

DIN EN 16603-50-13:2014-12 (E)

Space engineering - Interface and communication protocol for MIL-STD-1553B data bus onboard spacecraft; English version EN 16603-50-13:2014

Contents	Page
Foreword	7
1 Scope	8
2 Normative references	10
3 Terms, definitions and abbreviated terms	11
3.1 Terms from other standards.....	11
3.2 Terms and definitions to the present standard	11
3.3 Abbreviated terms.....	12
3.4 Conventions.....	13
3.4.1 Bit numbering convention.....	13
3.4.2 Sub-address convention	13
4 Overview	14
4.1 Context.....	14
4.2 Approach	14
4.3 Reference architecture	15
4.3.1 Communication devices architecture.....	15
4.3.2 Mapping on CCSDS/SOIS sub-network layer.....	15
4.3.3 Service model	17
4.3.4 1553 bus topology.....	18
4.4 1553 bus scheduling aspects.....	19
4.4.1 Bus profiling and scheduling	19
4.4.2 Bandwidth pre-allocation.....	21
4.4.3 Implementation of the bus profile	23
4.5 Description of services.....	25
4.5.1 Overview	25
4.5.2 Time service.....	27
4.5.3 Communication Synchronization service.....	31
4.5.4 Distribution and acquisition: Set and Get Data services	34
4.5.5 Data Block Transfer service	41
4.5.6 Terminal Management services	49

5 Physical Layer requirements	50
5.1 Overview	50
5.2 General.....	52
5.3 Data bus characteristics.....	52
5.4 Terminal characteristics	52
5.5 Connectors	53
5.5.1 General	53
5.5.2 Pin allocation for 15-pin.....	54
5.5.3 Pin allocation for remote terminal nominal bus	54
5.6 Transmission method	55
6 Data Link Layer requirements	56
6.1 General.....	56
6.2 Data Words and Messages.....	56
6.2.1 Data word format	56
6.2.2 Messages	58
6.3 Terminal operation.....	59
6.4 Subaddress usage.....	59
6.5 Message retries	59
7 Services definition	61
7.1 Time service	61
7.1.1 TimeData primitive	61
7.1.2 TimeSynchronize primitive	62
7.2 Communication Synchronization service	63
7.2.1 CommunicationSynchronize primitive.....	63
7.3 Set Data service	64
7.3.1 SendData primitive.....	64
7.3.2 ReadStatus primitive	66
7.4 Get Data service.....	67
7.4.1 ReceiveData primitive	67
7.4.2 ReadData primitive.....	69
7.5 Data Block Transfer Service	69
7.5.1 SendData primitive.....	69
8 Protocol specification	71
8.1 Overview	71
8.2 Time service	71
8.2.1 Time Data primitive	71

8.2.2	Time Synchronize primitive	72
8.3	Communication Synchronization service	74
8.3.1	Requirements when the Time Synchronization service is implemented.....	74
8.3.2	Requirements when the Time Synchronization service is not Implemented	75
8.3.3	BC Requirements for Accurate Message Transfer (optional).....	76
8.4	Set Data service	77
8.4.1	BC requirements	77
8.4.2	RT Requirements	77
8.5	Get Data service	77
8.5.1	BC requirements	77
8.5.2	RT requirements	78
8.6	Data Block Transfer service	78
8.6.1	Data Distribution requirements (BC to RT transfer)	78
8.6.2	Data Acquisition requirements (RT to BC transfer).....	83
8.7	Terminal Management services	89
8.7.1	RT monitoring	89
8.7.2	RT Health data word definition	90
8.7.3	Terminal configuration commands	91
8.7.4	Data wrap around	92
9	Test and verification.....	93
9.1	Test specification	93
9.2	Tests traceability.....	93
9.3	Test references.....	93
Annex A (informative)	Tailoring guidelines.....	94
A.1	Scope	94
A.2	Tailoring options and parameters.....	94
A.2.1	Overview.....	94
A.2.2	Step 1: Function and service selection	94
A.2.3	Step 2: Services configuration.....	94
Annex B (informative)	Unreferenced requirements in MIL-STD-1553B	99
Bibliography.....		100
Figures		
Figure 3-1:	Bit numbering convention	13
Figure 4-1:	Architecture of typical communication devices with MIL-STD-1553B I/F.....	16

Figure 4-2: CCSDS/SOIS communication stack architecture.....	16
Figure 4-3: Service model	17
Figure 4-4: 1553 Bus topology.....	18
Figure 4-5: Examples of 1553 bus redundancy scheme	19
Figure 4-6: Process of Bus Profiling	20
Figure 4-7: Example of synchronous access (pre-allocated, populated).....	22
Figure 4-8: Examples of asynchronous access (pre-allocated, unpopulated)	22
Figure 4-9: Typical implementation of 1553 messages sequence on BC.....	23
Figure 4-10: Typical communication frame decomposition on BC	24
Figure 4-11: Services dependencies	26
Figure 4-12: Time Service steps.....	28
Figure 4-13: Time Service	29
Figure 4-14: Time distribution and synchronization.....	30
Figure 4-15: Communication Synchronization scenarios	31
Figure 4-16: Communication Synchronization	32
Figure 4-17: Communication Frame duration adjustment methods.....	33
Figure 4-18: Set Data service	36
Figure 4-19: Get Data service.....	39
Figure 4-20: Data Distribution Transfer, BC to RT.....	45
Figure 4-21: Data Distribution timing with Best Effort QoS.....	45
Figure 4-22: Data Distribution timing with Verified Length QoS	46
Figure 4-23: Data Acquisition Transfer, RT to BC.....	47
Figure 4-24: Data Acquisition timing with Best Effort QoS	48
Figure 4-25: Data Acquisition timing with Verified Length QoS	48
Figure 5-1: Bus connectors for separated BCs or RTs	50
Figure 5-2: Bus connectors for integrated BCs or RTs	51
Figure 5-3: Bus connectors for separated BCs or RTs connected to dual buses	51

Tables

Table 5-1: Pin allocation for 15-pin Bus Controller 1553 Bus Connector.....	53
Table 5-2: Pin allocation for 15-pin Remote Terminal 1553 Bus Connector.....	53
Table 5-3: Pin allocation for 9-pin Bus Controller or Remote Terminal 1553 Bus Connector	54
Table 5-4: Pin allocation for Remote Terminal nominal bus.....	55
Table 6-1: Subaddress allocation	60
Table 7-1: TimeData primitive definition	61
Table 7-2: TimeSynchronize primitive definition.....	62
Table 7-3: CommunicationSynchronize primitive definition.....	63

Table 7-4: SendData primitive definition with predefined transfers (Type I)	64
Table 7-5: SendData primitive definition with pre-allocated bandwidth (Type II)	65
Table 7-6: ReadStatus primitive definition	66
Table 7-7: ReceiveData primitive definition with predefined transfers (Type I).....	67
Table 7-8: ReceiveData primitive definition with pre-allocated bandwidth (Type II).....	68
Table 7-9: ReadData primitive definition	69
Table 7-10: SendData primitive definition for the Data Block Transfer Service	70
Table 8-1: Time Message data words, CCSDS CUC format.....	72
Table 8-2: Communication Frame Synchronization Message Data Word	75
Table 8-3: Layout of the Distribution Transfer Descriptor (BC to RT, SA 27R).....	78
Table 8-4: Layout of the Distribution Transfer Confirmation (BC to RT, SA 27T)	82
Table 8-5: Layout of the Acquisition Transfer Confirmation, ATC (BC to RT, SA 28R)	85
Table 8-6: Layout of the Acquisition Transfer Request, ATR (RT to BC, SA 28T).....	86
Table 8-7: SA 1T: RT_Health & Monitoring data definition.....	90
Table 8-8: RT_Health data definition	91
Table 8-9: SA 1R: Terminal Configuration definition	92
Table 8-10: Reset Services command definition.....	92
Table A-1 : Requirements selection.....	95
Table A-2 : Services configuration.....	96