

**IEEE Standard for
Local and metropolitan area networks—**

**Part 15.4: Low-Rate Wireless Personal Area
Networks (LR-WPANs)**

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

IEEE
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USA

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IEEE Std 802.15.4-2006)

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**IEEE Standard for
Local and metropolitan area networks—**

Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs)

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Abstract: The protocol and compatible interconnection for data communication devices using low-data-rate, low-power, and low-complexity short-range radio frequency (RF) transmissions in a wireless personal area network (WPAN) were defined in IEEE Std 802.15.4-2006. In this revision, the market applicability of IEEE Std 802.15.4 is extended, the ambiguities in the standard are removed, and the improvements learned from implementations of IEEE Std 802.15.4-2006 are included.

Keywords: ad hoc network, IEEE 802.15.4, low data rate, low power, LR-WPAN, mobility, PAN, personal area network, radio frequency, RF, short range, wireless, wireless personal area network, WPAN

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Introduction

This introduction is not part of IEEE Std 802.15.4-2011, IEEE Standard for Local and metropolitan area networks—Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs).

This is the second revision of IEEE Std 802.15.4. From the beginning, the goal of 802.15.4 was to produce a standard that enabled very low-cost, low-power communications. The initial standard, IEEE Std 802.15.4-2003, defined two optional PHYs, operating in different frequency bands with a very simple, but effective, MAC.

In 2006, the standard was revised, adding two more PHY options. The MAC was backward-compatible, but it added MAC frames with an increased version number, new security features, and a variety of MAC enhancements, including:

- Support for a shared time base with a data time stamping mechanism
- Support for beacon scheduling
- Synchronization of broadcast messages in beacon-enabled PANs

In 2007, two new PHYs were added as an amendment, one of which supported accurate ranging. As a part of this amendment, MAC capability to support ranging was added.

In 2009, two new PHY amendments were approved, one to provide operation in frequency bands specific in China and the other for operation in frequency bands specific to Japan.

The current revision of the standard was created to roll in the previous three amendments into a single document. However, IEEE Std 802.15.4 had become very popular, and there were three additional amendments, 2 PHY and 1 MAC, in process at that time. It was clear that the original organization of the standard was inadequate for the variety of applications, optional PHYs and optional MAC features to which the 802.15.4 base standard would be applied.

Thus, the major changes in the current revision are not technical but editorial. The organization of the standard was changed so that each PHY now has a separate clause. The MAC clause was split into functional description, interface specification, and security specification. In addition, a great deal of informative text, including the coexisting annex and regulatory annex, were deleted so that the document would focus on only those technical requirements needed for interoperability. The revised organization is the consensus decision of a broad group of 802.15 members, including people who were part of the original standard as well as individuals developing amendments to the standard for new applications.

The PAR for IEEE Std 802.15.4-2011 was first proposed in July 2010 and was approved in September 2010 by NesCom. After a total of 10 drafts, 3 working group ballots, and 4 sponsor ballots, the final standard was approved in June 2011, less than one year from start to finish.

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Contents

1.	Overview.....	1
1.1	General.....	1
1.2	Scope.....	1
1.3	Purpose.....	2
2.	Normative references.....	3
3.	Definitions, acronyms, and abbreviations.....	4
3.1	Definitions.....	4
3.2	Acronyms and abbreviations.....	5
4.	General description.....	8
4.1	General.....	8
4.2	Components of the IEEE 802.15.4 WPAN.....	8
4.3	Network topologies.....	8
4.3.1	Star network formation.....	9
4.3.2	Peer-to-peer network formation.....	9
4.4	Architecture.....	10
4.4.1	Physical layer (PHY).....	11
4.4.2	MAC sublayer.....	11
4.5	Functional overview.....	12
4.5.1	Superframe structure.....	12
4.5.2	Data transfer model.....	13
4.5.3	Frame structure.....	14
4.5.4	Improving probability of successful delivery.....	14
4.5.5	Power consumption considerations.....	15
4.5.6	Security.....	15
4.6	Concept of primitives.....	16
5.	MAC protocol.....	18
5.1	MAC functional description.....	18
5.1.1	Channel access.....	18
5.1.2	Starting and maintaining PANs.....	24
5.1.3	Association and disassociation.....	32
5.1.4	Synchronization.....	36
5.1.5	Transaction handling.....	39
5.1.6	Transmission, reception, and acknowledgment.....	40
5.1.7	GTS allocation and management.....	48
5.1.8	Ranging.....	54
5.2	MAC frame formats.....	57
5.2.1	General MAC frame format.....	57
5.2.2	Format of individual frame types.....	61
5.2.3	Frame compatibility.....	67
5.3	MAC command frames.....	67
5.3.1	Association request command.....	67

5.3.2	Association response command	69
5.3.3	Disassociation notification command	70
5.3.4	Data request command	71
5.3.5	PAN ID conflict notification command	72
5.3.6	Orphan notification command	73
5.3.7	Beacon request command	73
5.3.8	Coordinator realignment command	74
5.3.9	GTS request command	75
6.	MAC services	77
6.1	Overview	77
6.2	MAC management service	77
6.2.1	Common requirements for MLME primitives	78
6.2.2	Association primitives	79
6.2.3	Disassociation primitives	83
6.2.4	Communications notification primitives	86
6.2.5	Primitives for reading PIB attributes	90
6.2.6	GTS management primitives	91
6.2.7	Primitives for orphan notification	94
6.2.8	Primitives for resetting the MAC sublayer	96
6.2.9	Primitives for specifying the receiver enable time	97
6.2.10	Primitives for channel scanning	99
6.2.11	Primitives for writing PIB attributes	102
6.2.12	Primitives for updating the superframe configuration	103
6.2.13	Primitives for synchronizing with a coordinator	107
6.2.14	Primitives for requesting data from a coordinator	110
6.2.15	Primitives for specifying dynamic preamble	112
6.2.16	Primitives for channel sounding	113
6.2.17	Primitives for ranging calibration (for UWB PHYs)	114
6.3	MAC data service	116
6.3.1	MCPS-DATA.request	116
6.3.2	MCPS-DATA.confirm	118
6.3.3	MCPS-DATA.indication	119
6.3.4	MCPS-PURGE.request	123
6.3.5	MCPS-PURGE.confirm	124
6.4	MAC constants and PIB attributes	124
6.4.1	MAC constants	124
6.4.2	MAC PIB attributes	124
6.4.3	Calculating PHY dependent MAC PIB values	129
7.	Security	131
7.1	Overview	131
7.2	Functional description	131
7.2.1	Outgoing frame security procedure	131
7.2.2	KeyDescriptor lookup procedure	132
7.2.3	Incoming frame security procedure	133
7.2.4	DeviceDescriptor lookup procedure	135
7.2.5	SecurityLevelDescriptor lookup procedure	135
7.2.6	Incoming security level checking procedure	135
7.2.7	Incoming key usage policy checking procedure	136
7.3	Security operations	136
7.3.1	Integer and octet representation	136

7.3.2	CCM* Nonce	136
7.3.3	CCM* prerequisites	137
7.3.4	CCM* transformation data representation	137
7.3.5	CCM* inverse transformation data representation	138
7.4	Auxiliary security header	139
7.4.1	Security Control field	140
7.4.2	Frame Counter field	141
7.4.3	Key Identifier field	141
7.5	Security-related MAC PIB attributes	142
8.	General PHY requirements	146
8.1	General requirements and definitions	146
8.1.1	Operating frequency range	146
8.1.2	Channel assignments	147
8.1.3	Minimum LIFS and SIFS periods	150
8.1.4	RF power measurement	151
8.1.5	Transmit power	151
8.1.6	Out-of-band spurious emission	151
8.1.7	Receiver sensitivity definitions	151
8.2	General radio specifications	151
8.2.1	TX-to-RX turnaround time	151
8.2.2	RX-to-TX turnaround time	151
8.2.3	Error-vector magnitude (EVM) definition	152
8.2.4	Receiver maximum input level of desired signal	153
8.2.5	Receiver ED	153
8.2.6	Link quality indicator (LQI)	153
8.2.7	Clear channel assessment (CCA)	153
9.	PHY services	155
9.1	Overview	155
9.2	PHY constants	155
9.3	PHY PIB attributes	156
9.4	PHY PIB attribute values for phyMaxFrameDuration and phySHRDuration	158
10.	O-QPSK PHY	160
10.1	PPDU format	160
10.1.1	Preamble field	160
10.1.2	SFD field	160
10.1.3	Frame Length field	160
10.1.4	PSDU field	160
10.2	Modulation and spreading	161
10.2.1	Data rate	161
10.2.2	Reference modulator diagram	161
10.2.3	Bit-to-symbol mapping	161
10.2.4	Symbol-to-chip mapping	162
10.2.5	O-QPSK modulation	163
10.2.6	Pulse shape	163
10.2.7	Chip transmission order	164
10.3	O-QPSK PHY RF requirements	164
10.3.1	Operating frequency range	164
10.3.2	Transmit power spectral density (PSD) mask	164

10.3.3	Symbol rate	165
10.3.4	Receiver sensitivity	165
10.3.5	Receiver interference rejection	165
10.3.6	TX-to-RX turnaround time	166
10.3.7	RX-to-TX turnaround time	166
10.3.8	Error vector magnitude (EVM).....	166
10.3.9	Transmit center frequency tolerance.....	166
10.3.10	Transmit power	166
10.3.11	Receiver maximum input level of desired signal.....	166
10.3.12	Receiver ED	166
10.3.13	Link quality indicator (LQI)	166
10.3.14	Clear channel assessment (CCA).....	166
11.	Binary phase-shift keying (BPSK) PHY	167
11.1	PPDU format.....	167
11.2	Modulation and spreading	167
11.2.1	BPSK PHY data rates	167
11.2.2	Reference modulator diagram.....	167
11.2.3	Differential encoding	167
11.2.4	Bit-to-chip mapping.....	168
11.2.5	BPSK modulation	168
11.3	BPSK PHY RF requirements.....	168
11.3.1	Operating frequency range.....	168
11.3.2	915/950 MHz band transmit PSD mask	168
11.3.3	Symbol rate	169
11.3.4	Receiver sensitivity.....	169
11.3.5	Receiver interference rejection	169
11.3.6	TX-to-RX turnaround time	170
11.3.7	RX-to-TX turnaround time	170
11.3.8	Error vector magnitude (EVM).....	170
11.3.9	Transmit center frequency tolerance.....	170
11.3.10	Transmit power	170
11.3.11	Receiver maximum input level of desired signal.....	170
11.3.12	Receiver ED	170
11.3.13	Link quality indicator (LQI)	170
11.3.14	Clear channel assessment (CCA).....	170
12.	Amplitude shift keying (ASK) PHY.....	171
12.1	PPDU format.....	171
12.1.1	Preamble for ASK PHY	171
12.1.2	SFD for ASK PHY	171
12.2	Modulation and spreading	171
12.2.1	ASK PHY data rates	171
12.2.2	Reference modulator diagram.....	172
12.2.3	Bit-to-symbol mapping	172
12.2.4	Symbol-to-chip mapping	172
12.2.5	ASK modulation	173
12.2.6	Pulse shape.....	173
12.2.7	Chip transmission order	175
12.3	ASK PHY RF requirements.....	175
12.3.1	Operating frequency range.....	175
12.3.2	915 MHz band transmit PSD mask.....	175

12.3.3	Symbol rate	175
12.3.4	Receiver sensitivity	175
12.3.5	Receiver interference rejection	176
12.3.6	TX-to-RX turnaround time	176
12.3.7	RX-to-TX turnaround time	176
12.3.8	Error vector magnitude (EVM).....	176
12.3.9	Transmit center frequency tolerance.....	176
12.3.10	Transmit power	176
12.3.11	Receiver maximum input level of desired signal.....	176
12.3.12	Receiver ED	177
12.3.13	Link quality indicator (LQI)	177
12.3.14	Clear channel assessment (CCA).....	177
12.3.15	Example of PSSS encoding	177
13.	Chirp spread spectrum (CSS) PHY	179
13.1	CSS PPDU format	179
13.1.1	Preamble	179
13.1.2	SFD field.....	179
13.1.3	PHY header (PHR)	180
13.2	Modulation and spreading	180
13.2.1	Data rates	180
13.2.2	Reference modulator diagram.....	180
13.2.3	De-multiplexer (DEMUX).....	180
13.2.4	Serial-to-parallel mapping	181
13.2.5	Data-symbol-to-bi-orthogonal-codeword mapping	181
13.2.6	Parallel-to-serial converter and QPSK symbol mapping.....	184
13.2.7	DQPSK coding	184
13.2.8	DQPSK-to-DQCSK modulation.....	185
13.2.9	CSK generator.....	185
13.2.10	Bit interleaver	186
13.3	Waveform and subchirp sequences.....	186
13.3.1	Graphical presentation of chirp symbols (subchirp sequences).....	186
13.3.2	Active usage of time gaps.....	186
13.3.3	Mathematical representation of the continuous time CSS base-band signal	188
13.3.4	Raised cosine window for chirp pulse shaping.....	189
13.3.5	Subchirp transmission order	190
13.3.6	Example of CSK signal generation.....	190
13.4	CSS RF requirements.....	191
13.4.1	Transmit power spectral density (PSD) mask and signal tolerance.....	191
13.4.2	Symbol rate	191
13.4.3	Receiver sensitivity.....	191
13.4.4	Receiver interference rejection	192
13.4.5	TX-to-RX turnaround time	192
13.4.6	RX-to-TX turnaround time	193
13.4.7	Transmit center frequency tolerance.....	193
13.4.8	Transmit power	193
13.4.9	Receiver maximum input level of desired signal.....	193
13.4.10	Receiver ED	193
13.4.11	Link quality indicator (LQI)	193
13.4.12	Clear channel assessment (CCA).....	193

14.	UWB PHY	194
14.1	General.....	194
14.2	UWB PPDU format	194
14.2.1	PPDU encoding process.....	195
14.2.2	UWB PHY symbol structure	196
14.2.3	PSDU timing parameters	197
14.2.4	Preamble timing parameters	200
14.2.5	SHR preamble.....	202
14.2.6	PHY header (PHR)	205
14.2.7	Data field.....	207
14.3	UWB PHY modulation.....	207
14.3.1	UWB PHY modulation mathematical framework.....	207
14.3.2	UWB PHY spreading.....	208
14.3.3	UWB PHY forward error correction (FEC)	209
14.4	UWB PHY RF requirements	211
14.4.1	Operating frequency bands	211
14.4.2	Channel assignments.....	213
14.4.3	Regulatory compliance	213
14.4.4	Operating temperature range	213
14.4.5	Baseband impulse response	213
14.4.6	Transmit PSD mask	214
14.4.7	Chip rate clock and chip carrier alignment.....	215
14.4.8	TX-to-RX turnaround time	215
14.4.9	RX-to-TX turnaround time	215
14.4.10	Transmit center frequency tolerance.....	215
14.4.11	Transmit power	215
14.4.12	Receiver maximum input level of desired signal.....	215
14.4.13	Receiver ED.....	215
14.4.14	Link quality indicator (LQI)	216
14.4.15	Clear channel assessment (CCA).....	216
14.5	UWB PHY optional pulse shapes.....	216
14.5.1	UWB PHY optional chirp on UWB (CoU) pulses	216
14.5.2	UWB PHY optional continuous spectrum (CS) pulses	217
14.5.3	UWB PHY linear combination of pulses (LCP).....	219
14.6	Extended preamble for optional UWB CCA mode	219
14.7	Ranging.....	220
14.7.1	Ranging counter.....	220
14.7.2	Crystal characterization	220
14.7.3	Ranging FoM.....	221
15.	GFSK PHY	223
15.1	PPDU formats	223
15.2	Modulation.....	223
15.2.1	GFSK PHY data rates.....	223
15.2.2	Reference modulator diagram.....	223
15.2.3	Data whitening.....	223
15.2.4	GFSK modulation.....	224
15.3	GFSK PHY RF requirements	224
15.3.1	Operating frequency range.....	224
15.3.2	Transmit PSD mask	224
15.3.3	Symbol rate	224
15.3.4	Receiver sensitivity.....	225

15.3.5	Receiver interference rejection	225
15.3.6	TX-to-RX turnaround time	225
15.3.7	RX-to-TX turnaround time	225
15.3.8	Transmit center frequency tolerance.....	225
15.3.9	Transmit power	225
15.3.10	Receiver maximum input level of desired signal.....	225
15.3.11	Receiver ED	225
15.3.12	Link quality indicator (LQI)	226
15.3.13	Clear channel assessment (CCA).....	226
Annex A (informative) Bibliography		227
Annex B (normative) CCM* mode of operation		229
B.1	Introduction.....	229
B.2	Notation and representation	229
B.2.1	Strings and string operations.....	229
B.2.2	Integers, octets, and their representation	229
B.3	Symmetric-key cryptographic building blocks.....	229
B.3.1	Block cipher	230
B.3.2	Mode of operation.....	230
B.4	Specification of generic CCM* mode of operation	230
B.4.1	CCM* mode encryption and authentication transformation.....	230
B.4.1.1	Input transformation	231
B.4.1.2	Authentication transformation	231
B.4.1.3	Encryption transformation	232
B.4.2	CCM* mode decryption and authentication checking transformation	232
B.4.2.1	Decryption transformation	233
B.4.2.2	Authentication checking transformation.....	233
B.4.3	Restrictions	233
Annex C (informative) Test vectors for cryptographic building blocks.....		235
C.1	AES block cipher	235
C.2	Mode of operation.....	235
C.2.1	MAC beacon frame.....	235
C.2.1.1	Description.....	235
C.2.1.2	CCM* mode encryption and authentication transformation.....	235
C.2.1.3	CCM* mode decryption and authentication checking transformation	237
C.2.2	MAC data frame	239
C.2.2.1	Description.....	239
C.2.2.2	CCM* mode encryption and authentication transformation.....	239
C.2.2.3	CCM* mode decryption and authentication checking transformation	241
C.2.3	MAC command frame	243
C.2.3.1	Description.....	243
C.2.3.2	CCM* mode encryption and authentication transformation.....	243
C.2.3.3	CCM* mode decryption and authentication checking transformation	245
Annex D (informative) Protocol implementation conformance statement (PICS) proforma.....		248
D.1	Introduction.....	248
D.1.1	Scope.....	248
D.1.2	Purpose.....	248
D.2	Abbreviations and special symbols.....	248

D.3	Instructions for completing the PICS proforma.....	249
D.4	Identification of the implementation.....	249
D.5	Identification of the protocol	250
D.6	Global statement of conformance	250
D.7	PICS proforma tables.....	251
D.7.1	Functional device types	251
D.7.2	Major capabilities for the PHY	251
D.7.2.1	PHY functions.....	251
D.7.2.2	Radio frequency (RF)	252
D.7.2.3	Channel capabilities for UWB PHY	252
D.7.3	Major capabilities for the MAC sublayer	255
D.7.3.1	MAC sublayer functions.....	255
D.7.3.2	MAC frames	256
Annex E (informative) Location topics		258
E.1	Overview.....	258
E.1.1	Two-way ranging.....	258
E.1.2	Position awareness through one-way transmissions.....	260
E.1.3	The ranging counter	260
E.1.4	Accounting for signal arrival time	261
E.1.4.1	Leading edge search during the acquisition preamble.....	261
E.1.4.2	FoM for bad times.....	262
E.1.4.3	Other opportunities for leading edge search refinement.....	262
E.1.4.4	Managing the preamble length for leading edge search	262
E.1.4.5	PHY deferral of the computations for leading edge search	262
E.1.4.6	PHY deferral of the computations for self-calibration	263
E.1.5	Management of crystal offsets.....	263
E.1.5.1	Characterizing crystal offsets with digital tracking loops	264
E.1.5.2	Characterizing crystal offsets with analog tracking loops	264
E.1.5.3	Characterizing crystal offsets with different tracking loops.....	264
E.1.5.4	Size of units	265
E.1.6	Accounting for internal propagation paths	265
E.1.6.1	PIB attributes for internal propagation paths.....	266
E.1.6.2	Support for self-calibration and one-way ranging	266
E.1.6.3	Use of the calibrate primitives	266
E.1.6.4	Use of the COMPUTATION_NEEDED status.....	266
E.1.7	Timestamp reports	267
E.1.7.1	Presentation of timestamp reports.....	267
E.1.7.2	Start and stop times in the timestamp report.....	267
E.1.8	Private ranging.....	267
E.1.8.1	Simple encryption of the timestamp reports	267
E.1.8.2	Dynamic preamble selection (DPS).....	267
E.2	Time-of-arrival estimation from channel sounding	268
E.3	Time-of-arrival estimation in non-line-of-sight (NLOS) conditions	270
E.4	Asynchronous ranging	271
E.4.1	Two-way ranging (TWR)	272
E.4.2	Symmetric double-sided two-way ranging (SDS-TWR).....	273
E.5	Location estimation from range data	274
E.5.1	Time of arrival	275
E.5.2	Time difference of arrival	276
E.5.2.1	Mode 1	276
E.5.2.2	Mode 2	276

E.6	Network location algorithms	276
E.6.1	Ad hoc algorithms	277
E.6.2	Centralized algorithms	279
E.6.3	Convex optimization algorithms	280
E.6.4	Location estimation using multipath delays	282
Annex F (informative) Example UWB PHY transmit data frame encoding		284
F.1	Channel used in the example	284
F.2	Encoding progression	284
F.2.1	Transmit PSDU	284
F.2.2	PSDU bits	284
F.2.3	Reed-Solomon encoded bits	284
F.2.4	Convolutional encoder input bits	285
F.2.5	Convolutional encoder output bits	285
F.2.6	Scrambler output bits	285
F.2.7	Ternary output symbols	286
Annex G (informative) MPSK PHY		289
G.1	General	289
G.2	780 MHz band data rates	289
G.3	Modulation and spreading	289
G.3.1	Reference modulator diagram	289
G.3.2	Bit-to-symbol mapping	289
G.3.3	Symbol-to-chip mapping	290
G.3.4	Pre-processing	291
G.3.5	PSK modulation	291
G.3.6	Pulse shape	291
G.3.7	Chip transmission order	292
G.4	MPSK PHY RF requirements	292
G.4.1	Transmit power	292
G.4.2	Operating frequency range	292
G.4.3	Transmit PSD mask	292
G.4.4	Symbol rate	292
G.4.5	Receiver sensitivity	292
G.4.6	Receiver interference rejection	293
Annex H (informative) Considerations for the 950 MHz band		294
H.1	General	294
H.2	Listen before talk (LBT) considerations	294

IEEE Standard for Local and metropolitan area networks—

Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs)

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1. Overview

1.1 General

Wireless personal area networks (WPANs) are used to convey information over relatively short distances. Unlike wireless local area networks (WLANs), connections effected via WPANs involve little or no infrastructure. This feature allows small, power-efficient, inexpensive solutions to be implemented for a wide range of devices.

1.2 Scope

This standard defines the physical layer (PHY) and medium access control (MAC) sublayer specifications for low-data-rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements typically operating in the personal operating space (POS) of 10 m.

Physical layers (PHYs) are defined for

- Devices operating in the license-free 868–868.6 MHz, 902–928 MHz, and 2400–2483.5 MHz bands
- Devices with precision ranging, extended range, and enhanced robustness and mobility
- Devices operating according the Chinese regulations, Radio Management of P. R. of China doc. #6326360786867187500 or current document, for one or more of the 314–316 MHz, 430–434 MHz, and 779–787 MHz frequency bands
- Devices operating in the 950–956 MHz allocation in Japan and coexisting with passive tag systems in the band