ARINC 664 PART 7
Product Overview

The AIT family of ARINC 664 Test & Simulation products provide solutions supporting both the conventional 10/100 Mbit/s ARINC 664 Ethernet interfaces as well as the next generation 1 Gbit/s Ethernet interface supporting the widest range of existing and emerging ARINC 664 and Ethernet Test & Simulation application requirements.

ARINC 664 TEST INSTRUMENTS

The AIT ARINC 664 Test & Simulation instruments are capable of supporting the simulation of multiple ARINC 664 End Systems on a single hardware module.

All of the ARINC 664 Test & Simulation modules utilize an FPGA based architecture, with multiple embedded processors, in order to support protocol error injection and to off load all upper layer protocol processing (ARINC 653, UDP, IP) from the host system. All ARINC 664 protocol operations, including VL traffic shaping, redundancy management, and IP fragmentation and reassembly, are handled onboard. Additionally, all modules use DMA to provide optimal data throughput.

COMPLETE & ROBUST SOFTWARE SUPPORT

Software support for Windows, Linux, VxWorks, and LabVIEW Real-Time is provided with the ARINC 664 Software Development Kit (SDK). Configuration of simulated End Systems is made easy with AIT's simple and intuitive XML based configuration data and *Flight Simulyzer*™ GUI application.

NEW FEATURES

- IRIG-B Time Synchronization
- Provides network statistics including VL message counts and data rates
- Automatic message sequencing & periodic data generated onboard
- Capture and timestamp all transmitted Ethernet data with transmit loopback

KEY FEATURES

- Supports IEEE 802.3 10/100/1000 Mbit/s Full-Duplex Ethernet links
- Utilizes SFPs to support both copper and optical interfaces
- Simulates multiple ARINC 664 End Systems, including VL traffic shaping and input VL redundancy management
- Standard Ethernet operations simultaneous to ARINC 664 operations
- Supports up to 128 Output VLs and 512 Input VLs
- Supports up to 1024 Sampling & Queuing output message ports and up to 4096 input Sampling & Queuing message ports
- Upper layer protocol handling (A653, UDP, IP) managed onboard
- Provides DMA for high data rate applications
- Time-stamping of all received messages with 8 nS resolution
- Optional "promiscuous" mode allows capture of all network traffic for protocol analysis and data logging applications
- Windows XP/7/8, Linux, VxWorks and LabVIEW Real Time Drivers & APIs provided (other OS support on request)
- Easy setup and configuration using AIT's *Flight Simulyzer*™ GUI and ARINC 664 End System configuration tools

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ARINC 664 OUTPUT OPERATIONS

The AIT ARINC 664 modules allow the simulation of multiple ARINC 664 End Systems. The modules can be configured to handle ARINC 664 VL traffic shaping for up to 128 output VLs. For each VL the source (MAC) address is individually configurable allowing output traffic to emulate multiple source End Systems.

The IP, UDP, and ARINC 653 upper protocol layers are fully managed on-board. IP fragmentation is managed by the module, as well as VL sequence numbers and redundant data transmission, with no additional host loading.

The configuration and use of up to 1024 output message ports is supported. The message ports can be configured as ARINC 653 Sampling & Queuing ports, UDP Service Access Ports (SAP), IP Ports, or MAC ports providing access to all protocol layers in support error injection and flexible output operations.

Optionally, the modules may be used in a replay mode to re-transmit previously captured network traffic from standard industry capture files (PCAP).

In addition to ARINC 664 output operations, the ARINC 664 modules also support the simultaneous output of standard Ethernet frames.
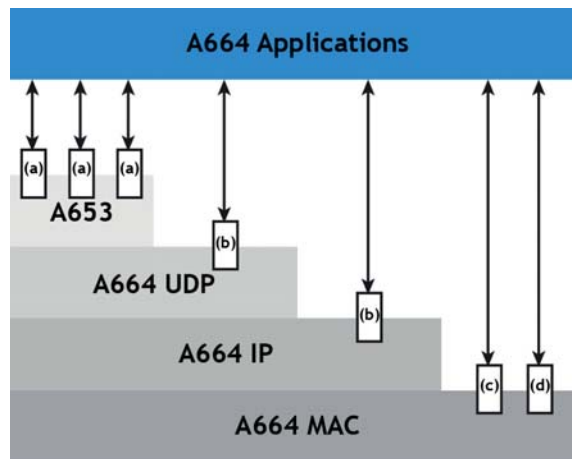
ARINC 664 INPUT OPERATIONS

The AIT ARINC 664 modules provide full onboard support for ARINC 664 integrity checking and redundancy management operations. These operations can be individually configured for each input VL, providing a flexible approach that supports a wide variety of data acquisition and analysis applications. In addition to supporting up to 512 input VL's the modules can also be configured to operate in promiscuous mode to capture all network traffic. All captured data is time tagged with 8 nS resolution.

The IP, UDP, and ARINC 653 upper protocol layers are fully managed onboard. IP reassembly is fully managed by the module and requires no host loading or memory resources. The module supports up to 4096 input message ports. Each message port can be configured as ARINC 653 Sampling & Queuing ports, UDP Service Access Ports (SAP), IP Ports, or MAC ports providing the test application a flexible approach, allowing error detection and access to all protocol layers . The incoming messages to each port are buffered on-board and require no host resources.

ARINC 664 ONBOARD PROTOCOL STACK

All of the AIT ARINC 664 modules provide full onboard support for the Ethernet MAC, IP, UDP, and ARINC 653 Sampling & Queuing protocol layers. No host resources are used for protocol overhead such as IP fragmentation and reassembly. All data can be buffered onboard requiring host interaction only when the application program wishes to read the latest data or write updated output. Additionally, the user application has access to all protocol layers providing a flexible approach to support a wide variety of test application requirements.

(a) Sampling & Queuing Comm Ports (A653)
(b) UDP Service Access Point (SAP)
(c) MAC SAP
(d) COTS Ethernet

ARINC 664 PART 7 TEST & SIMULATION HARDWARE MODULES

MODEL	FORM FACTOR	KEY FEATURES
PCI-C664-V2	PCI / PCI-X	• Supports IEEE 802.3 10/100/1000 Mbit/s Full-Duplex Ethernet links • Utilizes SFP's to support both copper and optical interfaces • IRIG-B Time Synchronization • Provides network statistics including VL message counts and data rates
PCIe-C664-V2	PCI Express	• Automatic message sequencing & periodic data generated onboard • Capture and timestamp all transmitted Ethernet data with transmit loopback • Standard Ethernet operations simultaneous to ARINC 664 operations
XMC-664-V2	XMC	• Supports up to 128 Output VLs and 512 Input VLs • Supports up to 1024 Sampling & Queuing output message ports and up to 4096 input Sampling & Queuing message ports
PXIe-C664-V2	PXI Express	Additional PXI features: • LabVIEW Real Time Drivers and APIs • PXI trigger & clock synchronization
PMC-664	PMC	• Supports IEEE 802.3 10/100/1000 Mbit/s Full-Duplex Ethernet links • Simulates multiple ARINC 664 End Systems, including VL traffic shaping and input VL redundancy management

NETWORK DEVELOPMENT SWITCHES

MODEL	SWITCHING CAPABILITY	DESCRIPTION
24 Port	10/100/1000 Mbps	ARINC 664 Network Development Switch • 4096 Virtual Links (VL) support • Support for up to four priorities • BAG range 0.5 to 1600ms • Concurrent operation of ARINC 664p7

AIT's ARINC 664 SOFTWARE DEVELOPMENT KIT

AIT's ARINC 664 ES SDK provides a complete suite of ARINC 664 software API's and ARINC 664 and Ethernet ES configuration tools to support intuitive and efficient development and integration of ARINC 664 applications.

MULTIPLE OPERATING SYSTEMS

The ARINC 664 SDK provides Drivers and APIs for a variety of Operating System platforms:

- Microsoft Windows XP and Windows 7
- Linux
- VxWorks
- LabVIEW Real-Time
- Other RTOS's on request (LynxOS, Integrity, …)

ARINC 664 END SYSTEM API

At the core of the ARINC 664 ES SDK is the A664 ES API. The ES API is a standard C API which provides read/write access to the messaging port interfaces of the ARINC 664 ES hardware modules. Applications utilize this API to send and receive data from Sampling & Queuing ports. Additionally, the ES API provides access to standard UDP ports and also allows access directly to the IP and MAC layers.
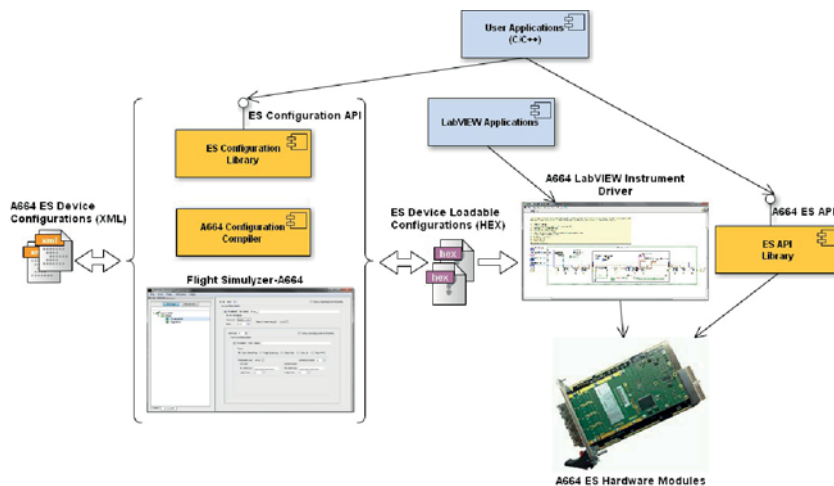
LabVIEW Real-Time INSTRUMENT DRIVER

The ARINC 664 SDK includes AIT's ARINC 664 LabVIEW Instrument Driver which is an easy to use LabVIEW VI interface to the features and functions of the ARINC 664 modules. The LabVIEW instrument driver is capable of importing and utilizing the complex ARINC 664 network configurations created using the End System Configuration Tools.

END SYSTEM CONFIGURATION TOOLS

In all ARINC 664 networks, to achieve optimal performance and deterministic operations, all network components (End Systems & Switches) must be statically configured prior to the beginning of operations. The ARINC 664 configurations are complex and composed of large amounts of data parameters needed to configure the multiple associated protocol layers, including A664 VLs, IP, UDP, and A653 message ports.

The AIT ARINC 664 ES Configuration Tools provide a simple, yet flexible, approach to configuring the ARINC 664 End Systems. Based on a core ARINC 664 ES XML schema, the ES Configuration Tools provide the application developer several options for creating ARINC 664 ES device configurations.

- The A664 Configuration Compiler is a command line application which compiles ARINC 664 ES XML configurations into loanable device configurations
- The A664 ES Configuration Library provides an object oriented (C++) API which can be used to programatically create the ARINC 664 ES configurations
- *Flight Simulyzer*™ (A664) provides a Windows GUI application that allows users to create ARINC 664 ES configurations using a common Windows user interface application