

ISO/IEC 18000-63:2013-01 (E)

Information technology - Radio frequency identification for item management - Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C

Contents		Page
Foreword		ix
Introduction		x
1	Scope	1
2	Conformance	1
2.1	Interrogator conformance and obligations	2
2.2	Tag conformance and obligations	2
3	Normative references	3
4	Terms and definitions, symbols and abbreviated terms	3
4.1	Terms and definitions	3
5	Symbols, abbreviated terms and notations	5
5.1	Symbols	5
5.2	Abbreviated terms	6
5.3	Notation	8
6	Type C	9
6.1	Parameter tables	9
6.2	Protocol overview	14
6.2.1	Physical layer	14
6.2.2	Tag-identification layer	14
6.3	Command types and command structure	14
6.3.1	General	14
6.3.2	Mandatory	15
6.3.3	Optional	15
6.3.4	Custom	15
6.3.5	Proprietary	15
6.4	Description of operating procedure	15
6.4.1	Signalling	15
6.4.2	Tag selection, inventory, and access	30
7	Battery Assisted Passive (BAP) Interrogator Talks First Type C systems (optional)	78
7.1	Applicability	78
7.2	General overview, definitions, and requirements of BAP	78
7.3	Battery Assisted Passive inventoried flag and state machine behaviour modifications	80
7.3.1	Modification to ready state and power-down support for BAP Tags	80
7.3.2	Signal loss tolerance via timer (mandatory)	81
7.3.3	Modified persistence of BAP PIE inventory flags (optional)	83
7.4	Battery Assisted Passive PIE (optional)	85
7.4.1	Flex_Query command (optional)	85
7.4.2	BAP PIE detailed operation including optional Battery Saver Mode	86
7.5	Manchester mode Battery Assisted operation protocol extensions	92
7.5.1	Introduction	92
7.5.2	Physical layer	93
7.5.3	Manchester Activation	98
7.5.4	Commands summary	114
7.6	Extended Protocol Control and Battery Tag Capabilities Reporting and Setting	128

7.6.1	General	128
7.6.2	Extended Protocol Control definition	129
7.6.3	Battery Assisted Passive Tag Capability Reporting, Setting, and duty cycle/mode control (optional)	131
8	Sensor support	159
8.1	Applicability	159
8.2	Overview	159
8.3	Real Time Clock (RTC)	160
8.3.1	General	160
8.3.2	Setting the RTC	160
8.3.3	BroadcastSync command (optional, for Type C)	161
8.3.4	Time synchronisation	162
8.4	HandleSensor command (optional, for Type C)	163
8.5	Simple Sensor	164
8.5.1	Type C and Simple Sensor	164
8.6	Sensor Directory System and Full Function Sensors	166
8.6.1	Sensor Access - General Approach	166
Annex A (normative) Extensible bit vectors (EBV)		173
Annex B (normative) State-transition tables		174
B.1	Contents	174
B.2	State transition tables for passive	174
B.2.1	Present state: Ready	174
B.2.2	Present state: Arbitrate	175
B.2.3	Present state: Reply	176
B.2.4	Present state: Acknowledged	177
B.2.5	Present state: Open	178
B.2.6	Present state: Secured	179
B.2.7	Present state: Killed	180
B.3	State transition tables for BAP PIE	181
B.3.1	Present state: sleep	181
B.3.2	Present state: low power listen	181
B.3.3	Present state: listen or stateful listen	181
B.3.4	Present state: stateful sleep or stateful low power listen	181
B.3.5	Present state: battery ready	182
B.3.6	Present state: Arbitrate	182
B.3.7	Present state: Reply	183
B.3.8	Present state: Acknowledged	184
B.3.9	Present state: Open	185
B.3.10	Present state: Secured	187
B.3.11	Present state: Killed	189
B.4	State transition tables for BAP Manchester	189
B.4.1	Present state: Hibernate	189
B.4.2	Present state: Activation code check	190
B.4.3	Present state: Stateful Hibernate	190
B.4.4	Present state: Battery Ready	191
B.4.5	Present state: Arbitrate	193
B.4.6	Present state: Reply	195
B.4.7	Present state: Acknowledged	197
B.4.8	Present state: Open	199
B.4.9	Present state: Secured	201
B.4.10	Present state: Killed	204
Annex C (normative) Command-response tables		205
C.1	Contents	205
C.2	Command response tables for passive	205
C.2.1	Command response: Power-up	205
C.2.2	Command response: Query	205

C.2.3	Command response: QueryRep	206
C.2.4	Command response: QueryAdjust	206
C.2.5	Command response: ACK	207
C.2.6	Command response: NAK	207
C.2.7	Command response: Req_RN	207
C.2.8	Command response: Select	208
C.2.9	Command response: Read	208
C.2.10	Command response: Write	208
C.2.11	Command response: Kill	209
C.2.12	Command response: Lock	209
C.2.13	Command response: Access	210
C.2.14	Command response: BlockWrite	210
C.2.15	Command response: BlockErase	211
C.2.16	Command response: BlockPermalock	211
C.2.17	Command response: T2 timeout	212
C.2.18	Command response: Invalid command	212
C.3	Command response tables for BAP PIE	213
C.3.1	Command response: Flex_Query (optional for BAP PIE)	213
C.3.2	Command response: INACT_T or Selective Global Timeout	213
C.3.3	Command response: Global Timeout	214
C.3.4	Command response: HandleSensor	214
C.3.5	Command response: BroadcastSync	214
C.4	Command Response Tables for Manchester	215
C.4.1	Command response: Power-up	215
C.4.2	Command response: QueryRep	215
C.4.3	Command response: QueryAdjust	215
C.4.4	Command response: ACK	216
C.4.5	Command response: NAK	217
C.4.6	Command response: Req_RN	217
C.4.7	Command response: Select	217
C.4.8	Command response: Read	217
C.4.9	Command response: Write	217
C.4.10	Command response: Kill	217
C.4.11	Command response: Lock	217
C.4.12	Command response: Access	218
C.4.13	Command response: BlockWrite	218
C.4.14	Command response: BlockErase	218
C.4.15	Command response: BlockPermalock	218
C.4.16	Command response: T2 timeout	218
C.4.17	Command response: Long Activation	218
C.4.18	Command response: Short Activation	219
C.4.19	Command response: Query_BAT	220
C.4.20	Command response: Next	221
C.4.21	Command response: Deactivate_BAT	221
C.4.22	Command response: Broadcast ID	222
C.4.23	Command response: Multirate_Reset	223
C.4.24	Command response: HandleSensor	223
C.4.25	Command response: BroadcastSync	223
C.4.26	Command response: Session Flag timer timeout	224
C.4.27	Command response: INACT_T or Selective Global Timeout	224
C.4.28	Command response: Global Timeout	224
C.4.29	Command response: TA	225
C.4.30	Command response: OpRegister Read/Write	225
C.4.31	Command response: Invalid command	226
Annex D (informative) Example slot-count (Q) selection algorithm		227
D.1	Example algorithm an Interrogator might use to choose Q	227
Annex E (informative) Example of Tag inventory and access		228
E.1	Example inventory and access of a single Tag	228

Annex F (informative) Calculation of 5-bit and 16-bit cyclic redundancy checks	232
F.1 Example CRC-5 encoder/decoder	232
F.2 Example CRC-16 encoder/decoder	232
F.3 Example CRC-16 calculations	233
Annex G (normative) Dense- and Multiple-Interrogator channelised signalling	234
G.1 General	234
G.2 Overview of Dense-Interrogator channelised signalling (informative)	234
Annex H (informative) Interrogator-to-Tag link modulation	237
H.1 Baseband waveforms, modulated RF, and detected waveforms	237
Annex I (normative) Error codes	239
I.1 Tag error codes and their usage	239
Annex J (normative) Slot counter	241
J.1 Slot-counter operation	241
Annex K (informative) Example data-flow exchange	242
K.1 Overview of the data-flow exchange	242
K.2 Tag memory contents and lock-field values	242
K.3 Data-flow exchange and command sequence	243
Annex L (informative) Optional Tag features	244
L.1 General	244
L.2 Optional Tag passwords	244
L.2.1 Kill password	244
L.2.2 Access password	244
L.3 Optional Tag memory banks and memory-bank sizes	244
L.3.1 Reserved memory	244
L.3.2 Ull memory	244
L.3.3 TID memory	244
L.3.4 User memory	244
L.4 Optional Tag commands	245
L.5 Optional Tag error-code reporting format	245
L.6 Optional Tag backscatter modulation format	245
L.7 Optional Tag functionality	245
Annex M (informative) Battery Assisted Tag to Interrogator synchronization	246
M.1 Introduction	246
M.2 General concept	246
M.3 Tag to Interrogator synchronization	247
Annex N (normative) Simple Sensors Data Block	249
N.1 Simple sensor types	249
N.2 General bit-based rules	250
N.3 Temperature sensor with 14° C span	250
N.3.1 Monitored measurement span	250
N.3.2 Accuracy	251
N.3.3 Sampling regime	251
N.3.4 High in-range limit level	251
N.3.5 Low in-range limit level	252

N.3.6	Monitor delay	252
N.3.7	High out-of-range alarm delay	253
N.3.8	Low out-of-range alarm delay	253
N.3.9	Alarms	254
N.4	Temperature sensor with 28° C span	255
N.4.1	Monitored measurement span	255
N.4.2	Accuracy	255
N.4.3	Sampling regime	255
N.4.4	High in-range limit	255
N.4.5	Low in-range limit	255
N.4.6	Monitor delay	256
N.4.7	High out-of-range alarm delay	256
N.4.8	Low out-of-range alarm delay	256
N.4.9	Alarms	256
N.5	Relative humidity	256
N.5.1	Monitored measurement span	256
N.5.2	Accuracy	256
N.5.3	Sampling regime	257
N.5.4	High in-range limit level	257
N.5.5	Low in-range limit level	257
N.5.6	Monitor delay	257
N.5.7	High out-of-range alarm delay	257
N.5.8	Low out-of-range alarm delay	257
N.5.9	Alarms	257
N.6	Impact	258
N.6.1	Monitored measurement span	258
N.6.2	Accuracy	258
N.6.3	Sampling regime	258
N.6.4	High in-range limit	258
N.6.5	Low in-range limit	258
N.6.6	Monitor delay	258
N.6.7	High out-of-range alarm delay	258
N.6.8	Low out-of-range alarm delay	259
N.6.9	Alarms	259
N.7	Tilt	259
N.7.1	Monitored measurement span	259
N.7.2	Accuracy	259
N.7.3	Sampling regime	259
N.7.4	High in-range limit	259
N.7.5	Low in-range limit	259
N.7.6	Monitor delay	259
N.7.7	High out-of-range alarm delay	260
N.7.8	Low out-of-range alarm delay	260
N.7.9	Alarms	260
Annex O (normative) Record structures and commands for Ported Simple Sensors		261
O.1	Record structure types	261
O.1.1	Simple sensor data block	261
O.1.2	Sensor characteristics record block	262
O.1.3	Manufacturer record block	262
O.1.4	Authorisation password record block	263
O.1.5	Calibration record block	263
O.1.6	Sample and configuration record block	265
O.1.7	Event record block	266
O.1.8	Time synchronisation record block	267
O.2	Ported Simple Sensor commands	267
O.2.1	Read-Simple-Sensor-Data-Block	267
O.2.2	Read-Manufacturer-Record	268
O.2.3	Write-Password	268
O.2.4	Read-Calibration-Record	269
O.2.5	Write-Sample-And-Configuration-Record	269

O.2.6	Initialise-Sensor-Monitoring	270
O.2.7	Read-Sample-And-Configuration-Record	271
O.2.8	Read-Event-Record	271
O.2.9	Write-UTC-Timestamp	272
O.2.10	Read-Time-Synchronisation-Record	273
O.2.11	Erase-Monitored-Data	274
O.2.12	Activate-Simple-Sensor	274
O.2.13	Deactivate-Simple-Sensor	275
Annex P (informative) BAP PIE and Manchester mode tutorial guide		276
P.1	Executive summary of Battery Assisted Passive RFID in this standard	276
P.2	Battery Assisted Passive fundamentals	278
P.2.1	Propagation physics and resulting relationship between Interrogator and Tag sensitivity	278
P.2.2	Tag receiver issues	280
P.3	BAP PIE	281
P.4	Manchester	281
P.5	Guidance on using Next vs. Deactivate_BAT (PIE and Manchester)	282
P.6	Reliable inventory status tracking	282
P.7	Environmental validation	283
P.7.1	INACT_T and (Selective) Global Timeout timer refresh	283
P.8	Fade delay tolerance via INACT_T and Global Timeout	284
P.9	Clocks and commanded data rates and BLFs	284
P.10	Tag Capabilities Reporting and Setting (TCRS)	285
P.11	BAP PIE persistence compliance	285
Annex Q (informative) Manchester mode RF power control		286
Q.1	General	286
Q.2	Power levelling description	286
Q.3	Power leveling algorithm	288
Bibliography		291