

Table of contents

- European Foreword.....7**
- 1 Scope.....8**
- 2 Normative references9**
- 3 Terms, definitions and abbreviated terms..... 10**
 - 3.1 Terms from other standards..... 10
 - 3.2 Terms specific to the present standard 10
 - 3.3 Abbreviated terms.....20
 - 3.4 Conventions.....21
 - 3.4.1 Numbers21
 - 3.4.2 Differential signals.....21
 - 3.4.3 Order of sending bits in symbols21
 - 3.4.4 Graphical representation of packets22
 - 3.4.5 State diagram notation22
 - 3.4.6 UML diagram notation.....23
 - 3.5 Nomenclature24
- 4 Overview of SpaceWire.....25**
 - 4.1 Introduction.....25
 - 4.2 SpaceWire Spacecraft Data-Handling Network.....25
 - 4.2.1 The Rationale for SpaceWire25
 - 4.2.2 Example SpaceWire Application26
 - 4.2.3 How SpaceWire Works28
- 5 Requirements.....33**
 - 5.1 Overview33
 - 5.2 Protocol stack and interface architecture33
 - 5.2.1 Protocol stack33
 - 5.2.2 Network layer34
 - 5.2.3 Data Link layer34
 - 5.2.4 Encoding layer35
 - 5.2.5 Physical layer35

5.2.6	Management Information Base	36
5.2.7	Service interfaces	36
5.2.8	SpaceWire Port architecture	36
5.3	Physical layer	37
5.3.1	Introduction	37
5.3.2	Cables.....	38
5.3.3	Connectors	41
5.3.4	Cable assemblies.....	45
5.3.5	PCB tracks.....	50
5.3.6	Line drivers and receivers	51
5.3.7	Data-Strobe skew	59
5.3.8	Physical layer management parameters	62
5.4	Encoding layer.....	63
5.4.1	Introduction	63
5.4.2	Serialisation and de-serialisation.....	63
5.4.3	Character and control code encoding.....	63
5.4.4	Data strobe encoding and decoding.....	66
5.4.5	First Null.....	68
5.4.6	Null detection	68
5.4.7	Parity error	69
5.4.8	Disconnect.....	69
5.4.9	ESC error.....	69
5.4.10	Data signalling rate	70
5.4.11	Encoding layer management parameters.....	71
5.5	Data link layer.....	71
5.5.1	Introduction	71
5.5.2	Data link layer interfaces.....	71
5.5.3	Data link layer management interface	72
5.5.4	Flow control.....	73
5.5.5	Flow control errors	74
5.5.6	Sending priority	75
5.5.7	Link initialisation behaviour	75
5.5.8	Link error recovery	80
5.5.9	Accepting broadcast codes for sending.....	82
5.6	SpaceWire network layer.....	82
5.6.1	Introduction	82
5.6.2	SpaceWire packets	83

5.6.3	Broadcast codes	83
5.6.4	SpaceWire time-codes	84
5.6.5	SpaceWire distributed interrupts	87
5.6.6	SpaceWire nodes.....	94
5.6.7	SpaceWire node management parameters	96
5.6.8	SpaceWire routing.....	96
5.6.9	SpaceWire routing switch management parameters	104
5.6.10	SpaceWire network.....	104
5.7	SpaceWire management information base	106
5.7.1	Introduction	106
5.7.2	General	106
5.7.3	Physical layer management parameters	106
5.7.4	Encoding layer management parameters.....	106
5.7.5	Data link layer management parameters.....	106
5.7.6	Network layer management parameters.....	106
6	Service interfaces	107
6.1	Network layer service interface	107
6.1.1	Packet service interface	107
6.1.2	Time-code service interface	108
6.1.3	Distributed interrupt service interface	109
6.2	Data link layer service interface	111
6.2.1	N-Char service interface.....	111
6.2.2	Broadcast code service interface	113
6.3	Encoding layer service interface	114
6.3.1	Encoding service interface	114
6.3.2	Decoding service interface.....	115
6.4	Physical layer service interface.....	117
6.4.1	Line transmit service interface.....	117
6.4.2	Line receive service interface.....	118
6.5	Management information base service interface.....	119
6.5.1	Set parameter service interface.....	119
6.5.2	Get parameter service interface	119
	Annex A (informative) Technical Changes.....	121
	Bibliography.....	123

Figures

Figure 3-1: Convention for first bit to be sent	21
Figure 3-2: Graphical packet notation.....	22
Figure 3-3: State diagram style.....	22
Figure 3-4: UML notation.....	23
Figure 4-1: Example SpaceWire Architecture without redundancy	27
Figure 4-2: SpaceWire Packet Format.....	29
Figure 4-3: Path Addressing	31
Figure 4-4 Logical Addressing	32
Figure 5-1: SpaceWire protocol stack.....	34
Figure 5-2: SpaceWire port architecture	37
Figure 5-3: SpaceWire connector contact identification	44
Figure 5-4: SpaceWire cable assembly Type A	47
Figure 5-5: SpaceWire cable assembly Type AL	49
Figure 5-6: SpaceWire LVDS	53
Figure 5-7: LVDS line driver output signals.....	54
Figure 5-8: LVDS line driver differential output signal	56
Figure 5-9: Physical layer components.....	59
Figure 5-10: Skew and jitter.....	62
Figure 5-11: Data character encoding	64
Figure 5-12: Control character encoding	65
Figure 5-13: Null control code encoding	65
Figure 5-14: Broadcast code encoding	66
Figure 5-15: Parity coverage	66
Figure 5-16: Data-Strobe (DS) encoding	67
Figure 5-17: Data and strobe signals for first Null.....	68
Figure 5-18: Null detection sequence	69
Figure 5-19: Link initialisation behaviour.....	76
Figure 5-20: Link error recovery behaviour	81
Figure 5-21: SpaceWire packet format	83
Figure 5-22: Specialisations and relationships of a SpaceWire broadcast code	84
Figure 5-23 Network layer time-code.....	85
Figure 5-24: Network layer interrupt	88
Figure 5-25: Network layer interrupt acknowledgement code	89
Figure 5-26: Components and specialisations of a SpaceWire node	95
Figure 5-27: Components of a SpaceWire routing switch	97
Figure 5-28: Components of a SpaceWire network	105

Tables

Table 5-1: Constants for a SpW cable using 28 AWG differential pairs	39
Table 5-2: Insertion loss values 28AWG SpW cable.....	40
Table 5-3: Constants for a SpaceWire cable using 26 AWG differential pairs.....	40
Table 5-4: Insertion loss values for 26 AWG SpaceWire cable.....	40
Table 5-5: Cable PSNEXT specification	41
Table 5-6: Cable PSELFEXT specification	41
Table 5-7: Connector contact identification.....	43
Table 5-8: Cable assembly Type A signal wire connections	47
Table 5-9: Cable assembly Type AL signal wire connections	49
Table 5-10 Example calculation of maximum bit rate.....	61
Table 5-11: Address function.....	99