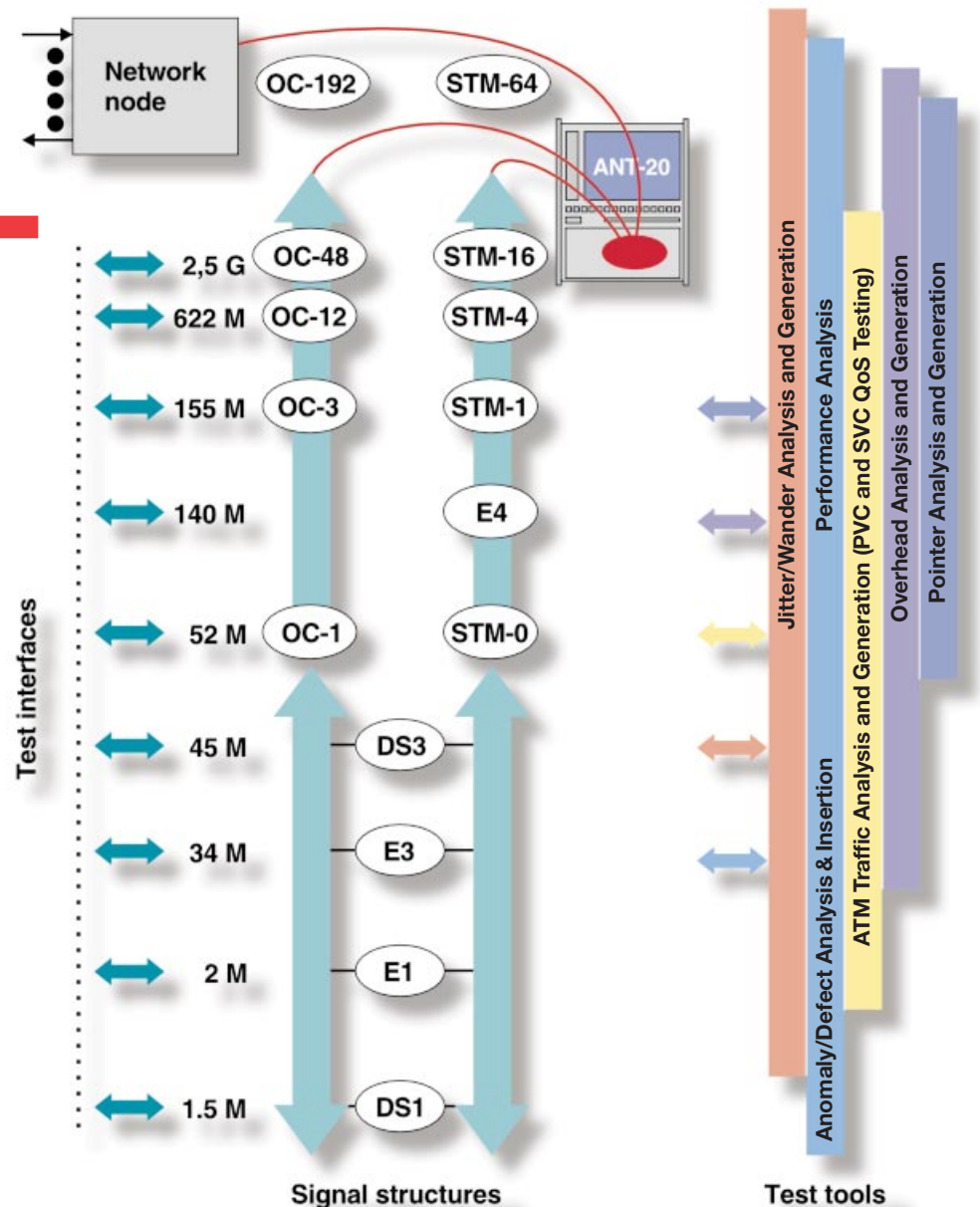
ANT-20: A pacesetter for the future

An overview of future trends

Recent years have seen a drastic increase in the popularity of electronic services, with a trend towards global interconnection. The Internet alone has been an incredible growth engine. To meet the new bandwidth requirements, two technologies predominate. Time division multiplexing (TDM) of synchronous channels is used to transmit higher bit rates, while dense wavelength division multiplexing exploits the different optical windows on a fiber. The idea behind both approaches is to make optimum usage of existing optical fiber capacity.

Test interfaces

	Signal structures	
	OC-192	STM-64
2,5 G	OC-48	STM-16
622 M	OC-12	STM-4
155 M	OC-3	STM-1
140 M		E4
52 M	OC-1	STM-0
45 M	DS3	
34 M	E3	
2 M	E1	
1.5 M	DS1	

Network node

Test tools

- Jitter/Wander Analysis and Generation
- Performance Analysis
- ATM Traffic Analysis and Generation (PVC and SVC QoS Testing)
- Overhead Analysis and Generation
- Pointer Analysis and Generation
- Anomaly/Defect Analysis & Insertion

Even at 10 Gbit/s, the ANT-20E can break down signal structures and analyze them down to the lowest levels.

Related products

T-BERD 310
Communications Analyzer:
Capable of analyzing DWDM, SONET, ATM, DS3, DS1, and DS0 circuits, the T-BERD 310 incorporates all the modular functionality needed to effectively turnup, maintain and troubleshoot today's transport networks. With over 13,000 units deployed, the T-BERD 310 is the industry standard in North America for Central Office transport test applications.

2310 SONET Field Services Module:
Quick, intuitive, and weighing only five pounds, the hand-held TTC 2000 Test Pad 2310 SONET Field Service Module offers an integrated, full-featured, high-speed services testing solution to access networks from multiple locations and provides the information needed to qualify networks for service.

ANT-20: Summary of documentation

ATM:
Pocket Guide for Asynchronous Transfer Mode and ATM Testing
TP/EN/PG02/0400/AE repl. 1020

SDH: Pocket Guide for Synchronous Digital Hierarchy
TP/EN/PG01/0400/AE repl. 1006

SONET: Pocket Guide for Synchronous Optical Networks
TP/EN/PG03/0900/AE repl. 1013

Application Note 71:
"Leading the Way with Innovative Jitter & Wander Test Solutions"
TP/EN/A071/0799/AE
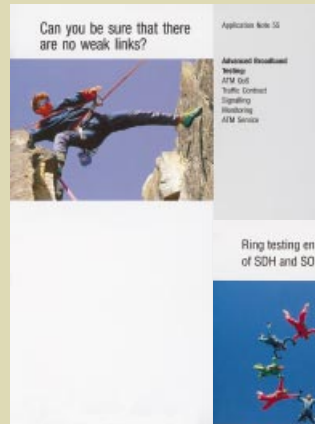
Application Note 55:
"Can you be sure that there are no weak links?"
E 3.98/WG1/55
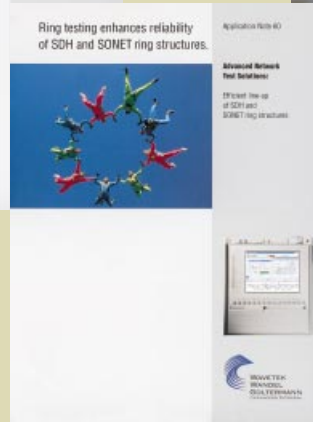
Application Note 60:
"Ring testing enhances reliability of SDH and SONET ring structures"
E 04.99/WG1/60

SONET/SDH Poster
TP/EN/P002/0400/AE repl. 204
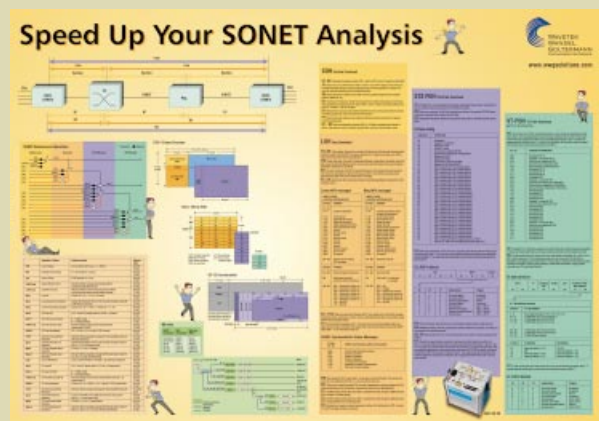
Application Note 59: "Conforming to the Maze of Network Standards" – E 02.99/WG1/59

Application Note 62: "Understanding ITU-T Error Performance Recommendations"
TP/EN/AN62/0600/AE

Application Note 68: "Get an Overview of Synchronous Networks!" – E 6.99/WG1/68

Application Note 73: "Tandem Connection Monitoring: Fundamentals, Operation, Test Solutions" – TP/EN/AN73/0500/AE

Data sheet: WWG ANT-20 and DominoCOM Advanced Network Tester, SONET
TP/EN/D067/0600/AE

Data sheet: WWG ANT-20SE Advanced Network Tester "Speed Evolution", SONET
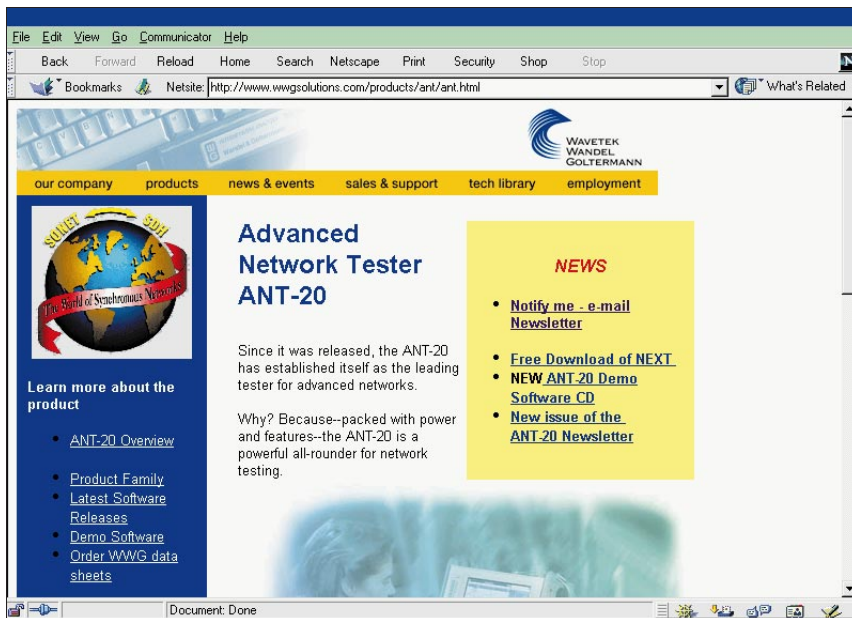TP/EN/D064/0500/AE repl D054

Data sheet: WWG ANT-10Gig Advanced Network Tester, SONET
TP/EN/D056/0200/AE repl D048

Advanced Network Testing (periodical): ANT-20 news, issue 1 to 7

ATM Forum Glossary – E 8.97/WG1/192

ANT-20 DEMO CD – TP/EN/CD01/0999/AE

ATM Poster – E 11.99/WG1/174

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