Aurora Forte Physical Bit Error Rate Testing on a PDH network

This application note will show you how to configure and operate Aurora Forte to carry out a Bit Error Rate Test (BERT) on a PDH interface (E1, E3, DS1 or DS3).

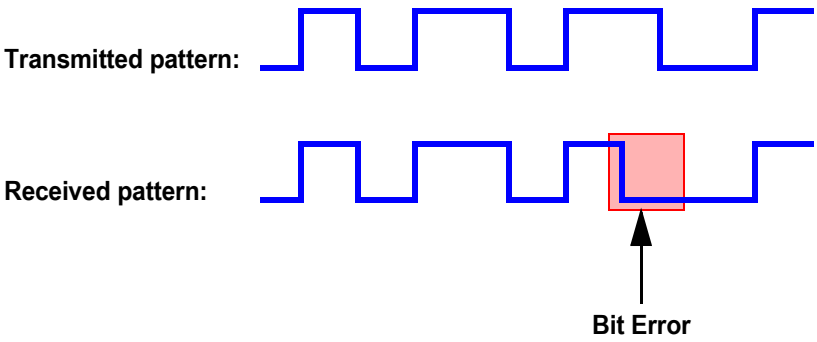
Application Note ANFORTE 03

Testing the World's Digital Networks

TrendCommunications

DETERMINING NETWORK QUALITY

In Application Note #1 it was explained that an ATM network requires an error free network for reliable transfer of ATM data. A bit error occurs when some form of interference or fault results in the line code that is encoding the data onto the network to produce a binary 1 to be received instead of a binary 0, or vice versa.



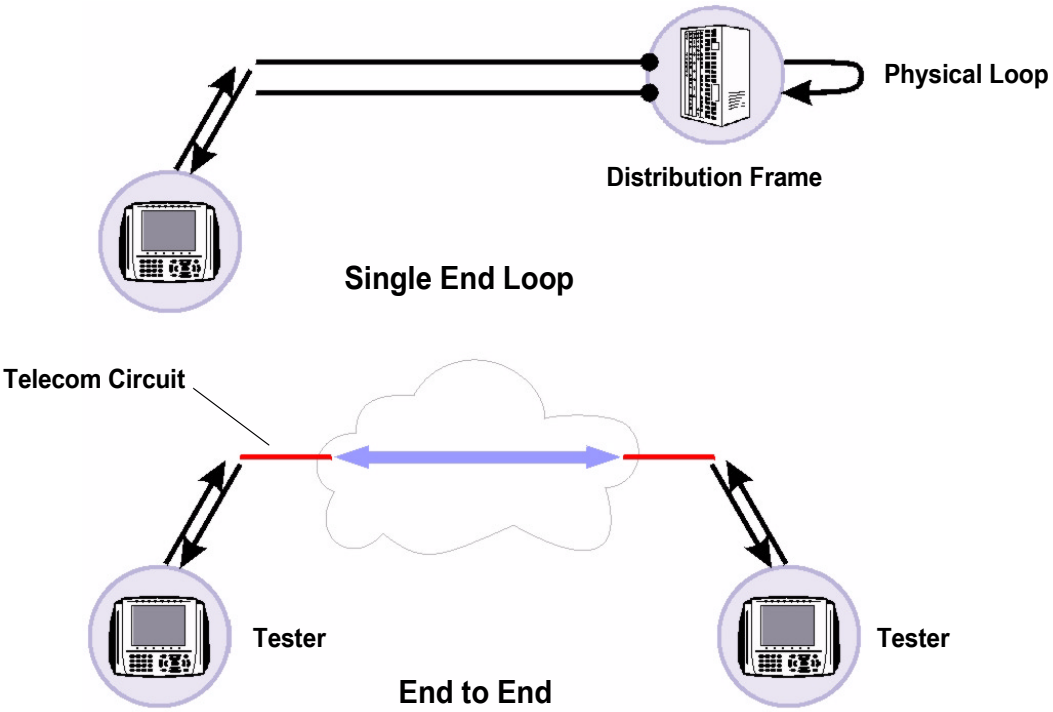
A Physical Layer Bit Error Rate Test (BERT) is carried to check that the quality of the link is good enough for transmitting data reliably. The basic method is to send a known data pattern along the link and to count how many errors occur on a bit-by-bit basis. The most common patterns to use are Pseudo Random Bit Sequences (PRBS), which are defined by the length of polynomial used to calculate the pattern. In general a long pattern is preferable because it will be more sensitive to the effects of noise, clock synchronisation and pattern specific errors.

There are perhaps three differing situations where a BERT would be carried out:

- Around the local loop from customer end point to exchange cross connect.
- Across a network link.
- End to end between customer terminations.

The method of testing is very similar, the major difference in procedure being whether the test will be done from one end only, with the signal looped back to the same tester. Or, end to end between two testers measuring the performance of each link direction separately.

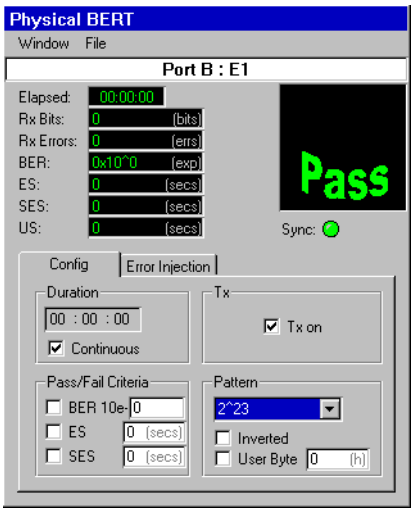
What need to be tested?



A physical BERT is done to prove that the link quality is adequate, you can also use it as confirmation that the network wiring is routing the signal to the expected destination. The first option is whether the BERT is to be made with network framing on or off. A test with framing off will only be done when there is no connection to the network, and the purpose of the test is to check that a section of unused wiring is suitable for operational use. For example, a copper pair which has been run from a network point of presence to a customer site will want to be tested to prove that the connection is OK and that it will operate reliably at the required data rate. A BERT with framing on will be done when the test signal is running through network equipment, for example when checking a data connection across a network between two customer sites.

How's the Testing done?

The Physical BERT application window shows you the setup for the test. You can set the test duration, or continuous Ð the timer will record the test up to 24 hours. You can select whether the tester should be transmitting the PRBS signal or not, generally you will want this on. In addition you have options for which PRBS pattern to use. There are also pass/fail criteria that you can set for the test. If these are selected then the test will indicate a pass or fail at the end of the test. Once you have setup the test this will be stored in memory and can be used for all subsequent testing with no changes, this will help you do quick and easy tests with a minimum of key presses.



When you start the measurement the tester will show that synchronisation has been achieved, the timer will start to increment and the Rx bit count will begin. At the end of the test the Bit Error Rate will be calculated. During the test the bit errors that are counted will be used to assess the quality of the line:

- Errored Seconds (ES)—any second containing at least one bit error.
- Severely Errored Seconds (SES)—Any second where the error rate is worse than 1 in 1000.
- Unavailable Seconds (US)—number of continuous seconds where SES is consecutively 10 or more.

During the test you can select to inject single errors, or continuous errors of 1 in 1000 (10e-3) or 1 in 1,000,000 (10e-6). These can be used to ensure that an error count is recorded correctly, and to check that the signal being received is from the transmit source that you expect.

Bit Error Rate Testing can be done for differing time periods. 15 minutes is usually the minimum to give confidence that a link is error free, or 1 hour to show that the error rate is acceptable. An extended test of 24 hours may be used to prove that a link is meeting a contractual obligation. Even longer tests lasting many days may be used to monitor a link whilst in use to show that it continues to operate OK, a scenario is beyond the scope of this application note.

At the end of the test you can check the measurements to decide if the line quality is acceptable. For most organisations an error rate of less than 10e-6 is OK, provided that SES=0. Different companies will normally have their own procedures and you should check these as well.

Typical Faults

No sync.

- Is the interface setup on the tester correct?
- Is the signal route correct, i.e. is the Rx wiring connected by a path to the Tx port?
- The error rate may be too high for sync to be possible.

Occasional errors

- Bad wiring joints may give errors when they are mechanically stressed.
- Wiring may be damaged, e.g. insulation stripped, or twisted pairs unbalanced, making it susceptible to interference.

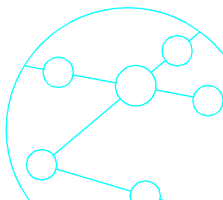
Bursts of errors

- Could be similar faults as for occasional errors.
- Interference from high voltage/current equipment, especially lifts or trains.

What Next?

This application note has described using Aurora Forte for a Physical Bit Error Rate test. This will prove that the wiring is connected as you expect, and that the line quality is acceptable. You may want to use the test results as a report to your customer, or archive the results for comparison at a later date.

Once you are happy with the link performance you may want to prove that the ATM layer operation is configured correctly and is reliable. ATM operation is where the real power of Aurora Forte is, and the different capabilities are explained in following application notes.



Aurora Forte

Aurora Forte is an ATM handheld tester with the key features of being multi-interface with a graphical user interface and providing physical, ATM and IP layer test routines. File Management System allows test results and configurations to be copied to/from a PC using the testers Ethernet port.

- *Portable, battery powered, handheld unit, rugged design*
- *Large high resolution colour display*
- *Graphical ICON based window applications for easy operation of tests*
- *Interfaces - combined E1 + E3, combined DS1 + DS3, ATM25,*
- *OC3/STM1 (Single mode, Multi mode, G703, CAT5)*
- *Bi-directional monitoring*
- *Pass / Fail parameters for fast analysis of test results*
- *Physical Frame and Alarm monitoring & Injection*
- *Physical BERT for E1, E3, DS1, DS3*
- *ATM VCC real time Traffic Scanning - up to 1024 VCC*
- *ATM cellstream transmission - up to 256 VCC*
- *ATM BERT*
- *Quality of Service (O.191) measurement*
- *Traffic Policing - to monitor and enforce a committed service level agreement*
- *F4 and F5 OAM testing of ATM fault management layer (AIS, RDI, CC, Loopback), real time and trace history OAM cell capture with English language decode*
- *IP ping over ATM - transmit and respond tests*
- *SVC UNI 3.0, 3.1, 4.0 support with comprehensive Information Element editing*
- *Management of results and configuration files via PC on Ethernet interface for simple operation*
- *Software upgrades available from Trend Communications website, with download to tester via Ethernet port*

Aurora Forte is subject to an ongoing development program with continuous addition of new features - call for more information.

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