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**Information technology —  
Telecommunications and information  
exchange between systems — High rate  
60 GHz PHY, MAC and PALs**

*Technologies de l'information — Téléinformatique — PHY, MAC et  
PALs 60 GHz à haut débit*

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# Contents

Page

Foreword .....	ix
Introduction .....	x
1 Scope .....	1
2 Conformance .....	1
3 Normative references .....	1
4 Terms and definitions .....	1
5 Notational conventions .....	3
6 Abbreviated terms .....	4
7 General description (informative) .....	7
7.1 PHY general description .....	7
7.2 MAC general description .....	7
7.2.1 General description of the architecture .....	7
7.2.2 Device address .....	8
7.2.3 Features assumed from the PHY .....	8
7.2.4 Overview of MAC service functionality .....	9
7.2.5 MAC policies .....	12
7.2.6 Support for higher-layer timer synchronization .....	12
7.3 MUX general description .....	12
7.4 HDMI PAL description .....	13
8 PHY layer (informative) .....	13
9 Description of signal .....	13
9.1 Mathematical framework for SCBT, OFDM, DBPSK, DQPSK, UEP-QPSK, OOK and 4ASK .....	13
9.2 Mathematical framework for the narrow band section of the discovery mode preamble .....	14
10 PLCP sublayer .....	14
10.1 General PPDU frame format .....	14
10.1.1 PLCP preamble .....	16
10.1.2 PLCP header .....	16
10.1.3 PPDU payload .....	19
10.1.4 Antenna training sequence .....	20
10.2 Type A PPDU .....	20
10.2.1 Mode dependent parameters .....	20
10.2.2 SCBT .....	21
10.2.3 OFDM .....	42
10.2.4 Constellation mapping .....	60
10.2.5 Discovery mode .....	69
10.3 Type B PPDU .....	71
10.3.1 Mode dependent parameters .....	71
10.3.2 Single carrier (DBPSK, DQPSK, UEP-QPSK) .....	72
10.3.3 Channel bonding .....	80
10.3.4 Discovery mode .....	80
11 General requirements .....	80
11.1 Operating band frequencies .....	80
11.1.1 Operating frequency range .....	80
11.1.2 Channel numbering .....	80
11.2 PHY layer timing .....	81
11.2.1 Receive-to-transmit turnaround time .....	81
11.2.2 Transmit-to-receive turnaround time .....	82

11.2.3 Time between successive transmissions .....	82
12 Transmitter specifications .....	82
12.1 Transmit PSD mask .....	82
12.1.1 Transmit PSD .....	82
12.2 Transmit centre frequency tolerance .....	83
12.3 Symbol clock frequency tolerance .....	83
12.4 Clock synchronization .....	83
12.5 Transmit power control .....	83
12.6 Transmitter EVM .....	83
12.6.1 Type A .....	83
12.6.2 Type B .....	87
13 Receiver specification .....	87
13.1 Type A device .....	87
13.1.1 SCBT receiver sensitivity .....	87
13.1.2 OFDM receiver sensitivity .....	88
13.2 Type B device receiver sensitivity .....	88
13.3 Receiver CCA performance .....	89
14 Antenna training symbols and feedback methods .....	89
14.1 Antenna training sequence transmission .....	89
14.1.1 Training matrix in closed-loop mode .....	90
14.1.2 Tracking matrix .....	92
14.2 Antenna training feedback in closed-loop mode .....	92
14.2.1 Index feedback .....	92
14.2.2 Codebook based feedback .....	92
14.2.3 Quantised weights .....	95
15 MAC frame formats .....	95
15.1 Frame format conventions .....	95
15.1.1 Figures .....	95
15.1.2 Octet order .....	96
15.1.3 Encoding .....	96
15.2 General MAC frame format .....	96
15.2.1 Unaggregated MAC frame .....	96
15.2.2 Aggregated MAC frame .....	97
15.2.3 Frame control .....	98
15.2.4 DestAddr .....	99
15.2.5 SrcAddr .....	99
15.2.6 Sequence control .....	99
15.2.7 Access information .....	100
15.2.8 Frame payload .....	101
15.2.9 FCS .....	101
15.3 Beacon frames .....	102
15.4 Discovery frames .....	104
15.5 Control frames .....	105
15.5.1 Immediate acknowledgement (Imm-ACK) .....	106
15.5.2 Block acknowledgement (B-ACK) .....	107
15.5.3 Application-specific .....	108
15.5.4 B-Poll .....	108
15.5.5 B-Poll response frame .....	109
15.5.6 Antenna training/tracking control frames .....	109
15.6 Command frames .....	110
15.6.1 DRP reservation request .....	111
15.6.2 DRP reservation response .....	111
15.6.3 Channel selection .....	111
15.6.4 Link feedback .....	113
15.6.5 Probe .....	116
15.6.6 Pairwise temporal key (PTK) .....	117

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[ISO/IEC 13156:2011](https://standards.iteh.ai/catalog/standards/sist/31911aa-193f-43ae-bc79-18d11d24cf8c/iso-iec-13156-2011)

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15.6.7	Group temporal key (GTK)	118
15.6.8	Application-specific	119
15.6.9	Relay	119
15.6.10	Transmit switched diversity (TSD) request	119
15.6.11	Transmit switched diversity (TSD) set response	120
15.6.12	Transmit switched diversity (TSD) switch	120
15.6.13	Fast uplink channel allocation (FUCA)	121
15.7	Data frames	121
15.8	Aggregated MAC frames	122
15.8.1	Aggregated data frames	122
15.8.2	Aggregated tracking frames	122
15.9	Information elements	122
15.9.1	Application-specific IE (ASIE)	124
15.9.2	Application-specific probe IE	124
15.9.3	Antenna Capabilities IE (ACIE)	124
15.9.4	ATIE	125
15.9.5	ATTCIE	127
15.9.6	AFIE	128
15.9.7	Beacon period occupancy IE (BPOIE)	129
15.9.8	BP Switch IE	131
15.9.9	Channel bonding IE (CBOIE)	131
15.9.10	Channel change IE	132
15.9.11	Channel measurement IE	133
15.9.12	Distributed reservation protocol (DRP) IE	134
15.9.13	DRP availability IE	137
15.9.14	Hibernation anchor IE	137
15.9.15	Hibernation mode IE	137
15.9.16	Identification IE	138
15.9.17	Link feedback IE	139
15.9.18	MAC capabilities IE	140
15.9.19	Master key identifier (MKID) IE	141
15.9.20	Multicast address binding (MAB) IE	141
15.9.21	PHY capabilities IE	142
15.9.22	Probe IE	145
15.9.23	Relinquish request IE	145
15.9.24	Relay IE	146
15.9.25	Scan Timing IE	148
15.9.26	UEP information IE	149
16	MAC sublayer functional description	150
16.1	Frame processing	150
16.1.1	Frame addresses	150
16.1.2	Frame reception	151
16.1.3	Antenna training frame transaction	151
16.1.4	Frame transfer	151
16.1.5	Frame retry	152
16.1.6	Inter-frame space (IFS)	152
16.1.7	Duplicate detection	152
16.1.8	RTT/CTT use	152
16.1.9	MAC header fields	153
16.1.10	Information elements	154
16.2	Distributed contention access (DCA)	157
16.2.1	DCA medium availability	157
16.2.2	NAV	157
16.2.3	Medium status	158
16.2.4	Obtaining a TXOP	158
16.2.5	Using a TXOP	159
16.2.6	Invoking a backoff procedure	159

16.2.7	Decrementing a backoff counter	160
16.3	Device discovery	160
16.3.1	Power-up scan	161
16.3.2	Transmission and reception of discovery frames	162
16.4	Channel selection	164
16.4.1	Explicit channel selection	165
16.4.2	Implicit channel selection	166
16.5	Transmission and reception of beacons	166
16.5.1	Transmission and reception of Type A beacons	166
16.5.2	Transmission and reception of Type B beacon frames	167
16.5.3	Superframe	168
16.6	Distributed reservation protocol (DRP)	174
16.6.1	Reservation type	175
16.6.2	Reservation waveform	175
16.6.3	Medium access	175
16.6.4	DRP availability IE	176
16.6.5	DRP reservation negotiation	176
16.6.6	DRP reservation announcements	178
16.6.7	Resolution of DRP reservation conflicts	178
16.6.8	BPST realignment and existing DRP reservations	180
16.6.9	Modification and termination of existing DRP reservations	180
16.6.10	Retransmit procedures in DRP reservations	180
16.7	Coexistence and interoperability	181
16.7.1	Coexistence	181
16.7.2	Interoperability	181
16.8	Synchronization of devices	182
16.8.1	Clock accuracy	182
16.8.2	Synchronization for devices in hibernation mode	182
16.8.3	Guard times	182
16.9	Fragmentation and reassembly	184
16.10	Aggregation	184
16.11	Channel bonding	186
16.12	Acknowledgement policies	187
16.12.1	No-ACK	187
16.12.2	Immediate ACK	187
16.12.3	Block ACK	187
16.13	Probe	189
16.14	Multi-rate support	189
16.15	Transmit power control (TPC)	190
16.16	Power management mechanisms	190
16.16.1	Power management modes	190
16.16.2	Power state transitions at active mode	190
16.16.3	Hibernation mode operation	191
16.16.4	Hibernation anchor operation	192
16.17	ASIE operation	193
16.18	Antenna training and tracking	193
16.18.1	Announcement of antenna capabilities	193
16.18.2	Antenna training/tracking configuration	193
16.18.3	Iterative antenna training	194
16.18.4	Antenna tracking	195
16.19	Transmit switched diversity (TSD) operation	196
16.19.1	TSD initiating procedure	196
16.19.2	Antenna switching	196
16.20	MAC sublayer parameters	197
17	Security	198
17.1	Security mechanisms	198
17.1.1	Security operation	199

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ISO/IEC 13156:2011

[https://standards.iteh.ai/catalog/standards/sist/31911aa-193f-43ae-bc79-](https://standards.iteh.ai/catalog/standards/sist/31911aa-193f-43ae-bc79-18d11d24cf8c/iso-iec-13156-2011)

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17.1.2	4-way handshake	199
17.1.3	Key transport	199
17.1.4	Freshness protection	199
17.1.5	Data encryption	199
17.1.6	Frame integrity protection	199
17.2	Security modes	200
17.2.1	Security mode 0	201
17.2.2	Security mode 1	201
17.2.3	Security mode 2	201
17.3	Temporal keys	202
17.3.1	Mutual authentication and PTK derivation	202
17.3.2	GTK exchange	203
17.3.3	Pseudo-random function (PRF) definition	204
17.3.4	PTK and KCK derivation	204
17.3.5	PTK MIC generation	205
17.3.6	Random number generation	205
17.4	Frame reception steps and replay prevention measures	206
17.4.1	Frame reception	206
17.4.2	Replay prevention	206
17.4.3	Implications on GTKs	207
17.5	AES-128 GCM inputs	207
17.5.1	Overview	207
17.5.2	Nonce	207
17.5.3	GCM blocks	208
17.6	Token authentication	209
17.6.1	Token issuance	209
17.6.2	Token revoke	210
18	HDMI PAL	210
18.1	Introduction	210
18.2	HDMI transmission	211
18.2.1	Identification of video vs. data	211
18.2.2	TMDS removal	211
18.2.3	Data type multiplexing	211
18.3	HDMI reception	213
18.3.1	TMDS encoding	213
18.3.2	Packet demultiplexing	213
18.4	PAL header format	217
18.4.1	Sub-packet header	218
18.5	PAL payload format	219
18.6	Block retransmission request	219
18.7	Type specific header fields	220
18.7.1	S-UEP	220
18.7.2	P-UEP	223
18.8	Video/audio format adaptation	224
18.8.1	Fast video format adaptation	224
18.8.2	Fast audio format adaptation	227
18.8.3	Control messages to support fast format adaptation	228
18.9	Fast uplink channel allocation (FUCA)	229
18.9.1	FUCA operation	230
18.9.2	The procedure of data exchange using FUCA	233
19	Out-of-band control channel	234
19.1	OOB operation	235
19.1.1	Ad hoc mode	235
19.1.2	Infrastructure mode	237
19.1.3	Other OOB functions	239
19.2	OOB frame format	240
19.2.1	General frame format	240

19.2.2	OOB-beacon	240
19.2.3	OOB-60GHz capability request	241
19.2.4	OOB-60GHz capability response	241
19.2.5	OOB-interference detection request	242
19.2.6	OOB-interference detection response	242
19.2.7	OOB-channel loss notification	242
19.2.8	OOB-block ACK	243
19.2.9	OOB-probe request	243
19.2.10	OOB-probe response	243
19.3	Convergence MAC sublayer parameters	244
20	Relay operation	244
20.1	Relay path setup	244
20.1.1	Identification of relay capabilities	244
20.1.2	Association with a relay device	244
20.1.3	Antenna training between the source and the destination	244
20.1.4	Antenna training between the source and the relay	244
20.1.5	Antenna training between the relay and the destination	245
20.1.6	Transition to data channel	245
20.2	Data transmission in relay operation	247
20.2.1	DRP reservation for relay operation in data channel	247
20.2.2	Usage of relay device	247
20.2.3	Frame transfer in relay operation	247
20.2.4	Frame reception in relay operation	248
20.2.5	Data exchange using relay device	248
20.2.6	Decision on path change	249
20.2.7	Path Change	249
20.2.8	Relay link feedback via relay device	250
20.2.9	Scan of idle path	251
20.2.10	Operation of relay device	251
Annex A (normative)	MUX sublayer	253
Annex B (normative)	MAC Policies	255
Annex C (informative)	Higher Layer Synchronization Support	258
Annex D (informative)	IP PAL	260
Annex E (informative)	USB PAL	263
Annex F (informative)	B-ACK buffer with fixed size elements	266
	Bibliography	267

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ISO/IEC 13156:2011  
<https://standards.iteh.ai/catalog/standards/sist/31f911aa-193f-43ae-bc79-18d11d24c18c/iso-iec-13156-2011>



## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 13156 was prepared by Ecma International (as ECMA-387) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This second edition cancels and replaces the first edition (ISO/IEC 13156:2009), which has been technically revised.

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## Introduction

This International Standard specifies PHY, MAC and PALs for flexible and heterogeneous multi-Gigabit Wireless Personal Area networks. The heterogeneous network consists of two types of devices (Types A and B) that can fully coexist and interoperate but at the same time are able to operate independently. As a result this standard enables a wide range of different implementations and applications ranging from simple and low-power data transfer at short ranges, suitable for handheld devices, to high-rate multimedia streaming at longer distances, when adaptive antenna arrays are employed. Applications include Sync-and-Go, Access points, Wireless desktops and docking stations and uncompressed video streaming.

The Type A device is designed to be the high-end, high-performance device and provides many features including high data rate, longer range, robustness against multipath, support for adaptive antenna arrays and multi-level QoS. On the other hand, Type B devices, designed for handheld devices, are simpler, low power and low cost, while offering high data rates.

Type A and Type B devices offer data rates up to 6,350 Gbps and 3,175 Gbps in a single channel, respectively. This International Standard defines four frequency channels with separation of 2,160 GHz, which may be bonded to each other to increase the data rates by a factor of 2, 3 or 4.

This International Standard defines a single decentralized MAC protocol for both device types, which provides interoperability and coexistence for the device types and features high bandwidth efficiency, QoS provisions, and spatial reuse capability (Figure 1).

Multiple PALs can reside on top of the MAC layer, which interact with the MAC layer through a multiplexing sublayer (MUX). This edition of ISO/IEC 13156 provides an HDMI<sup>1</sup> PAL as well as information regarding IP and USB PALs.

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1. HDMI is the registered trademark of the HDMI LLC.

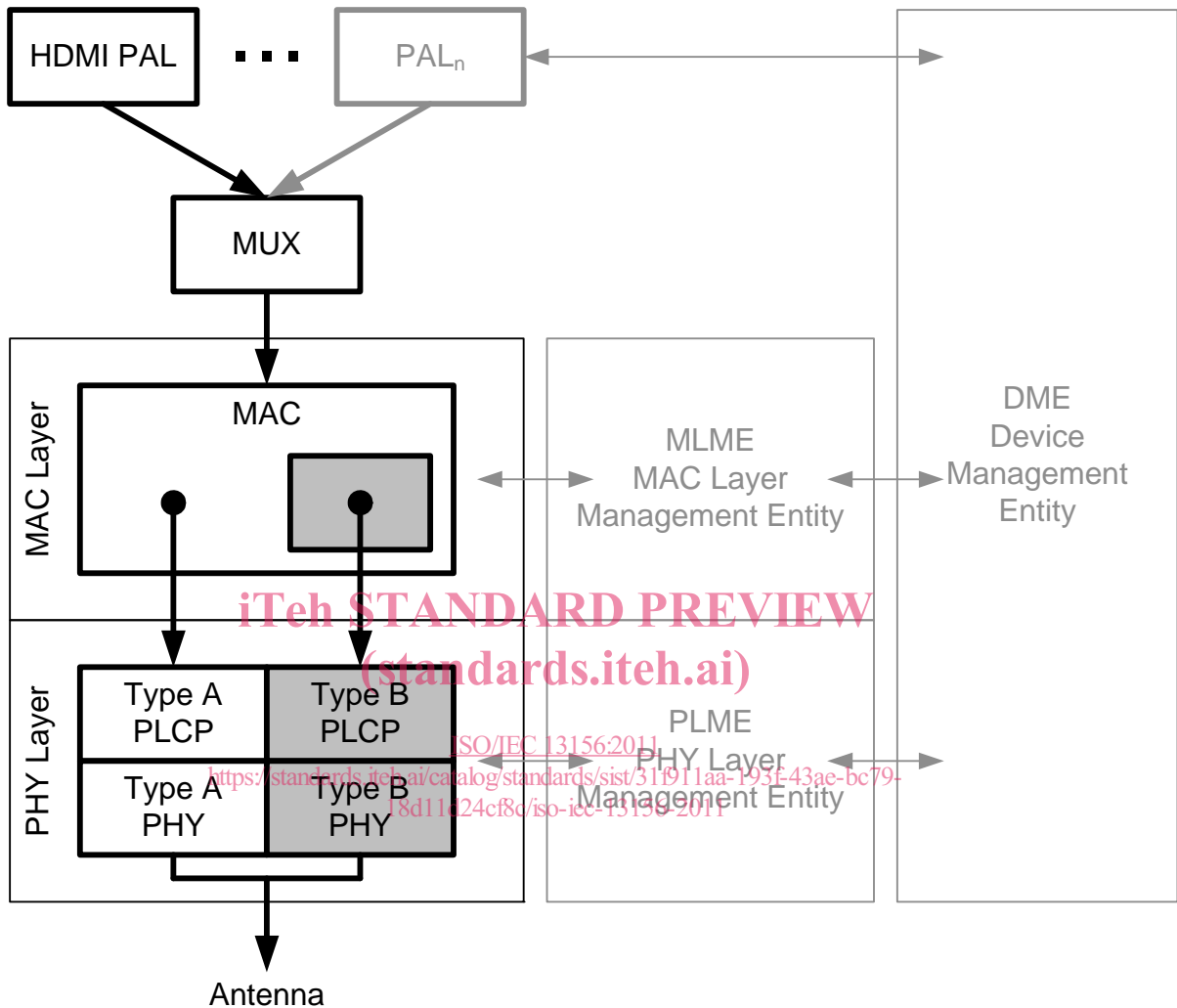


Figure 1 - Protocol structure

NOTE The DME, MLME, PLME, and PALs (except the HDMI PAL) are outside the scope of this International Standard and all references to these are informative.

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# Information technology — Telecommunications and information exchange between systems — High rate 60 GHz PHY, MAC and PALs

## 1 Scope

This International Standard specifies a physical layer (PHY), distributed medium access control (MAC) sublayer, and an HDMI protocol adaptation layer (PAL) for 60 GHz wireless networks.

## 2 Conformance

Conforming devices of Type A, B or C shall implement the MAC sublayer and the PHY layer and may implement the HDMI PAL as specified herein.

## 3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8802-11:2005/Amd.6, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements — Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications — Amendment 6: Medium Access Control (MAC) Security Enhancements*

IEEE 100, *The Authoritative Dictionary of IEEE Standards Terms*, Seventh Edition

## 4 Terms and definitions

For the purposes of this document, the following terms and definitions apply. For terms and definitions not defined in this Clause, the term and definitions given in IEEE 100, *The Authoritative Dictionary of IEEE Standards Terms*, Seventh Edition apply.

### 4.1

#### **Beacon Group**

##### **BG**

set of devices from which a device receives beacons that identify the same beacon period start time (BPST) as the device

### 4.2

#### **Beacon Period**

##### **BP**

period of time declared by a device during which it sends or listens for beacons

### 4.3

#### **Beacon Period Start Time**

##### **BPST**

start of the beacon period

### 4.4

#### **channel**

medium over which cooperating entities exchange information

**4.5**

**data integrity**

assurance that the data has not been modified from its original form

**4.6**

**device**

entity containing an implementation of this International Standard

**4.7**

**Distributed Reservation Protocol**

**DRP**

protocol implemented in each device to support negotiation and maintenance of channel time reservations binding on all neighbours of the reservation participants

**4.8**

**Equivalent Isotropic Radiated Power**

**EIRP**

amount of power that a theoretical isotropic antenna (that evenly distributes power in all directions) would emit to produce the peak power density observed in the direction of maximum antenna gain

**4.9**

**Equivalent Isotropic Received Power**

**EIRxP**

amount of power that a theoretical isotropic antenna (that evenly receives power in all directions) would receive

**4.10**

**extended beacon group**

union of a device's beacon group and the beacon groups of all devices in the device's beacon group

**4.11**

**frame**

unit of data transmitted by a device

**4.12**

**frame protection**

security service provided for a frame, including (but not limited to) payload encryption, message authentication, and replay attack protection

**4.13**

**MAC client**

entity above the MAC sublayer that generates MAC service data units for delivery to corresponding entities in other devices, and receives MAC service data units from such entities

**4.14**

**MAC Command Data Unit**

**MCDU**

unit of data exchanged between peer medium access control sublayers in order to manage medium access control functions

**4.15**

**MAC Protocol Data Unit**

**MPDU**

unit of data exchanged between two peer medium access control sublayers using the physical layer

**4.16**

**MAC Service Data Unit**

**MSDU**

information that is delivered as a unit between medium access control service access points (SAPs)

**4.17****Master-Slave Pair****MSPr**

device-to-device link in which a first device acts as the master (initiates polling) and a second device acts as a slave (responds to a polling inquiry)

**4.18****Message Integrity Code****MIC**

cryptographic checksum generated using a symmetric key that is typically appended to data in order to provide data integrity and source authentication similar to a digital signature

**4.19****neighbour**

any device in a device's beacon group

**4.20****reservation**

named set of one or more medium access slots (MASs) within a superframe during which a device has preferential access to the medium

**4.21****reservation block**

one or more temporally contiguous medium access slots (MASs) within a reservation not adjacent to other MASs in the reservation

**4.22****secure frame**

frame in which frame protection is applied

**4.23****stream**

logical flow of MSDUs from one device to one or more other devices

**4.24****superframe**

periodic time interval used in this International Standard to coordinate frame transmissions between devices, which contains a beacon period followed by a data period

**4.25****symmetric key**

secret key shared between two or more parties that may be used for both encryption and decryption as well as for message integrity code computation and verification

**4.26****Time Domain Spreading Factor****TDSF**

bandwidth expansion ratio due to the application of time domain spreading sequence

**5 Notational conventions**

The use of the word *shall* is meant to indicate a requirement which is mandated by the Standard, i.e. it is required to implement that particular feature with no deviation in order to conform to the Standard.

The use of the word *should* is meant to recommend one particular course of action over several other possibilities, however without mentioning or excluding these others.

The use of the word *may* is meant to indicate that a particular course of action is permitted.