

# Lite 3000

## Description of Basic Product



### KEY FEATURES

- Fast troubleshooting
- Simultaneous monitoring in both directions of 2 Mbps PCM lines
- Powerful testing of framed Nx64 kbps and unframed 2 Mbps PCM systems
- Advanced all-layer signalling analysis options
- Immediate LED indications
- Large colour display
- Battery-powered, with more than 10 hours between recharges

### General description

The NetTest Lite 3000 is a hand-held, battery-powered, multipurpose telecommunications test instrument for 2048 kbps PCM systems. The instrument is a powerful tool for a wide range of applications, from fast first aid troubleshooting to comprehensive, in-depth analysis of transmission and signalling problems. Adding options converts the Lite 3000 from a full-featured transmission line quality tester into an advanced signalling analyser.

The basic Lite 3000, with its two independent receivers and one transmitter, supports framed and unframed testing and monitoring. The instrument is thus ideal for both in-service and out-of-service transmission-quality measurement. For fast troubleshooting, the Lite 3000 displays alarms and transmission link status on LED indicators. The instrument's two inputs permit immediate monitoring of the two sides of a PCM line and allow comparison of simultaneously recorded results.

With options added, the Lite 3000 analyses the A-bis interface of GSM/GPRS networks. Yet other options turn the Lite 3000 into a very powerful signalling analyser for SS7 and ISDN protocols and for CAS and MF signalling.

Results are easily read from the large display. Colours and graphical symbols facilitate interpretation. Measurement data can be printed on an external printer or exported to a PC via the V.24 interface. With its few keys and large colour LCD screen, the Lite 3000 is very user-friendly in operation. It can be operated remotely through an optional MS Windows® program that simulates the instrument's front panel. The Lite 3000 can automatically configure to the received signal, eliminating time-consuming instrument setup. Setups supporting particular applications may be stored in the instrument. Setups can also be transferred to a PC from where they can be loaded to other instruments, allowing a very fast and easy distribution of standardised test setups within the organisation.

Fault location is greatly facilitated by the high degree of portability of the robust Lite 3000, allowing measurements to be taken at any suitable measuring point. The instrument is powered by rechargeable and replaceable intelligent high-capacity NiMH batteries, which provide more than 10 hours of operation between recharges with PowerSave. The Lite 3000 can also be powered via an external mains adapter for long-term measurements.

### Measurement

The Lite 3000 has three measurement functions:

#### The status monitor

The status monitor is always active and provides essential information for fast troubleshooting of the monitored transmission system. Status monitoring covers:

- **Line alarms on LED indicators with a trap facility**
- **Display of current input frequency and deviation**
- **Indication of input level**
- **Traffic channel usage**
- **Audio level in a traffic channel**
- **Propagation time monitor**
- **Listen-in on a traffic channel**



Fig 1 Fast overview of traffic channel time slots

#### Interval-based measurement

Interval-based measurement provides information for transmission-error performance for installation/commissioning and troubleshooting. Information on errors and alarms is collected for intervals with a user-defined duration and error-performance parameters (G.821/G.826/M.2100) are calculated. A Measurement Summary function provides a very fast overview of a measurement via an “OK/Questionable/not-

OK” indication. The user can define thresholds for the "OK" and the "not OK" levels. Histogram presentations facilitate the tracing of errors.

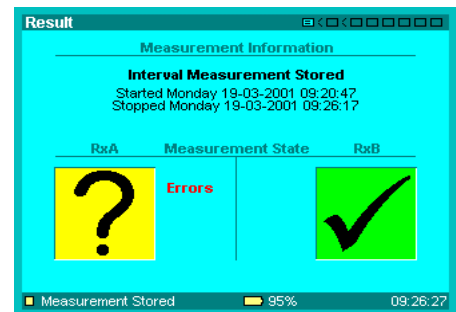


Fig 2 The “OK/Questionable/ not-OK” measurement indication

#### Log-based measurements

Log-based measurements are available for signalling analysis and advanced transmission-error troubleshooting. Events are logged in the memory with high-resolution time stamps. Logged events are detected alarms, errors, CAS bit changes, Sa bit changes and, depending on the options added, a number of other events types such as GSM, SS7 and ISDN signalling messages. This allows the user to examine the correlation of the different types of events. Filters enable/disable the logging and display of individual events for optimal memory usage and read-out of only the information required. The event log can be examined during or after a measurement.

#### Typical applications

##### Comprehensive out-of-service testing

The Lite 3000 supports unframed 2048 kbps testing for installation, commissioning and stability tests. Performance of system under test is evaluated on the basis of BER measurements with a loop back at the far end of the tested line.

##### Framed 2 Mbps testing

The Lite 3000 can simulate errors for testing system behaviour on variations in a framed signal as a part of installation testing and conformance testing. The synchronisation circuits are tested by generating errors in the frame alignment signals. CRC-4 can be calculated and inserted in the PCM frame. Relevant alarms can be generated. Analogue tones or digital signals may be inserted into a channel in the PCM signal.

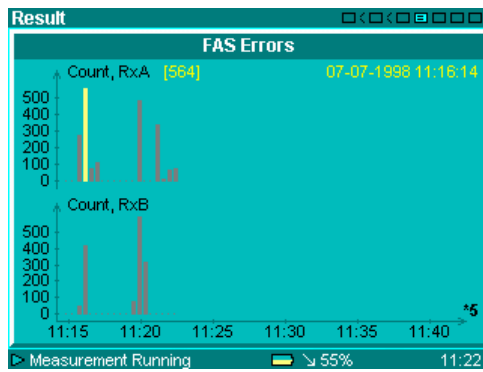


Fig 3 Graphical histogram presentation of a detected error

### In-service monitoring

In troubleshooting, it is of utmost importance to be able to easily and quickly determine the state of the PCM lines in a network. The Lite 3000's two receivers permit simultaneous monitoring of both sides of a PCM line. The Line Status LEDs present the current status in relation to alarms and errors. A trap facility saves information on earlier alarms and errors, permitting detection of sporadic errors and allowing unattended operation. A PCM level indicator provides information on the current level of the monitored PCM signal, making it easy to verify that the expected signal level is present.

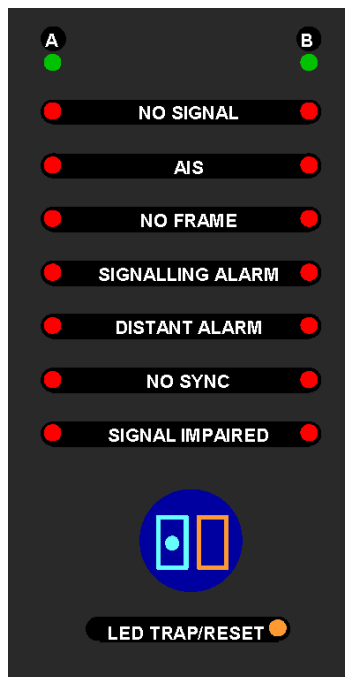


Fig 4 Line status LEDs. Detailed information on errors and alarms is shown in the display

### In-service error-performance measurement

FAS and CRC-4 based error measurements are often used for in-service verification of transmission quality. With the Lite 3000, it is easy to obtain this information, including G.821, G.826 or M.2100 error-performance parameters.

### Identification of synchronisation problems

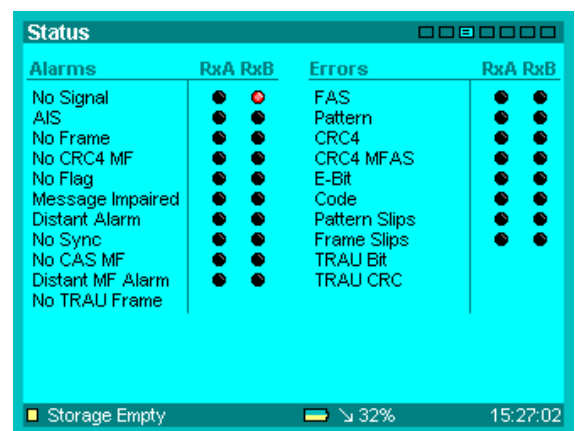
To eliminate errors, the network elements in modern telecommunications networks are synchronised to a single clock. Synchronisation faults result in transmission errors caused by bit or frame slips in the network. It is easy to identify synchronisation problems with the Lite 3000. The instrument highlights the occurrence of bit and frame slips to the user and displays the frequency deviation between the two inputs. A deviation indicates that two network elements are synchronised to different clocks; i.e. that one of them is mis-synchronised.

### Slip measurements

Slip may be caused by fading on digital radio link; transmission through digital switches or error bursts corrupting too many justification bits. As a result, one or more bits are inserted or deleted from the signal. The Lite 3000 records slips and bit errors separately.

### Traffic monitoring

The Lite 3000 analyses the content of the traffic channels in the monitored lines, using this data to present an easy-to-understand survey of the current channel states (busy/idle).



This can be used to ensure that all channels are idle before the line is taken out of service. In addition, a lock facility identifies channels with an abnormal usage (always/never busy).

#### Propagation time

Propagation time can be measured when the instrument sends out a PRBS and the pattern is looped back to the instrument, thus permitting checks of the controllers for the signal routing, satellite links etc. and that introduced delays are below specified limits.

#### Advanced in-service troubleshooting

Troubleshooting transmission errors may require analysis of timing between events, which occur within a few milliseconds. The Lite 3000's high-resolution log facilitates analysis of timing between errors or alarms.

Time	RxA	RxB	Description
00:00:00.047			No Signal
00:00:00.007			No Alarms
00:00:01.883			No Frame
00:00:00.058			No Alarms
00:00:00.000			No Sync
00:00:00.206			No Alarms
00:00:05.377			Code
00:00:01.127			Distant Alarm
00:00:00.744			No Alarms
00:00:01.207			No Sync
00:00:00.370			No Alarms
00:00:01.049			No Flag
00:00:00.758			No Alarms
00:00:01.320			No Flag
00:00:00.173			No Alarms

Fig 5 Log of errors and alarms with high-resolution time stamps

#### In-service testing (drop-and-insert)

A full error-performance analysis is based on a PRBS pattern located in one or more channels. Channels within a 2048 kbps link can be tested using the drop-and-insert function. If the tested channel is looped back, the Lite 3000 can test loop performance and propagation time. It is also possible to insert errors in a live traffic signal. Thus, handling of errors in signals with a special format can be checked.

#### Audio performance test

Audio checks of the digital side of the multiplexer identify impaired voice channels. The audio information in a channel may be output to the built-in loudspeaker, to a headset (option) or to external equipment for further analysis.

#### Analogue multiplex testing

The Lite 3000 can insert a tone into a channel to measure its audio level for the test of D/A-converters. If the channel carries a single tone, the frequency can also be measured.

#### Specifications

##### PCM line interfaces

- Generally complying with ITU-T Rec. G.703.
- Unbalanced plug: 1.6/5.6 or BNC
- Balanced plug: BNO
- Configuration of interfaces: One transmitter (Tx) and two receivers (RxA-RxB)
- Transmitter and receivers can be set independently or locked together

##### Transmitter (Tx)

- Bit rate: 2048 kbit/s
- Adjustable offsets:  $\pm 125$  ppm in 1-ppm steps
- Clock source: Internal, recovered from RxA or RxB
- Internal clock: 2048 kbit/s  $\pm 4.6$  ppm
- Line code: HDB3, AMI
- Impedance: 75 Ohms unbalanced, 120 Ohms balanced

##### Test patterns

- PRBS11, PRBS15, PRBS23, all 0's, all 1's, alternate 1:1, normal or inverted
- User-defined 1, 2, 4, 8 or 16-bit

##### Signal insertion

Test patterns or fixed values are injected in nx64 kbps channels (framed) or as an unframed signal.

Tone in one speech channel:

- Frequency: 1 Hz to 4 kHz in 1 Hz steps
- Level: +3 dBm to -70 dBm in 1 dBm steps

##### CAS signalling bits

Sa-bits (non-FAS)

Alarms: Manual insertion of No signal, AIS,

No Frame, Distant, No MF, Distant MF

Error insertion: Bit, code, FAS bit, FAS

word, CRC-4, CRC-4 MFAS, CAS MFAS,

E-bit

- **Manual:** 1-255 consecutive errors (1-16 consecutive FAS word errors)
- **Continuous** 10-2, 10-3, 10-4, 10-5, 10-6, 10-7
- **Provoking of G.821, G.826 or M.2100 events (ES, SES etc.) (Bit, FAS, CRC-4, E-bit)**

Manual slip insertion: Frame slip, pattern slip

#### Receivers (RxA-RxB)

- **Bit rate:** 2048 kbit/s  $\pm$  100 ppm
- **Line code:** HDB3, AMI
- **Impedance:** 75 Ohms unbalanced, 120 Ohms balanced or high (approx. 10 \* nominal)
- **Sensitivity:** 0 to 40 dB cable attenuation (normal) or 20 to 30 dB linear attenuation (monitor)
- **Jitter tolerance:** In accordance with ITU-T G.823 section 3.1.1
- **Return loss:** Complies with the ITU-T Rec. G.703
- **Auto configuration:** Input, line code, framing and pattern are automatically determined. Signalling channels are identified if signalling options are installed

#### Measurements

Either interval-based or log-based measurement can be activated

##### Interval-based measurement

- **User-defined interval length:** 1, 2, 5, 10, 15, 30s, 1, 5, 15, 30 min, 1, 2, 4, 6, 12 hour
- **Information logged per interval:**
  - Alarms
  - Code error count/ratio
  - FAS, CRC-4, E-bit and bit-error count/ratio and G.821, G.826 or M.2100 parameters

##### Log-based measurements

Events are logged with 1 msec resolution time stamps. Time stamps are absolute, relative to start or relative to previous

- **Logged events:** Detected alarms and errors. Changes in CAS and Sa bits
- **Filters enable/disable the logging of individual events**

#### Test patterns

- Same as transmitter

#### Detected signals

Test patterns or fixed values are detected in nx64 kbps channels (framed) or as an unframed signal.

#### Alarms and errors

- **Alarms:** No signal, AIS, No Frame, Distant Alarm, Signalling Alarm (No MF, Distant MF Alarm, Message impaired, No Flag)
- **Errors:** Bit, code, FAS, CRC-4, CRC-4 MFAS, E-bit, frame slip, pattern slip

#### Error performance

- **G.821, G.826 or M.2100 analysis** of a PRBS in the received signal, or based on CRC-4, E-bit or FAS. ES, SES, DM (G.821), BBE (G.826), UAT, EFS, AT % or count
- **Error performance evaluation for the total measurement:** HR% for a user defined error performance parameter or programmable OK and not-OK limits for Bit, FAS, CRC-4 or E-bit count or ratio

#### Time-slot monitoring

- **FAS, NONFAS, CAS signalling, Contents of single time slot incl. positive/negative peak values and coder offset. Level and frequency for encoded tone:**
  - Frequency: 1 Hz to 4 kHz with 1 Hz resolution
  - Level: +3 dBm to -70 dBm with 1 dBm resolution

#### Speech decode

- **64 kbit/s (ITU-T Rec. G.703): A-law according to ITU-T Rec. G.711**

#### Frequency deviation indication

- **Accuracy:**  $\pm$  1 ppm.

#### Input level indication

- **Range:** 0 to -46 dB (normal) or -20 to -32 dB (monitor)

#### Propagation time

- **Resolution:** 1  $\mu$ sec (unframed), 0.1 msec framed
- **Range:** 0 - 4 sec

### Drop-and-insert

Permits the user to insert an nx64 kbps test pattern in an incoming signal and send it out through the transmitter. It is also possible to insert errors in a selected 64 kbps traffic channel.

### ADPCM speech decode option

- **ADPCM in 32 kbit/s subchannels in accordance with ITU-T Rec. G.721 and G.761**

### Storage capacity

Memory size: 640 kbytes (equals more than 20,000 signalling messages with an average message length of 20 bytes or up to 7,500 measurement intervals). Continuous or stop-on-full operation is user-selectable. The memory is non-volatile. Up to 10 measurements can be stored.

### Time stamps

- **Resolution 1 msec**

### Real-time clock

Battery-backed; for event time stamps etc.

### Built-in loudspeaker

- **The built-in loudspeaker monitors speech in both directions of a voice channel**
- **Output level: User-controlled from front panel**
- **A jack provides headset access to the audio signal. The built-in loudspeaker is disconnected when a headset is plugged in**
- **A nominal level (at 600 Ohms load) can be provided through the jack for connection to an external test set**

### Printer/remote control

- **V.24/RS-232C. Male DE-9 connector**

### Display

- **Backlit colour LCD with 320 x 240 pixels**

### Battery

10.8 V rechargeable and replaceable intelligent NiMH battery

### Operating time:

- With PowerSave; more than 10 hours
- Without PowerSave; more than 6 hours

### Fast charge: Approx. 3 hours

### Normal charge: Approx. 6 hours

### Indicator for remaining capacity: % and hours/minutes

### Mains adapter

- **Input: 120-240 V AC, 50-60 Hz**
- **Output: 18 V DC, max. 2.5 A**

### Mechanical

- **Dimensions: Approx. 21 x 24 x 8.5 cm (HxWxD)**
- **Weight: Approx. 2.5 kg**

### Environmental

- **Operating temperature: -5°C to +40°C**
- **Storage temperature: -25°C to +60°C**
- **The Lite 3000 is CE-marked and complies with EN 50081-1 and EN 50082-1**

### Standard accessories

- **User's Guide**
- **NiMH battery**
- **Mains adapter with mains cable**
- **Instrument carrying strap**

### Options

- **Basic A-bis interface and protocol functionality**
- **A-bis protocols – ETSI and vendor specific (basic A-bis interface and protocol functionality option required)<sup>1</sup>**
- **Vendor specific GPRS A-bis PCU protocols (basic A-bis interface and protocol functionality is required)<sup>1</sup>**

- **Basic SS7 protocol functionality**
- **SS7 protocols (basic SS7 protocol functionality option required)<sup>1</sup>**
- **Basic ISDN protocol functionality**
- **ISDN protocols (basic ISDN protocol functionality option required)<sup>1</sup>**
- **MF tone detection and CAS bit decode**
- **CAS signalling tables (MF tone detection and CAS bit decode option required)**
- **ADPCM speech decode**
- **FrontSim: Remote operation (front simulation) SW for MS Windows®**
- **Carrying case**
- **Carrying soft bag**
- **Hardware manual**
- **Service maintenance agreement**
- **Accredited calibration**
- **Extra NiMH battery**
- **Stand-alone charger for battery**
- **Headset**
- **Measurement cables**

**Notes**

<sup>1</sup> For details on available protocols, please contact your local NetTest representative



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