

THE SPACEWIRE LINK ANALYSER Mk2

Session: SpaceWire test and verification

Short paper

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ABSTRACT

The STAR-Dundee SpaceWire Link Analyser Mk2 is a key piece of equipment when performing test, validation and verification of a SpaceWire [1] system. The analyser sits between two SpaceWire devices and monitors traffic in both directions of the link providing the user with the functionality to monitor, record and analyse SpaceWire traffic. The new features of the SpaceWire Link Analyser Mk2 make it an invaluable tool when testing, debugging, validating or verifying any type of SpaceWire equipment.

INTRODUCTION

The SpaceWire Link Analyser Mk2 is the second generation of the STAR-Dundee link analysis solutions [2] and is designed to specifically support the testing and debugging of SpaceWire systems by providing a rich set of test functionality. The analyser benefits from increased traffic storage capacity which is up to 2000 times the capacity of the original analyser allowing millions of events to be stored in both directions of the link. RMAP and custom protocol analysis is supported, considerably reducing the effort required to capture and analyse RMAP traffic. Trigger in and trigger out ports can be configured to allow interaction with external equipment and provide a trigger source for an external scope or logic analyser. The analyser also has a Mictor breakout port which makes decoded SpaceWire traffic available to an external logic analyser.

The analyser is provided with a comprehensive set of software including an easy to use graphical user interface with context sensitive help and a new analysis API. This API exposes the full set of analysis features to automated user test suites where analysis can be coordinated with other test equipment.

OVERVIEW

The SpaceWire Link Analyser Mk2 hardware unit is depicted in Figure 1 and an example setup of the analyser is depicted in Figure 2.



Figure 1 SpaceWire link analyser hardware unit

On the front panel are two SpaceWire ports, input and output trigger connectors and status LEDs for the ports and triggers. To use the analyser a SpaceWire cable is connected from each device to be monitored and to the analyser. The link analyser buffers the LVDS signals internally and analysis is unobtrusive. A new feature of the analyser is the inclusion of an input trigger and an output trigger to allow cross triggering and synchronisation with other external EGSE equipment. Link status, error and data transfer information is provided by the SpaceWire status LEDs and trigger activity is provided by the trigger LEDs.

A Mictor connector is provided on the rear panel of the Link Analyser Mk2 to allow the analyser to be connected directly to a Logic Analyser. The SpaceWire traffic in each direction of the link is decoded into a set of characters which are provided on the logic analyser connector. The analyser connects to a host PC through the USB 2.0 interface and is powered by a provided 5V power brick.

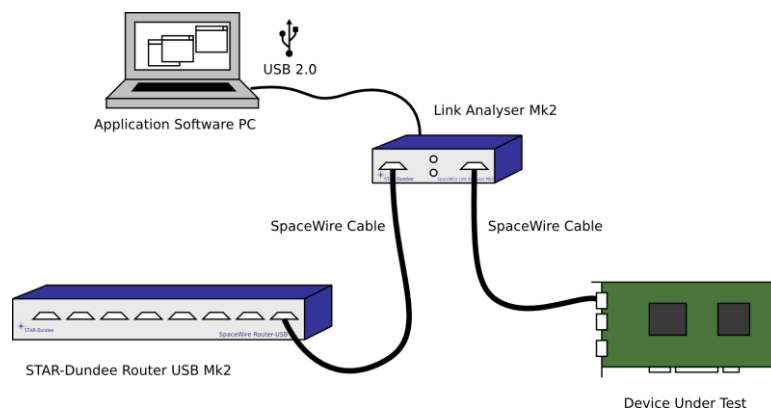


Figure 2 SpaceWire Link Analyser Mk2 example configuration

The analysis software which runs on the Application Software PC supports Windows (7, Vista, XP and 2000) and Linux (2.6 kernel) systems.

FUNCTIONALITY

The link analyser operates using a trigger to capture an event and a storage memory to capture the data which occurs before and after an event. The analyser software is used to setup the trigger condition, start and stop the analyser's trigger, monitor the trigger status and display the stored data when the trigger occurred. The link analyser also has a status monitoring function which provides an updating display, updated once per second, of the traffic on the SpaceWire link.

The analyser trigger condition can be set to capture one or more events on the link including: link errors, NULL, FCT and data characters or data packet comparators. A sequence of up to eight triggers can be set. Dependent on the debugging level the analyser can be configured to capture all link characters or can be set-up to filter out link control characters and only capture data. This greatly increases the amount of data storage available.

When the trigger condition has been met, and data has been stored in the analyser's deep internal memory, the data can be viewed using the analyser's extensive SpaceWire traffic displays including: a character level display which displays all link control, error and data information; a packet level display which can display raw data or protocol encoded traffic; and a bit level display which displays the raw data-strobe bits around the trigger condition at a resolution of 1.25 ns per sample. A new search feature has been added to the software providing the ability to quickly find information in the large storage memory. The character level and packet level displays are illustrated in Figure 3.

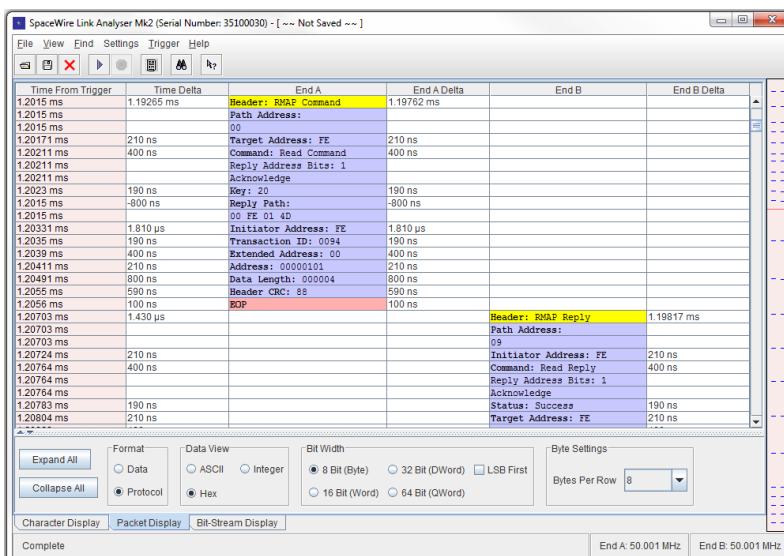
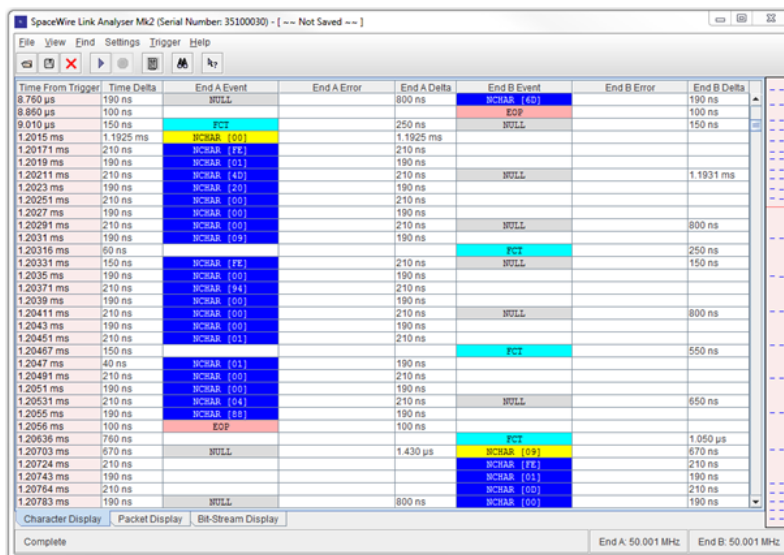


Figure 3 Character level and Packet level displays

Offline analysis is supported using the save and storage functions of the software. Recorded data can be saved in Link Analyser format for future analysis or saved to a text format file for display in other software tools. The software is also capable of saving raw N-Char data values (excluding EOPs and EEPs).

The functionality available in the Link Analyser software is replicated in an easy to use Application Programming Interface. For EGSE purposes the collection and analysis of the operation of the SpaceWire links often needs to be automated and coordinated with the operation of other test equipment. To support this, the Link Analyser Mk2 is provided with an API for C.

PERFORMANCE AND RESULTS

The SpaceWire link analyser Mk2 is capable of monitoring links running up to 400 Mbit/s and the bit-stream level display is capable of capturing data-strobe bit transitions at a rate of 1.25 ns (800 MHz).

The storage capacity of the link analyser has been greatly increased and up to 16 Million (16 Mebi) events can be captured using the C API and 1 million (1 Mebi) events in the software user application.

CONCLUSION

The new features of the SpaceWire Link Analyser Mk2 make it an invaluable tool when testing, debugging, validating or verifying any type of SpaceWire equipment.

REFERENCES

- [1] European Cooperation for Space Standardization, Standard ECSS-E-ST-50-12C, "SpaceWire – Link, Nodes, Routers and Networks", European Cooperation for Space Standardization, July 2008.
- [2] S. M. Parkes, C. McClements, S. J. Mills and I. Martin, "SpaceWire: IP, components, development support and test equipment", DASIA Data Systems in Aerospace, SP-532, Prague, Czech Republic, June 2003