

IEEE Standard for Adoption of MIPI Alliance Specification for A-PHY Interface (A-PHY) Version 1.0

Developed by the
IEEE Board of Governors Corporate Advisory Group (CAG)

IEEE SA Industry Affiliate Network (IAN)
base specification contributed by MIPI Alliance



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Corporate Advisory Group (BOG/CAG)
of the
IEEE SA Board of Governors

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Abstract: This standard adopts MIPI Alliance—MIPI A-PHY Specification Version 1.0 as an IEEE Standard. The adopted standard provides an asymmetric data link in a point-to-point or daisy-chain topology, with high-speed unidirectional data, embedded bidirectional control data and optional power delivery over a single cable. In this way, it reduces wiring, cost and weight, as high-speed data, control data and optional power share the same physical wiring. For integration with existing network backbones, it complements Ethernet, Controller Area Network (CAN), FlexRay, and other interfaces.

Keywords: 8B/10B PCS, ACMD, ACMP, adoption, advanced driver assistance systems, A-Header, A-Packet, A-Payload, APDLL, A-PHY, APPI, asymmetric, automotive, autonomous driving systems, camera, car noise, Clock Forwarding Service, coaxial cable, Control and Management System Architecture, CSE, CSI, CSI-2, descrambler, Display, DSE, DSI, DSI-2, Duplication Table, Eye Diagram, functional safety, gear, high-speed uni-directional data stream, I2C, I3C, infotainment, inline connectors, IEEE 2977, ISO 26262, jitter, Lidar, Local Functions, long reach, low-speed bi-directional command and control data, MIPI Alliance, Multi-Port, NRZ, optimal wiring cost and weight, Packet Duplication, Packet Forwarding, PAL/CSI-2, PAL/DSI-2, PAL/eDP-DP, PAL/GPIO, PAL/I2C, PAM, PAM16, PAM-X PCS, Phy, Physical layer, PMD, power distribution, power over coax, Power over Differential Line, Profile, protocol adaptation layer, Radar, Routing Table, scrambler, sensor, SerDes, Serial interface, serializer-deserializer, Shielded Differential Pair (SDP), Shielded Parallel Pair (SPP), Shielded Twisted Pair (STP), test modes

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Introduction

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The A-PHY v1.0 specification was developed in 2018–2020 by member companies of the MIPI Alliance and adopted by the MIPI Board of Directors in September 2020. MIPI Alliance is a collaborative global organization serving industries that develop mobile and mobile-influenced devices.

In October 2020 a memorandum of understanding between MIPI Alliance and IEEE was announced, with the purpose of facilitating a MIPI A-PHY v1.0 adoption process within IEEE. IEEE Std 2977 is intended to bring MIPI A-PHY to a broader ecosystem beyond MIPI's membership, which in turn will foster greater interoperability, choice, and economies of scale for the global automotive industry. For IEEE, the contribution of MIPI A-PHY will add a new asymmetric approach to its existing portfolio of IEEE automotive standards.

MIPI A-PHY v1.0 is a long-reach serializer-deserializer (SerDes) physical layer interface for automotive applications, including Advanced Driver-Assistance Systems (ADAS), Automated Driving Systems (ADS), and other surround-sensor applications.

Ongoing development of the A-PHY specification will remain with MIPI Alliance.

Users should note that the only normative reference listed in the Reference clause of this adoption is to Section 4.5 of M-PHY Specification [MIPI08]. The referenced section is provided in Annex B.

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Contents

Figures	ix
Tables	xiii
Release History.....	xvii
1 Introduction	1
1.1 Scope	1
1.1.1 In Scope	1
1.1.2 Out of Scope	1
1.2 Purpose	1
2 Terminology	2
2.1 Use of Special Terms	2
2.2 Definitions	2
2.3 Abbreviations	3
2.4 Acronyms	4
3 References	6
4 Overview	8
5 Architecture	10
5.1 High Level Structure	10
5.2 Profiles	11
5.3 Gears.....	12
5.4 Safety.....	13
6 Interconnect	15
6.1 Lane Configuration.....	15
6.2 Cable Topology	15
6.3 Boundary Conditions.....	16
6.4 S-Parameter Specifications.....	16
6.5 Characterization Conditions	16
6.6 Interconnect Specifications	17
6.6.1 Total Interconnect	18
6.6.2 Cable TLIS (Transmission Line Interconnect Structure).....	18
6.6.2.1 Characteristic Impedance	18
6.6.2.2 Insertion Loss	18
6.6.2.3 Return Loss.....	19
6.6.2.4 Coupling Attenuation.....	20
6.6.2.5 Alien Cable Bundle Crosstalk	22
6.6.3 ENIS (End Node Interconnect Structure)	23
6.6.3.1 Characteristic Impedance	23
6.6.3.2 Insertion Loss	24
6.6.3.3 Return Loss.....	25
6.6.3.4 Mode Conversion	26
6.6.3.5 Receiver Alien Near End Crosstalk.....	26

6.6.4	PCB TLIS (Transmission Line Interconnect Structure) (Informative)	27
6.6.4.1	Characteristic Impedance	28
6.6.4.2	Insertion Loss	28
6.6.4.3	Return Loss	28
6.6.5	Power Distribution	28
6.6.5.1	DC Requirements	28
6.6.5.2	AC Requirements	29
6.6.5.3	Power Over Coax	30
6.6.5.4	Power Over Differential Line	30
6.6.6	Ground Voltage Offset	31
7	EMC Environmental Conditions	32
7.1	RF Ingress	32
7.2	Bulk Current Injection (BCI)	32
7.3	Fast Transient	33
7.4	Alien Cable Bundle Max PSD Level	33
7.5	Car Noise (PSD)	34
8	PHY Layer	35
8.1	Architecture	35
8.1.1	High Level Structure	35
8.1.2	Port Specification Generalization	35
8.1.3	Master/Slave Clocking Schemes	36
8.1.4	PHY Layer Implementation Guidelines	36
8.1.4.1	A-PHY P1 G1/G2 Architecture	36
8.1.4.2	A-PHY P2 G1/G2 Architecture	37
8.1.4.3	A-PHY G3–G5 Architecture	38
8.1.5	PHY-Related A-Packet Fields	40
8.2	RTS	40
8.2.1	PAM-X Payload Data Modulation Assignment by Source	45
8.2.2	Active Message Counter Window	46
8.2.3	Retransmission Request / Ack Types	46
8.2.3.1	Retransmission Request Triggering by the Receiver	47
8.2.3.2	Retransmission Request Handling at TX RTS	48
8.2.3.3	Format of Single/Gap Retransmission Request Sent Over Downlink	48
8.2.4	Time Bounded RTS	50
8.2.5	A-Packet – PHY Related Header/Tail Modifications	51
8.2.5.1	Tx Delay	51
8.2.5.2	Message Counter and Original Indication Bit	51
8.2.5.3	Header CRC (CRC-8)	51
8.2.5.4	A-Packet Tail CRC (CRC-32)	53
8.2.6	Fully Paced A-Packet Stream from TX Data Link Layer to TX RTS	54
8.2.6.1	Max Net Link Rate for 8B/10B PCS	54
8.2.6.2	Max Net Link Rate for PAM-X PCS	54
8.2.6.3	8B/10B PCS Fully Paced, A-Packets Stream from Link to TX RTS	54
8.2.6.4	PAM-X PCS Fully Paced, A-Packets Stream from Link to TX RTS	55
8.2.7	Retransmitted A-Packets Scheduling Priority at TX RTS	56
8.2.8	RTS Bypass	56

8.3	Physical Coding Sub-Layer (PCS)	58
8.3.1	PAM-X PCS	58
8.3.1.1	PAM16 Sub-Constellation Bit to Symbol mapping	59
8.3.1.2	Symbol and Token Rate/Period	61
8.3.1.3	A-Packet to Token Conversion	63
8.3.1.4	Downlink Scrambler	65
8.3.1.5	Downlink Training Mode	66
8.3.1.6	Downlink Idle Mode	69
8.3.1.7	Downlink Normal Mode	69
8.3.1.8	Downlink JITC Re-Training	71
8.3.2	8B/10B PCS	72
8.3.2.1	10b Symbols to NRZ Mapping	73
8.3.2.2	8B/10B Encoding	73
8.3.2.3	Uplink Scrambler	73
8.3.2.4	Downlink Scrambler	74
8.3.2.5	Byte Stream Controller	74
8.3.2.6	Training Mode	75
8.3.2.7	Idle Mode	76
8.3.2.8	Normal Mode	77
8.3.3	Startup Procedure	80
8.3.3.1	“Mission Mode” Startup Procedure	81
8.3.3.2	Unidirectional Startup Procedure	83
9	PMD Electrical Specification	86
9.1	TX Electrical Specification	86
9.1.1	Test Mode Pattern Generator (TMPG)	86
9.1.1.1	LFSR Usage Example	87
9.1.2	Test Modes	89
9.1.2.1	TM1: Test Mode 1: Transmit PSD	89
9.1.2.2	TM2: Test Mode 2: Droop	89
9.1.2.3	TM3: Test Mode 3: Transmit Jitter	90
9.1.2.4	TM4: Test Mode 4: Transmit Linearity	90
9.1.2.5	TM5: Test Mode 5: In Silent State	90
9.1.2.6	TM6: Test Mode 6: Unidirectional Startup	90
9.1.3	Transmitter Power Spectral Density Mask	90
9.1.3.1	Requirement	90
9.1.3.2	Processing Procedure	94
9.1.4	Transmitter Maximum Output Droop	98
9.1.4.1	Requirement	98
9.1.4.2	Processing Procedure	98
9.1.5	Transmitter Timing Jitter	98
9.1.5.1	Requirement	98
9.1.5.2	Processing Procedure	98
9.1.6	Transmitter Symbol Rate Accuracy	99
9.1.7	NRZ Downlink Transmitter Eye Opening	99
9.1.7.1	Requirement	99
9.1.7.2	Processing Procedure	99
9.1.7.3	NRZ Jitter (Informative)	100

9.1.8	PAM-X Transmitter Linearity.....	101
9.1.8.1	Requirement	101
9.1.8.2	Processing Procedure.....	101
9.2	RX Electrical Specification.....	104
9.2.1	Profile 1 Receiver Bit Error Rate.....	104
9.2.2	Profile 2 Downlink Receiver Pre-RTS Packet Error Rate	104
9.2.3	Profile 2 Uplink Receiver Bit Error Rate.....	104
9.2.4	Receiver Symbol Rate Frequency Tolerance.....	104
9.2.5	Receiver Test Modes.....	104
9.2.5.1	RTM6: Receiver Test Mode 6: Unidirectional Startup.....	104
10	Modes of Operation.....	106
10.1	Non-Active Mode.....	106
10.2	Active Mode	106
10.3	Operation Mode State Machine.....	106
10.3.1	General Operation.....	107
10.3.2	States.....	107
10.3.2.1	Power-Up State.....	108
10.3.2.2	Start-Up State	108
10.3.2.3	Normal State.....	108
10.3.2.4	Sleep State	108
10.3.3	Transitions.....	109
10.3.3.1	Power-Off Transition.....	109
10.3.3.2	Reset Transition.....	109
10.3.3.3	Ready Transition.....	109
10.3.3.4	Stop Transition.....	109
10.3.3.5	Link Establish Transition.....	110
10.3.3.6	Link Down Transition.....	110
10.3.3.7	Sleep Transition.....	110
10.3.3.8	Wakeup Transition.....	111
10.3.4	Test Mode	111
10.4	FSM Parameters	112
10.5	Wake-Up Protocol	113
10.5.1	General.....	113
10.5.1.1	System Architecture (Informative).....	113
10.5.2	Wake-Up Pattern (WUP) Signal	116
10.5.2.1	PRBS9 Pattern.....	116
10.5.2.2	WUP Amplitude	116
10.5.2.3	WUP Bit Rate.....	117
10.5.2.4	WUP Duration	117
10.5.2.5	WUP Generation.....	117
10.5.2.6	WUP Detection.....	117
10.5.3	WUP Handshake Procedure.....	117
10.5.4	WUP Parameters	118

11	Data Link Layer	119
11.1	Architecture Overview	119
11.2	A-Packet Format.....	121
11.2.1	A-Packet Header (A-Header) Fields.....	122
11.2.1.1	Adaptation Descriptor Field	123
11.2.1.2	Service Descriptor Field.....	123
11.2.1.3	Placement Descriptor Field	126
11.2.1.4	PHY2 Field.....	126
11.2.1.5	Target Address Field.....	126
11.2.1.6	PHY3 Field.....	128
11.2.1.7	Payload Length Field.....	128
11.2.1.8	PHY Header CRC Field.....	128
11.2.2	A-Packet Payload (A-Payload).....	128
11.2.3	A-Packet Tail (A-Tail) (CRC-32 Field)	128
11.3	Link Service	129
11.3.1	BIST A-Packet	129
11.3.1.1	BIST Modes.....	129
11.3.1.2	BIST Payload Patterns.....	129
11.3.1.3	BIST Rate	129
11.3.1.4	BIST Burst.....	130
11.3.2	Keep-Alive.....	130
11.3.3	Remote Sleep Command	130
11.4	Local Functions	131
11.4.1	Local Table (LOC_TBL) Recommendations (Informative)	131
11.5	Multi-Port Functions	133
11.5.1	Multi-Port Routing Function	134
11.5.1.1	Packet Duplication Stage.....	134
11.5.1.2	Packet Forwarding Stage.....	134
11.5.1.3	Routing Table (ROUT_TBL) Recommendations (Informative)	135
11.5.1.4	Duplication Table (DUP_TBL) Recommendations (Informative)	135
11.6	Network Functions	137
11.6.1	Scheduling and Priorities.....	137
11.6.2	Clock Forwarding Service	137
11.6.2.1	CFS A-Packet Format.....	137
11.7	APPI Signal Interface.....	138
11.7.1	Signals Description.....	139
11.7.1.1	APPI Signals.....	139
11.7.2	APPI Clock.....	140
11.7.3	APPI A-Packet Mapping.....	141
11.7.4	APPI Timing Diagrams.....	141

12	A-PHY Control and Management Database (ACMD) and Protocol (ACMP)..	144
12.1	Control and Management System Architecture (Informative)	145
12.2	ACMD	146
12.2.1	Register Base Address Alignment	146
12.2.2	Register Data Byte Order	146
12.2.3	Register Space	147
12.2.4	Register List	148
12.2.5	Detailed Register Description	150
12.2.5.1	ACMD Programming	150
12.2.5.2	Port Programming	154
12.3	ACMP	160
12.3.1	ACMP Message Format	161
12.3.1.1	ACMP Message Header Part	161
12.3.1.2	ACMP Message Payload Part	162
12.3.1.3	ACMP Message Mapping to I ² C	164
12.3.2	ACMP Message Receiver Rules and Responsibilities	165
12.3.2.1	ACMP Header CRC (HCRC) Errors	165
12.3.2.2	ACMP Payload CRC (PCRC) Errors	165
12.3.2.3	Message Counter (MC)	165
12.3.2.4	Keep-Alive	165
12.3.2.5	Message Format Setting	165
12.3.2.6	Virtual Base Address Maintenance	165
12.3.2.7	Accessing Register Data	165
12.3.3	ACMP Interrupts	165
12.3.3.1	ACMPI in I ² C	166
12.3.3.2	ACMPI in I3C	166
Annex A	PMD Simplified Implementation Examples (Informative).....	167
A.1	Profile 1 G1–2 Source PMD	167
A.1.1	PMD without External Diplexer (Internal Replica)	167
A.1.2	PMD With External Diplexer	167
A.2	Profile 1 G1–2 Sink PMD	168
A.3	G3–5 Source PMD	168
A.4	G3–5 Sink PMD	169
Participants	171

Figures

Figure 1 Data and Power Logical Structure	8
Figure 2 High Level Layer Structure.....	8
Figure 3 A-PHY High Level Structure	11
Figure 4 A-PHY Interconnect.....	15
Figure 5 Cable Topologies.....	16
Figure 6 Set-up for S-parameter Characterization of End Nodes and TLIS.....	17
Figure 7 Interconnect Test Points Definition.....	18
Figure 8 Coax and SDP Cable Insertion Loss Limits.....	19
Figure 9 Cable TLIS Return Loss Limits	20
Figure 10 Cable TLIS Coupling Attenuation	21
Figure 11 Cable TLIS Attenuation Limits	22
Figure 12 Alien Cable Bundle Crosstalk Limit	23
Figure 13 Single-Ended End Node Routing Example.....	24
Figure 14 End Node Insertion Loss Limit.....	25
Figure 15 End Node Return Loss Limits.....	26
Figure 16 Receiver ANEXT Limit	27
Figure 17 PCB-Based Interconnect	28
Figure 18 Power Ripple Gain Function.....	29
Figure 19 Power Over Coax (PoC) Configuration	30
Figure 20 Power Over Differential Line (PoDL) Configuration	30
Figure 21 Examples of Applicable Pulses	32
Figure 22 P2 Decaying Sawtooth Model at 40 MHz / 4 nS Tr / 150 mV to 15 mV in 150 nS.....	33
Figure 23 Alien Bundle PSD Limit Line.....	34
Figure 24 A-PHY Unified Architecture.....	35
Figure 25 A-PHY P1 G1/G2 Architecture	37
Figure 26 A-PHY P2 G1/G2 Architecture	38
Figure 27 A-PHY P2 G4/G5 Architecture	39
Figure 28 Dynamically Modulated, Time Bounded, Local Retransmission	41
Figure 29 TX RTS Over 8B/10B PCS Block Diagram	42
Figure 30 TX RTS Over PAM-X PCS Block Diagram	43
Figure 31 Single Retransmission Request Sent Over Downlink.....	50

Figure 32 Gap Retransmission Request Sent Over Downlink	50
Figure 33 Header CRC (CRC-8) Bit Level Diagram	52
Figure 34 Header CRC Bit Assignment	52
Figure 35 CRC-32 Calculation Bit Level Diagram	53
Figure 36 CRC-32 Byte Mapping	53
Figure 37 Fully Paced TX Link to TX Phy Interface	56
Figure 38 RTS Bypass	58
Figure 39 PCS Block Diagram	59
Figure 40 PAM16 Sub-Constellations	60
Figure 41 A-Packet Partitioning	63
Figure 42 Bit/Symbol/Token Conversion Per Header Sub-Constellation	64
Figure 43 Bit/Symbol/Token Conversion Per Payload Data and CRC-32 Bytes	65
Figure 44 Downlink TX Scrambler LFSR	66
Figure 45 PAM-X Transition from Training to Idle	68
Figure 46 PAM-X Transition from Idle to Normal	69
Figure 47 PCS Normal Mode Data Example	70
Figure 48 TX Re-Training Procedure State Machine	71
Figure 49 PCS Block Diagram	72
Figure 50 Uplink TX Scrambler LFSR	73
Figure 51 Training with K-Sequences Example	76
Figure 52 DHA Startup Control Sequence	76
Figure 53 In_Idle Startup Control Sequence	76
Figure 54 Interrupting Request with Data Packet Continues	77
Figure 55 In Normal Startup Control Sequence	77
Figure 56 Re-Train Request	78
Figure 57 sCMax Request	78
Figure 58 Single Retransmission Request	78
Figure 59 Retransmission Gap Request	79
Figure 60 Ack Indication	79
Figure 61 Distinct A-Packet 8B/10B Encapsulation	79
Figure 62 Back-to-Back A-Packets: 8B/10B Encapsulation	79
Figure 63 A-Packet 8B/10B Encapsulation with Request Insertion	80
Figure 64 Typical Startup Procedure	81

Figure 65 Unidirectional Startup Procedure.....	85
Figure 66 TPA Conformance Point.....	86
Figure 67 Test Mode Pattern Generator LFSR.....	86
Figure 68 Test Mode 2.....	90
Figure 69 NRZ PMD: Upper & Lower PSD Limits.....	92
Figure 70 Uplink PMD Upper & Lower PSD Limits: Gears #1–#3	93
Figure 71 PAM-X PMD Upper & Lower PSD Limits	94
Figure 72 Example Matlab Figure #1.....	97
Figure 73 Example Matlab Figure #2.....	97
Figure 74 NRZ Downlink Transmitter Eye Diagram	100
Figure 75 A-PHY Port Operation Mode State Machine.....	106
Figure 76 Sleep Sequence Example, View 1	110
Figure 77 Sleep Sequence Example, View 2.....	111
Figure 78 Optional System Architecture	114
Figure 79 WUP Directions	115
Figure 80 Wakeup_ind Configuration Signaling.....	116
Figure 81 General Waveform of Main Signals.....	116
Figure 82 WUP Handshake ACK/NACK.....	117
Figure 83 A-PHY High Level Structure	119
Figure 84 Example A-PHY High-Level Layer	120
Figure 85 A-Packet Format	121
Figure 86 Bad Packet Indication and Propagation Example	125
Figure 87 Many-to-One Target Address Assignment Example	127
Figure 88 One-to-Many Target Address Assignment Example	127
Figure 89 Local Table Example.....	131
Figure 90 Entry-Element Formats	133
Figure 91 Local Table Example.....	133
Figure 92 ROUT_TBL Example	135
Figure 93 DUP_TBL Example	136
Figure 94 CFS A-Packet Payload Format	137
Figure 95 APPI Connectivity.....	140
Figure 96 APPI A-Packet Mapping	141
Figure 97 APPI Timing.....	142

Figure 98 A-PHY Control and Data Planes	144
Figure 99 Control and Management System Architecture	145
Figure 100 ACMD Register Space	147
Figure 101 Ports and AL Instances Register Space Arrangement	148
Figure 102 ACMP Message Format	161
Figure 103 Message Mapping to I ² C	164
Figure 104 Profile 1 G1–2 Source with Internal Replica	167
Figure 105 Profile 1 G1–2 Source with External Diplexer	167
Figure 106 Profile 1 G1–2 Sink PMD	168
Figure 107 G3–5 Source PMD	168
Figure 108 G3–5 Sink PMD	169

Tables

Table 1 A-PHY Gears Per Profile.....	12
Table 2 Cable TLIS Return Loss.....	20
Table 3 Coupling Attenuation.....	21
Table 4 Screening Attenuation.....	21
Table 5 Unbalanced Attenuation.....	22
Table 6 Alien Cable Bundle Crosstalk.....	23
Table 7 End Node Insertion Loss	24
Table 8 End Node Return Loss.....	25
Table 9 Receiver ANEXT.....	27
Table 10 DC Requirements	28
Table 11 Power Ripple Gain.....	29
Table 12 Power Over Coax (PoC) Component Values.....	30
Table 13 Power Over Differential Line (PoDL) Component Values.....	31
Table 14 Alien Cable Bundle Upper PSD Limit.....	33
Table 15 Car Noise PSD Limits	34
Table 16 A-Packet Fields Modified by PHY Layer.....	40
Table 17 Sub-Constellation Assignment for Original A-Packets	45
Table 18 SCI Code Per Assigned Payload Data Sub-Constellation	45
Table 19 A-Packet Fields Modified by PHY Layer.....	49
Table 20 Downlink Per Gear Max RTS Delay & Retransmission Request Wait	50
Table 21 Nominal Per Gear RTS Delay Unit	51
Table 22 Actual Byte Period Consumption Per Gear	55
Table 23 P1 A-Packet Fields Update	57
Table 24 PAM16 Sub-Constellations.....	61
Table 25 Token Data (TD) per Sub-Constellation.....	61
Table 26 Symbol / Token Rate and Symbol / Token Period Ratios.....	62
Table 27 Header Sub-Constellation Per sCMax.....	63
Table 28 Token Data Scrambling	66
Table 29 Scrambler Output Training Bits.....	67
Table 30 PAM-X "K Sequence" Symbol Mapping vs Training Symbols	67
Table 31 Idle Bits Allocation.....	69

Table 32 PAM-X EOI Symbol Allocation	69
Table 33 TX Re-Training Procedure State Machine Sequence-Length Values	71
Table 34 NRZ Electrical Levels Mapping.....	73
Table 35 8B/10B Encoding	73
Table 36 Startup Control Nibbles	74
Table 37 Normal Control Nibbles	75
Table 38 Handshake Indications for Typical Startup (Summary).....	83
Table 39 Time Periods for Startup Procedures	83
Table 40 Timer Values for Unidirectional Startup Procedure.....	84
Table 41 PAM-X Test Mode Pattern Generator LFSR Bit Allocation for Sub-Constellation	87
Table 42 LFSR Output of First 5 Symbol Periods.....	87
Table 43 sC16 ₁₆ Coding.....	87
Table 44 sC8 ₁₆ Coding.....	88
Table 45 sC4 ₁₆ Coding.....	89
Table 46 sC2 ₁₆ Coding.....	89
Table 47 Nominal TX Amplitude Over Coax, Per Gear, Per Direction (Informative)	91
Table 48 NRZ PMD Upper PSD Limit	91
Table 49 NRZ PMD Lower PSD Limit.....	91
Table 50 Uplink PMD Upper PSD Limit	92
Table 51 NRZ PMD Lower PSD Limit.....	93
Table 52 Transmitter Timing Jitter Requirements	98
Table 53 NRZ Downlink Eye Mask Parameters	99
Table 54 Jitter Components in TM3 and TM4	101
Table 55 Selection of RTM6 Sub-Mode via Field TMDData	104
Table 56 Transition Appearance Legend	107
Table 57 FSM Configuration Parameters	112
Table 58 Link Quality Code Levels.....	113
Table 59 WUP Parameters.....	118
Table 60 A-Packet Fields and Sub-Fields Description	122
Table 61 Adaptation Type Sub-Field Values.....	123
Table 62 Prio Sub-Field Values (Scheduling-Priority Codes)	123
Table 63 Quality-of-Service Codes	124
Table 64 OB (Odd-Bytes) Sub-Field Values	126

Table 65 Order Sub-Field Values.....	126
Table 66 Target Address Field Values (Pre-Defined T-Address Values).....	127
Table 67 A-Packet Payload Length and OB Sub-Field	128
Table 68 BIST Mode Codes	129
Table 69 BIST Payload Pattern Codes	129
Table 70 BIST Rate Codes	130
Table 71 BIST Burst Codes	130
Table 72 Local Table Entry Descriptor.....	132
Table 73 Duplication Stage Actions	134
Table 74 Pre-Defined Port ID Values	134
Table 75 DUP_TBL Entry Elements	136
Table 76 APPI Signals	139
Table 77 APPI Clock Frequency Settings.....	140
Table 78 Register Base Address (BA) Alignment	146
Table 79 Register Data Byte Order.....	146
Table 80 ACMD Space Register List	148
Table 81 Port Space Register List	150
Table 82 Register ACMP_VER.....	150
Table 83 Register ACMP_ADDRESS.....	151
Table 84 Register PORT_NUM.....	151
Table 85 Register AL_NUM	151
Table 86 Register ID6_HIGH.....	151
Table 87 Register ID6_LOW.....	151
Table 88 Register MID	151
Table 89 Register PRODUCT_ID.....	152
Table 90 Register ACMP_IF	152
Table 91 Register ACMP_SECONDADDR.....	152
Table 92 Register ACMP_BRDCSTADDR	152
Table 93 Register BIST_CTRL1	153
Table 94 Register BIST_CTRL2	153
Table 95 Register BIST_CTRL3	153
Table 96 Register BIST_CTRL4	153
Table 97 Register BIST_CTRL5	154

Table 98 Register INST_DESC.....	154
Table 99 Register PORT_CAP	154
Table 100 Register PORT_CONFIG	156
Table 101 Register TEST_CONFIG.....	156
Table 102 Register FSM_CONFIG	157
Table 103 Register FSM_STATUS.....	157
Table 104 Register WUP_CTRL.....	158
Table 105 Register DIAG_CTRL.....	158
Table 106 Register DIAG_CNT1	158
Table 107 Register DIAG_CNT2	159
Table 108 Register DIAG_CNT3	159
Table 109 Register DIAG_CNT4.....	159
Table 110 Register DIAG_CNT5	159
Table 111 Register DIAG_CNT6	159
Table 112 Register DIAG_CNT7	159
Table 113 Register DIAG_CNT8	160
Table 114 Register DIAG_CNT9	160
Table 115 Register DIAG_CNT10	160
Table 116 Register DIAG_CNT11	160
Table 117 Register DIAG_CNT12	160
Table 118 ACMP Message Header Fields	161
Table 119 ACMP Message Payload Fields.....	162

Release History

Date	Version	Description
06-Aug-2020	v1.0	Initial Board adopted release.

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1 Introduction

1 This document specifies MIPI A-PHY, a serial interface technology with high bandwidth capabilities
2 developed particularly for long reach (e.g., automotive) applications, enabling low pin count and a high level
3 of power efficiency.

4 A-PHY is designed for a wide range of long reach applications, and specifically for automotive market, to
5 carry multiple protocols from MIPI Alliance such as CSI-2 for cameras, and DSI and DSI-2 for displays.
6 Non-MIPI protocols are also supported using a generic Data Link Layer Interface (APPI).

7 A-PHY features include:

- 8 • Long reach capability – optimized to support cables up to 15 m with up to 4 inline connectors
- 9 • Multiple speed gears ranging from 2 Gbps up to 16 Gbps
- 10 • Support for multiple cable types commonly used in automotive
- 11 • Strong noise immunity for the harsh automotive environment
- 12 • Generic Data Link Layer, supporting multiple protocols from MIPI Alliance and external entities

1.1 Scope

1.1.1 In Scope

13 This A-PHY Specification document specifies the implementation of the A-PHY, including its layering,
14 electrical characteristics, and its optional features.

1.1.2 Out of Scope

15 **Protocol Adaptation Layers (PALs)**

16 A single A-PHY can serve multiple protocols at the same time, and each protocol has its own interface to the
17 Data Link Layer, called a Protocol Adaptation Layer (PAL). PALs are not part of this document.

18 **Specific Channel Configurations**

19 Different protocols employing A-PHY technology can have different constraints, which can require the use
20 of different approaches for operation control. Therefore, while this document provides the features to enable
21 stable, optimized Link configuration, it does not mandate specific configurations for specific channels.

1.2 Purpose

22 Long reach devices, and specifically automotive devices, face increasing bandwidth demands for each of
23 their functions, as well as an increase in the number of functions integrated into the system.

24 Addressing this demand requires wide bandwidth, low pin count (serial), highly power-efficient (network)
25 interfaces with sufficient flexibility to be attractive for multiple applications, while employing just a single
26 physical layer technology.

27 A-PHY complements MIPI Alliance's existing D-PHY and C-PHY interfaces by addressing the long reach
28 automotive channel.