Round Trip Delay with Victoria Combo

Delay measurements are necessary in order to quantify the time it takes for digital signals to reach their destination. Delays appear in long paths, but they can also be found in transit between the ports of different nodes in a PDH or SDH network.

Application Note *Combo RTD*

Testing the World's Digital Networks

TrendCommunications

Introduction

Delays in the time it takes for a signal to reach its destination are due to two factors: long paths and transit times through the network elements. Delay due to long paths depends on the design of the overall link. The transit time in network elements is due to the processing of signal frames inside these elements, for example, reconstructing the frames in multiplexers, exchanging VCs in the DXC etc). Data communications are particularly sensitive to this type of disturbance.

Delays in Long Paths

Delays due to long paths occur most commonly in intercontinental links that include sections via satellite. In these cases, variations in the position of the satellite cause frequency deviations and delays. When the delay exceeds a certain value, synchronization and signalling errors may occur. The connection may not even be made or may be lost during data transmission.

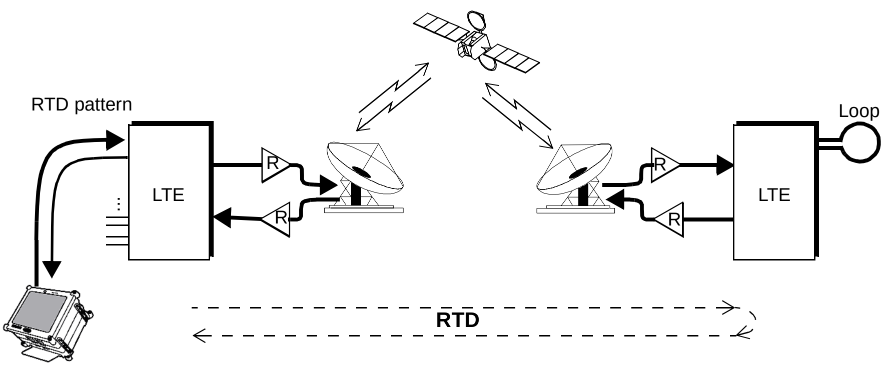

Figure 1 Measuring RTD in a path.

Transit Time in Network Elements

When a link includes several multiplexers and DXCs, a noticeable delay may occur that is greater than the maximum recommended limits. The transit delay introduced by these network elements depends on the processing they perform on the signals they receive. For example, in an ADM the delay between the input of an STM-1 aggregated signal and the output of one of its 2 Mbit/s tributaries through the corresponding port may be around 75 µs. Every network element adds delay to the signal it processes.

QUANTIFYING THE DELAY

ITU-T recommendation G.114 stipulates the maximum tolerable delay between the ends of a connection for the processing time. It does not include the part of the total delay that is due to the time it takes for the signal to reach its destination. This delay depends on the rate of the signal transmitted, the media and the distance, and can only be controlled in a limited way by the network planners.

Table 1
Limits for end-to-end transmission time (ITU-T Rec. G.114).

One Direction Delay	*Application*
0 to 150 ms	Acceptable for most user applications
150 to 400 ms	Acceptable if the delay influence on the performance of the user applications is known (for example, connections with a satellite hop)
> 400 ms	Unacceptable

In exceptional cases, times of more than 400 ms can be accepted; for example, in double satellite hops, when satellites are used to restore terrestrial routes, interconnection of fixed satellite service, cellular telephony, etc. It is recommended that the one way processing time from multiplexers, DXCs and other network elements from each national system, and the chain of circuits in an international connection should be limited to 50 ms; although in real cases it tends to be much less (for example, around 6 ms for a national system and 3 ms for the international chain).

CALIBRATING THE MEASUREMENT DEVICE

In order to make sure that the measurement is correct, the measurement device must be calibrated so that it subtracts the delay caused by its own internal circuits. For this reason, delay must be measured when the input and output have been connected via a short loop. The value obtained must then be subtracted from the delay measured in the path or network element to obtain the correct measurement. It may also be necessary to subtract the delay added by external elements from the measurement to be made, for example, to eliminate the delay introduced by line terminal equipment. In this case, the loop must be set up between the input and output of these external elements, see Figure 2 on page 4.

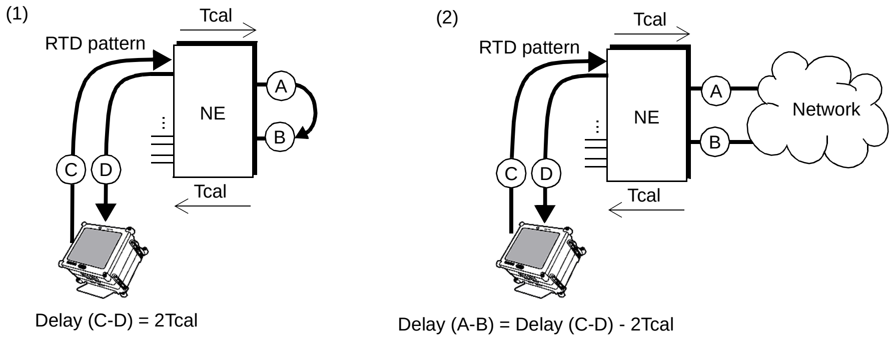

Figure 2 Generic calibration process and measurement of delay between A and B; (1) measuring delay introduced by the NE and the tester; (2) measuring delay between A and B from points C-D.

Victoria Combo incorporates the measurement of round trip delay as one of its functions. The range of delays it can measure is from 1 µs to 10 s. To subtract the delay due to the internal circuits Victoria Combo can easily be calibrated by touching the **Calibrate** button.

You can also enter a known offset value can using the alphanumerical keyboard on Victoria Combo's screen.

MEASURING A ROUND TRIP DELAY

When the Round Trip Delay function, or any other function is running, the tester will not perform any other measurement until the function has finished.Victoria Combo will not run more than one function at the same time.

1. Touch the main menu button ().
2. From the main menu choose the module you want to perform the RTD on.

3. Choose **Functions**, then **Round Trip Delay** and then **Open**.
   The **Round Trip Delay** window is displayed.

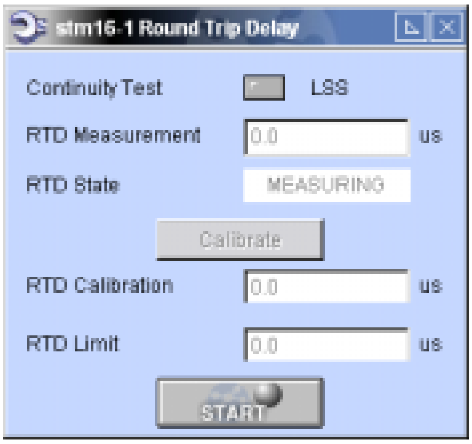

Figure 3 The Round Trip Delay window

4. To start the RTD measurement, touch **Start**.
   The value of the RTD is displayed in the **RTD Measurement** field.
5. This measurement is performed repeatedly, therefore when you have finished with this function you must stop it - touch **Stop**.

   An **LSS** (Loss of Sequence Synchronization) alarm LED indicates whether there is a continuity problem with the line being tested.

   The **RTD State** field display status information about the measurement. The different RTD status messages are:

- *OK* - the measurement displayed is valid
- *MEASURING* - the measurement displayed is valid but a new measurement has started
- *IDLE* - configuring or waiting for a control pattern that is lost: for example when a LOS occurs during the RTD measurement
- *TIMEOUT* - the *IDLE* state has existed for a long time

If you enter a value in the **RTD Calibration** field and touch **Calibrate**, this value will be subtracted from the measured value and sets the tester to zero before an RTD measurement. Ffor example, if you make an RTD measurement with the tester looped back, and calibrate it using this RTD measurement, the delay due to internal circuits of the tester will be subtracted from the next measurement result. You can enter the maximum acceptable RTD by entering a value in **RTD Limit** so that you compare it with the measured value. Note that the values of **RTD Measurement**, **RTD Calibration** and **RTD Limit** are all expressed in microseconds (µs).

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