IA3 - MIL-STD 1553B

This course covers the 1553 military bus

Objectives

- The bus topology is explained.
- The various bus standards are described, mainly focusing on 1553B and 1553C.
- Bus frames are studied field per field.
- The architecture of a 1553 coupler is described.
- The course describes testing, covering the MIL-HDBK-1553A.
- The course details the software interface necessary to control the coupler.
- This course has been delivered several times to companies developing defense/avionics equipments.

A more detailed course description is available on request at formation@ac6-formation.com

Prerequisites

- Basic knowledge of a processor or DSP.

Environnement du cours

- Cours théorique
  - Support de cours au format PDF (en anglais) et une version imprimée lors des sessions en présentiel
  - Cours dispensé via le système de visioconférence Teams (si à distance)
  - Le formateur répond aux questions des stagiaires en direct pendant la formation et fournit une assistance technique et pédagogique
- Au début de chaque demi-journée une période est réservée à une interaction avec les stagiaires pour s'assurer que le cours répond à leurs attentes et l'adapter si nécessaire

Audience visée

- Tout ingénieur ou technicien en systèmes embarqués possédant les prérequis ci-dessus.

Plan du cours

INTRODUCTION

- History
- Utilization domain
- Objectives of this bus
- Protocol overview
- The 3 node types: BC, RT and BM
- Differences between 1553, 1553A, 1553B, and 1553C
- Multiplex selection criteria

PHYSICAL LAYER

- Introduction to differential transmission
- 1553B transmission medium
- Stubbing
- Connecting a terminal to a backbone, long stub

- Connection a terminal to a backbone, short stub
- Multi-stub couplers
- Terminal electrical characteristics

LINK LAYER

- Terminal operation
- Manchester bi-phase coding scheme
- Word formats, SYNC pattern
- Word validation
- Command word detail
- Data word detail
- Status word detail, studying various sequences in order to explain Status flags
- Terminal architecture, word controller, message controller, frame controller

MESSAGE FORMATS

- Remote Terminal operation, assigning an address
- The 10 message types
- Point-to-point messages
- Broadcast messages
- Studying various sequences explaining the way of transferring data from terminal to terminal
- Message timings, taking into account the round-trip delay
- Illegal commands vs invalid commands

MODE CODES

- Management messages
- Command format, subaddress specific usage
- Mode codes supporting data
- Dynamic bus control
- Synchronize commands, usage to implement a heardbeat
- Transmit Status word and Transmit Last command use cases
- Interface with self tests in both RT and subsystems
- Transmitter shutdown commands used in redundant systems

SYSTEM ISSUES

- Using subaddress
- Double buffering
- Framing in the BC to support both periodic transfers and asynchronous transfers

REDUNDANT DATA BUS REQUIREMENTS

- Electrical isolation
- Dual standby redundant data bus operation
- Superseding commands
- High reliability requirements

TESTING

- Test plans described in 1553A handbook
- Using an analyzer to capture traffic
- Generating traffic to check how the system react in case of errors
- Data wrap around mechanism, remote loopback test