RMAP Draft F
Corrections and Clarifications from Draft E

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Contents

- CRC
- Minor corrections and clarifications

RMAP CRC

- Original suggestion was based on serial data stream
- SpaceWire CRC does not run on serial data stream
- Intention in standard was to have:
  - CRC run on byte stream
  - CRC calculated MS bit first since most natural mathematically
    - i.e. avoided having to swap the data bytes round
- VHDL code and C-code examples added (informative)
- Examples CRC values added to RMAP Use Case section (informative)

RMAP CRC Problem

- Not specifically stated MS bit first
- VHDL code and C-code examples were informative and could possibly be interpreted either way
- There were two cut-and-paste errors in the example CRC values and these were informative

RMAP Testing

- ESA tested two separate implementations of RMAP
- Found that they did not talk to one another
- Investigation revealed one MS bit first the other LS bit first
- One checked out against the informative examples (except the cut-paste errors)
- The other gave completely different answers

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RMAP CRC Modification

- Substantial investigation of problem
  - When CRC run on serial data
  - Burst error protection given when first bit processed first
  - LS bit is sent first in SpaceWire
  - RMAP CRC does not operate on serial data
  - No burst error benefit gained from RMAP CRC (either LS or MS first)
- Analysis of technical audit trail
  - Had been agreed to adopt original proposed CRC (LS bit first)
  - No notification of a change to this decision was made
  - Standard was ambiguous
  - Informative information was not completely correct
- Decided to change to LS bit first

Separate CRC Algorithm Definition

- Section 6.2 Definitions
- CRC definition clarification to avoid ambiguity
- CRC algorithm information put in separate CRC definition
- CRC calculated on byte stream NOT serial bit stream
  - Since RMAP protocol operates above SpaceWire packet level
- Equivalent serial representation
  - Takes least significant bit first
  - Does not include data/control or parity bits, nulls, FCT or other non-data characters

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CRC Test Patterns

- Section 6.2, Definitions
- Three CRC test patterns added

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VHDL and C-code Examples

- Section 6.11, Annex A
- Informative CRC implementation examples in VHDL and C-code
- Updated to clarify that the CRC is calculated least-significant bit first

Lessons Learnt

- Read and use the informative parts of the standard
  - They are written to help
- Participate directly in the SpaceWire working group
  - If you are working on SpaceWire implementations
  - Do not leave this to someone else
  - The group is here to support direct communications
- Look out for changes to the draft standards
  - Understand them
  - Look beyond them for potential problems and misunderstandings
  - Let SpaceWire working group know

Minor Corrections and Clarifications

Number Representation

- Section 6.1.3 Nomenclature
- New section inserted.
- Describing how hexadecimal and binary numbers are represented.
- Hexadecimal: 0x34, 0xde3a, etc
- Binary: 01001011b, 01b, etc

Definition Order

- Section 6.2, Definitions
- Sentence explaining the order of the definitions added at the beginning of this section
- The following definitions are presented in the order in which the respective fields are found in the RMAP commands and replies.

Source Path Address Definition

- Section 6.2, Definitions
- Clarification, in the form of some examples, has been added to the definition of the Source Path Address in section 6.2 Definitions.

Data CRC always present

- Section 6.3.1 Write Command Format
- Section 6.4.2 Read Reply Format
- Section 6.5.1 Data/Mask CRC
- Section 6.5.2 Data CRC
- Extra text added stating:
- Note that the data CRC is always present. When there is no data (data length is zero) the data CRC is set to 0x00.

Replies with Data Length of Zero

- Section 6.5.4, RMW reply format, path addressing, Figure 6.23
- Replies can have a data length of zero
- So 0x000000 is allowed in the data length field
- Text was correct
- Figure 6.23 updated to include replies with data length of 0x000000
- Text and figure now consistent

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Error Code Definition

- Section 6.6, Error Codes, Table 6-1
- Definitions of error codes 2 and 7 clarified
- Error code 2
  - Unused RMAP Packet Type or Command Code
  - The header CRC was decoded correctly but the packet type is reserved or the command is not used by the RMAP protocol. No reply should be sent if the ACK bit is not set.
- Error code 7
  - EEP
  - EEP marker detected at or before the end of the data. Indicates that there was a communication failure of some sort on the network.

ECSS Standardization

- Important that ECSS standardization process is started as soon as possible
- Several chips have been and are being designed to a draft standard
- ECSS should be persuaded that Protocol IDs and RMAP need to be standardised now