

MEASURING TIME AND TIME-RELATED ASPECTS OF SPACEWIRE

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Short Paper

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Many companies in the space industry measure time and other related parameters in order to find out how well their products and systems work. This paper describes some of the time-related measurements that are available to SpaceWire users.

An obvious and simple measurement is the bit-rate that the equipment under test (EUT) is sending. This can be seen on the front-panel display of the test equipment, or alternatively accessed over the Internet, possibly from across an ocean.

Measurement of packet duration with Time Tags indicates whether the packet was received contiguously or whether Null characters were inserted and hence bandwidth reduced.

Time Tags can also be used to measure latency or delay. A time tag can be generated at start of transmission and when EoP is received. Latency is relevant for both nodes and routing switches — and indeed for an entire network to determine if the overall performance meets expectations.

As well as measuring time, it is useful to determine the operating margins of the EUT's SpaceWire Receiver. Equipment is available with 1Mbit/s steps in transmit speed up to 400Mbits/s to find the limits of operation.

The arbiters in SpaceWire routing switches need to work with asynchronous inputs from the different ports. For full testing of the function of such arbiters, it is necessary to have multiple packets arriving at the same time. Test equipment is available that produces synchronized packets over any or all of the output ports.

Modular SpaceWire test units can be joined together, so that time tagging can be consistent (to less than a bit-period at normal SpaceWire speeds), and so that outputs can be synchronized, across an entire SpaceWire network.

The paper will expand each of these measurement techniques, giving examples of how they are performed together with typical results of the measurements. Put together, the techniques enable quality to be assured, risk to be mitigated, and costs of under and over-engineering to be seen and corrected.