

ISO/IEC 24730-5:2010-04 (E)

Information technology - Real-time locating systems (RTLS) - Part 5: Chirp spread spectrum (CSS) at 2,4 GHz air interface

Contents		Page
Foreword		vi
Introduction		vii
1	Scope	1
2	Normative references	1
3	Terms and definitions	2
4	Symbols and abbreviated terms	3
5	Overview	6
5.1	Components	6
5.2	Purpose	6
5.3	Not covered by the standard	7
5.4	System	7
5.5	Document structure	7
6	Requirements	7
6.1	Frequency range	7
6.2	2,4 GHz spread spectrum air interface specifications	7
6.3	Compliance requirements	8
6.4	Manufacturer tag ID	8
6.5	Physical layer parameters	8
7	Physical (PHY) layer specification	9
7.1	Modulations	9
7.2	Data rates	9
7.2.1	General PHY packet format	9
7.3	2-ary orthogonal CSS	9
7.3.1	Reference modulator diagram	10
7.3.2	Bandwidths and Transmit power spectral density (PSD) mask	10
7.3.3	Equivalent baseband representation of the continuous time 2-ary orthogonal CSS signal	12
7.3.4	Signal tolerance	13
7.3.5	Bit to symbol mapping	13
7.3.6	Chirp generator	13
7.3.7	Preamble	13
7.3.8	Start of frame delimiter	14
7.3.9	Bit scrambler	14
7.3.10	PHY Header	14
7.3.11	Overview (informative)	14
7.4	DQPSK-CSS	16
7.4.1	Reference modulator diagram	16
7.4.2	Bandwidth and transmit Power Spectral Density (PSD) mask	17
7.4.3	Equivalent baseband representation of the continuous time DQPSK-CSS signal	18
7.4.4	Signal tolerance	20
7.4.5	Overview (informative)	20
7.4.6	Demultiplexer (DEMUX)	22
7.4.7	Serial to Parallel mapping (S/P)	22
7.4.8	Data Symbol - to - Bi-Orthogonal code word mapping	22

7.4.9	Parallel - to - Serial converter (P/S) and QPSK symbol mapping	25
7.4.10	Differential-QPSK (DQPSK) coding	25
7.4.11	DQPSK to DQPSK-CSS modulation	26
7.4.12	Chirp generator	26
7.4.13	Bit interleaver	26
7.4.14	Preamble	26
7.4.15	Start of frame delimiter	27
7.4.16	PHY Header	27
8	MAC sub-layer specification	27
8.1	Overview	27
8.2	General packet format	27
8.3	Packet types	27
8.4	MAC frame formats	28
8.4.1	MAC frame format for Data packet	28
8.4.2	MAC frame format for ACK packet	28
8.4.3	MAC frame format for Broadcast packet	28
8.4.4	MAC frame format for RTS packet	29
8.4.5	MAC frame format for CTS packet	29
8.4.6	MAC frame fields	29
8.5	MAC Timing	31
8.5.1	2-way handshake	31
8.5.2	3-way handshake	32
8.5.3	Ranging-related time measurements	33
8.5.4	Media access	33
9	Tag application layer specification	36
9.1	Overview	36
9.1.1	Example scenario	37
9.2	Tag application states	38
9.2.1	Default state	38
9.2.2	Wait state	38
9.2.3	Range state	39
9.2.4	Sleep state	39
9.2.5	Blink state	39
9.2.6	State transitions	40
9.3	Commands	41
9.3.1	SwitchState command	42
9.3.2	SetConfigVector command	45
9.3.3	GetConfigVector command	47
9.3.4	SetRangingPeers command	47
9.3.5	AddRangingPeers command	47
9.3.6	GetRangingPeers command	48
9.3.7	User defined command	48
9.3.8	Command prioritization	48
9.4	Tag application packet formats	49
9.4.1	Application blink packet	50
9.4.2	Application command packet	51
9.4.3	Application report packet	51
9.4.4	GetConfigVector report	52
9.4.5	GetRangingPeers report	52
9.4.6	Ranging report	52
9.4.7	Application ranging packet	53
9.5	Ranging packet exchanges	57
9.5.1	Ranging packet exchange type 1	57
9.5.2	Ranging packet exchange type 2	58
9.5.3	Ranging packet exchange type 3	60
9.5.4	Ranging packet exchange type 4	61
9.6	Timing values	62
9.7	Default profile	62
9.8	Error handling	62

Annex A (informative) Time base tolerances in two-way ranging	63
Annex B (informative) Coexistence	66
Annex C (informative) Computing location values from range values	69
Annex D (informative) Location and roaming of tags	70
Bibliography	72