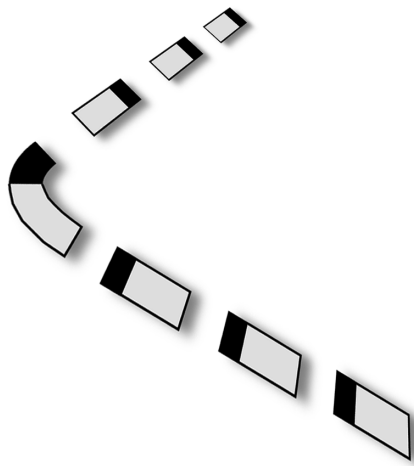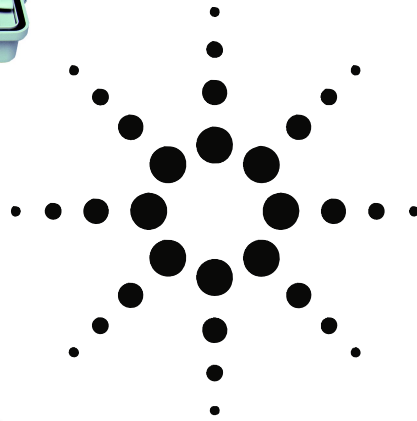# Measuring service disruption times in high-speed ATM networks

Product note

OmniBER
communications
performance
analayzer

Protection switching in linear and ring networks ensures that data integrity and quality-of-service is maintained in the event of equipment failure or fiber cuts. The length of time taken to recover the ATM service is a key parameter in todays competitive ATM market.

As high speed ATM (up to 2.5 Gb/s) is deployed in the core network, it is more important than ever to verify these protection switching features with a test signal containing ATM cells.

This product note describes a unique method of accurately measuring switching completion times. This ensures that not only do NE's comply with Bellcore and ITU-T recommendations, they also preserve mission critical quality-of-service and hence provide a degree of revenue protection.

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Automating the measurement of service disruption times for fast and conclusive results
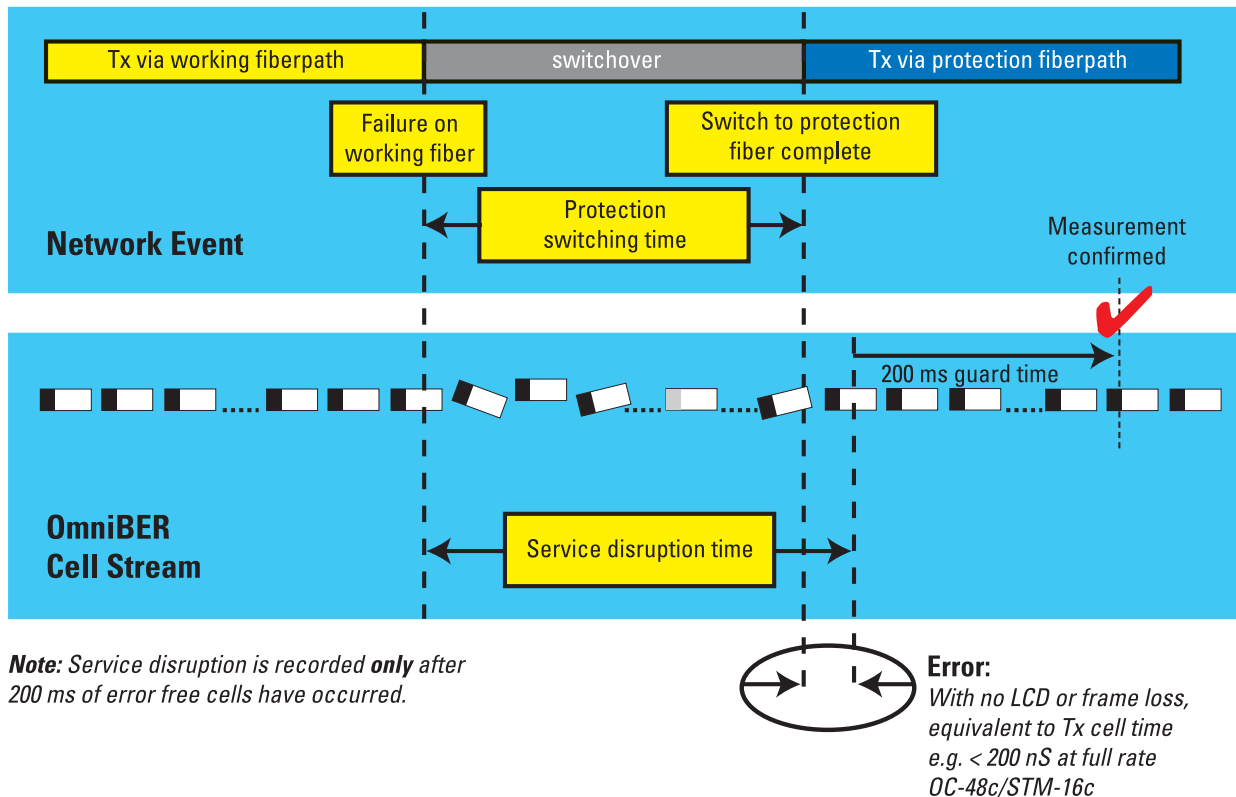

Figure 1.

Introduction

The back up or "protection" circuit, as it is known, is brought into service by a procedure known as Automatic Protection Switching (APS). Equipment failure, fibre cuts or degradation of the 'working' circuit can all activate a protection switch. Automatic protection switching uses the K1 and K2 bytes in the SONET/SDH transport overhead of the protection circuit to signal the switchover.

Data disruption of up to 50 ms can occur, equivalent to the loss of some 70,000 ATM cells at 622 Mb/s and four times this at 2.5 Gb/s. There is also a secondary effect which can occur at the ATM layer.

If an ATM signal is being carried by the link that has experienced protection switching, each ATM virtual channel (VC) carried on the path or section being switched may be affected by the protection switching event. If one of

these VC's is observed at the output of an ATM switch that forms part of the virtual channel circuit, the physical layer is unaffected but the ATM cell stream in the VC may suffer impairments.

The objective is to accurately measure the time that the virtual channel has been disrupted due to a switching event.

Service disruption measurement

To measure the disruption of an ATM service the cells can be captured and inspected. This is complex and time consuming. An estimate can also be obtained by transmitting an ATM cell stream at an appropriate cell rate and counting the number of lost cells during the protection switch event. The number of lost cells can then be converted into a disruption time.

However, when the protection switching occurs, the period of cell loss may be preceded and followed by a short period of errored cells. In this case, the disrupted period is underestimated if only the lost cell count is considered. The measurement is further impaired when you consider the possibility that cells will not return cleanly. Some irregularities may be observed in the switching performance where cells briefly return but are followed by a second period of lost cells. In this case, the lost cell count again does not indicate the total disruption period. In today's high speed ATM network, such measurements must be accurate and account for such events.

To overcome the difficulties described, it is important that the disruption period that is measured begins when errored or lost cells are detected and finishes when error-free transmission has been completely restored.

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The Agilent solution

Agilent Technologies provides a unique, automated method of measuring service disruption (awaiting patent approval). The measurement ensures that the protection switching time is a measure of the actual time the ATM traffic is lost. It is, therefore, directly related to the quality of service of a VC during a protection switch.

The test cell (defined by ITU-T O.191 and endorsed by the ATM Forum – see Figure 3) provides CRC and sequence number data to detect errored, lost and misinserted cells. These key parameters are used as inputs to the OmniBER's ATM disruption measurement.

The measurement time starts at the last good cell before the disruption and finishes whenever the first good cell arrives following a disruption. If loss of cell synchronisation occurs during the protection switching event, this appears as a period of loss and is measured correctly as part of the service disruption time. To ensure the disruption has completely finished, 200 ms or error free cells are required before the measurement is recorded (see Figure 1).

Performing the measurement

Service disruption can be measured on any virtual channel contained within the ATM signal (up to full bandwidth OC-48c/STM-16c).

The test is performed out of service with the OmniBER providing a cell stream to the ATM switch. For best resolution and result accuracy, the transmit test traffic should have a constant cell rate and the cell rate should be chosen to be as high as possible for the channel under test.

1. Connect OmniBER to the PDH or SONET/SDH add/drop ports of the ATM switch.
2. Ensure OmniBER and the ATM switch are synchronised.
3. Select test cell as the ATM payload and also the VP/VC to be tested.
4. Verify that no alarms or errors are detected.
5. Activate the protection switch.
6. Measure and record the result in the service disruption results page (see Figure 2).
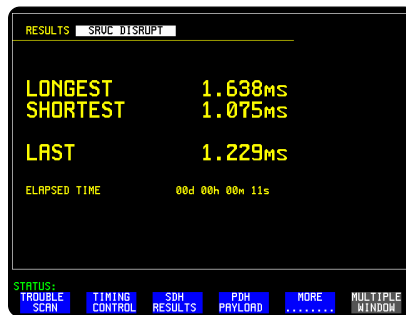7. Evaluate the results against the limits of 50 ms.

Figure 2.

Note: This measurement is made simultaneously with all other OmniBER measurements. Other results can then be correlated.

Conclusion

The time an ATM service is disrupted during switchover is crucial. To test ATM switches you have to provide a test signal which keeps the switch happy. Often this means concatenated payloads filled with ATM cells, up to 2.5 Gb/s.

In order to test the effects of APS, test equipment must have the ability to make appropriate ATM measurements while also being able to activate automatic protection switching. Such equipment should also be able to measure service disruption times.

Agilent Technologies' OmniBER provides all of this and the added capability to simulate and measure jittered signals containing ATM cells up to 2.5 Gb/s. Due to its unique measurement algorithm, OmniBER provides the most accurate way to characterise your ATM service disruptions.
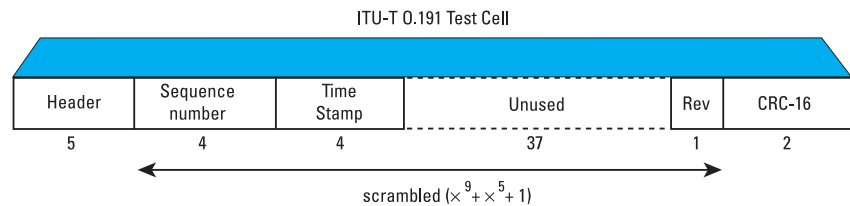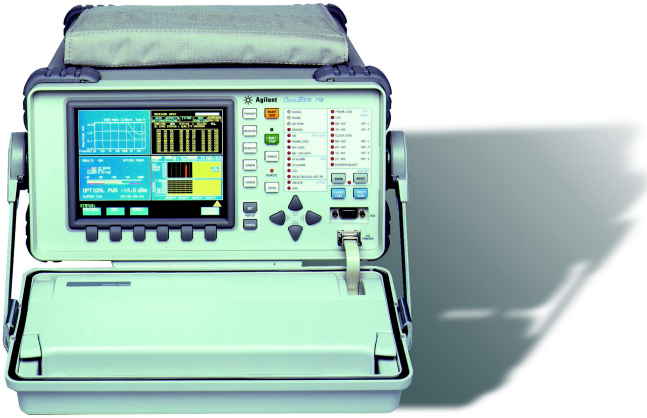
ITU-T O.191 Test Cell

Header	Sequence number	Time Stamp	Unused	Rev	CRC-16
5	4	4	37	1	2

scrambled $(\times^9 + \times^5 + 1)$

Figure 3.

OmniBER communications performance analyzer

Offers a modular, upgradeable one-box solution for installation, commissioning, and field maintenance. This rugged, portable tester allows comprehensive functional testing of SDH, PDH and ATM equipment including jitter generation and test. A 3.5-inch disk drive eases results retrieval, test firmware upgrades, and analysis.

Related Literature

The complete global tester to 2.5 Gb/s (OmniBER 718) 5968-8740E

OmniBER 718 technical specification 5968-8335E

OmniBER 718 configuration guide 5968-8012E

OmniBER product note:
Verifying the policing functions in the ATM network
5968-9884E

OmniBER product note:
Physical layer jitter testing in an ATM environment
5968-9883E

OmniBER product note:
ATM error performance testing
5968-9885E

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