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- Ce document détaille les spécifications du profil comptage du CPL G3 (nommé "OFDM type 2" dans ce document).
- Il a été soumis auprès du CENELEC (<http://www.cenelec.eu>) dans le cadre de la normalisation du CPL G3 au titre de "technical specification" (TS). Il est une évolution du document "Spécification du profil G3", précédemment publié sur le site ERDF. Des modifications y ont été apportées notamment des changements de style imposés par le gabarit CENELEC.
- Ce document est un des livrables du projet européen OPEN meter Project, Topic Energy 2008.7.1.1, Project no.: 226369, www.openmeter.com
- Ce document peut être changé sans préavis.

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- This document deals with G3-PLC profile specifications (designated "OFDM modulation type 2" in this document).
- This document has been submitted to CENELEC (<http://www.cenelec.eu>) for technical specification (TS). It is a new release of the "PLC G3 profile specification" document previously released on ERDF web site. Additional changes have been brought like a change in style due to CENELEC document template.
- This document is one of the deliverables of the European OPEN meter Project, Topic Energy 2008.7.1.1, Project no.: 226369, www.openmeter.com
- This document can be subject to change without prior notice.

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Version	Date d'application	Titre et nature de la modification	Annule et remplace
1.0		"Spécification du profil G3"	
2.0	4/04/2011	"The PLC Orthogonal Frequency Division Multiplexing (OFDM) Type 2 profile" <ul style="list-style-type: none">• Clarifications• Mise en forme selon le gabarit CENELEC	"Spécification du profil G3"

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**Electricity metering data exchange – The DLMS/COSEM suite –
Part 8-5: The PLC Orthogonal Frequency Division Multiplexing
(OFDM) Type 2 profile**

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73 **1 Introduction**

74 This Technical Specification is based on the results of the European OPEN meter Project,
75 Topic Energy 2008.7.1.1, Project no.: 226369, www.openmeter.com.
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77 **Electricity metering data exchange – The DLMS/COSEM suite –**
78 **Part 8-5: The PLC Orthogonal Frequency Division Multiplexing**
79 **(OFDM) Type 2 profile**

80 **2 Scope**

81 This Technical Specification specifies the DLMS/COSEM communication profile for metering
82 purposes based on Orthogonal Frequency Division Multiplexing (OFDM) Type 2 Power Line
83 Communications (PLC) system.

84 The physical layer provides a modulation technique that efficiently utilizes the allowed
85 bandwidth within the CENELEC A band (3 kHz – 95 kHz), thereby allowing the use of
86 advanced channel coding techniques. This combination enables a very robust communication
87 in the presence of narrowband interference, impulsive noise, and frequency selective
88 attenuation.

89 The medium access control (MAC) layer allows the transmission of MAC frames through the
90 use of the power line physical channel. It provides data services, frame validation control,
91 node association and secure services.

92 The 6LoWPAN adaptation sublayer enables an efficient interaction between the MAC and the
93 IPv6 network layers. The IPv6 network protocol; the new generation of IP (Internet Protocol),
94 widely opens the range of potential applications and services for metering purposes (but not
95 limited to metering purposes).

96 The transport layer, the application layer and the data model are as specified in the IEC
97 62056 DLMS/COSEM suite.

98 **3 Normative references**

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

102 EN 50065-1:2001, *Signalling on low-voltage electrical installations in the frequency range 3*
103 *kHz to 148,5 kHz – Part 1: General requirements, frequency bands and electromagnetic*
104 *disturbances*

105 prEN/TS 5VVVV-2:2010, *Data exchange for meter reading, tariff and load control – Part 4-5:*
106 *PLC OFDM Type 2 Physical and MAC layer using OFDM modulation*

107 IEC 61334-5-1:2001, *Distribution automation using distribution line carrier systems – Part 5-1:*
108 *Lower layer profiles – The spread frequency shift keying (S-FSK) profile*

109 IEC 62056-47:2006, *Electricity metering - Data exchange for meter reading, tariff and load*
110 *control – Part 47: COSEM transport layers for IPv4 networks*

111 future IEC 62056-4-7 Amd1:20XX, *Electricity metering - Data exchange for meter reading,*
112 *tariff and load control – Part 4-7: COSEM transport layers for IPv4 and IPv6 networks*

113 future 13/1475/CDV, IEC 62056-9-7 Ed.1.0:201X, *Electricity metering data exchange – The*
114 *DLMS/COSEM Suite – Part 9-7: Communication profile for TCP-UDP/IP networks*

115 13/1468/CDV, IEC 62056-5-3 Ed.3.0:201X, *Electricity metering data exchange – The*
116 *DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*

- 117 13/1465/CDV, IEC 62056-6-1 Ed. 3.0:20XX, *Electricity metering data exchange – The*
118 *DLMS/COSEM suite – – Part 61: OBIS Object identification system*
- 119 13/1466/CDV, IEC 62056-6-2 Ed 3.0:201X, *Electricity metering data exchange – The*
120 *DLMS/COSEM suite – Part 6-2: COSEM interface classes*
- 121 IEEE 802:2001, *IEEE Standard for Local and Metropolitan Area Networks – Overview and*
122 *Architecture*
- 123 IEEE 802.15.4:2006, *IEEE Standard for Information technology – Telecommunications and*
124 *information exchange between systems – Local and metropolitan area networks – Specific*
125 *requirements – Part 15.4: Wireless Medium Access (MAC) and Physical Layer (PHY)*
126 *Specifications for Low-Rate Wireless Personal Area Networks (WPANs)*
- 127 IETF RFC 768: User Datagram Protocol. Edited by J. Postel. August 1980. Available from
128 <http://www.ietf.org/rfc/rfc768.txt>
- 129 IETF RFC 793: Transmission control protocol. September 1981. Available from
130 <http://www.ietf.org/rfc/rfc793.txt>
- 131 IETF RFC 1213: Management Information Base for Network Management of TCP/IP-based
132 internets:MIB-II. Edited by K. McCloghrie, M. Rose. March 1991. Available from
133 <http://www.ietf.org/rfc/rfc1213.txt>
- 134 IETF RFC 1350: The TFTP protocol (revision 2). Edited by K. Collings. July 1992. Available
135 from <http://www.ietf.org/rfc/rfc1350.txt>
- 136 IETF RFC 1952: GZIP file format specification version 4.3. Edited by P. Deutsch. May 1996.
137 Available from <http://www.ietf.org/rfc/rfc1952.txt>
- 138 IETF RFC 2090: TFTP Multicast Option. Edited by A. Emberson. February 1997. Available
139 from <http://www.ietf.org/rfc/rfc2347.txt>
- 140 IETF RFC 2347: TFTP Option Extension. Edited by G. Malkin, A. Harkin. May 1998. Available
141 from <http://www.ietf.org/rfc/rfc2347.txt>
- 142 IETF RFC 2348: TFTP Blocksize Option. Edited by G. Malkin, A. Harkin. May 1998. Available
143 from <http://www.ietf.org/rfc/rfc2348.txt>
- 144 IETF RFC 2349: TFTP Timeout Interval and Transfer Size Options. Edited by G. Malkin, A.
145 Harkin. May 1998. Available from <http://www.ietf.org/rfc/rfc2349.txt>
- 146 IETF RFC 2460: Internet Protocol, Version 6 (IPv6) Specification. Edited by S. Deering, R.
147 Hinden. December 1998. Available from <http://www.ietf.org/rfc/rfc2460.txt>
- 148 IETF RFC 2578: Structure of Management Information Version 2 (SMIv2). Edited by K.
149 McCloghrie, D. Perkins, J. Schoenwaelder. April 1999. Available from
150 <http://www.ietf.org/rfc/rfc2578.txt>
- 151 IETF RFC 2863: The Interfaces Group MIB. Edited by K. McCloghrie, F. Kastenholz. June
152 2000. Available from <http://www.ietf.org/rfc/rfc2863.txt>
- 153 IETF RFC 3414: User-based Security Model (USM) for version 3 of the Simple Network
154 Management Protocol (SNMPv3). Edited by U. Blumenthal, B. Wijnen. December 2002.
155 Available from: <http://www.ietf.org/rfc/rfc3414.txt>
- 156 IETF RFC 3416: Version 2 of SNMP (Simple Network Management Protocol). Edited by R.
157 Presuhn, J. Case, M. Rose, S. Waldbusser. December 2002. Available from:
158 <http://www.ietf.org/rfc/rfc3416.txt>

159 IETF RFC 3418: Management Information Base (MIB) for the Simple Network Management
160 Protocol (SNMP). Edited by R. Presuhn, J. Case, K. McCloghrie, M. Rose, S. Waldbusser.
161 December 2002. Available from: <http://www.ietf.org/rfc/rfc3418.txt>

162 IETF RFC 3584: Coexistence between Version 1, Version 2, and Version 3 of the Internet-
163 standard Network Management Framework. Edited by R. Frye, D. Levi, S. Routhier, B.
164 Wijnen. August 2003. Available from : <http://www.ietf.org/rfc/rfc3584.txt>

165 IETF RFC 4022: Management Information Base for the Transmission Control Protocol (TCP).
166 Edited by R. Raghunathan. March 2005. Available from : <http://www.ietf.org/rfc/rfc4022.txt>

167 IETF RFC 4113: Management Information Base for the User Datagram Protocol (UDP). Edited
168 by B. Fenner, J. Flick. June 2005. Available from <http://www.ietf.org/rfc/rfc4113.txt>

169 IETF RFC 4194: The S Hexdump Format. Edited by J. Strombergson, L. Walleij, P. Faltstrom.
170 October 2005. Available from <http://www.ietf.org/rfc/rfc4194.txt>

171 IETF RFC 4293: Management Information Base for the Internet Protocol (IP). Edited by S.
172 Routhier. April 2006. Available from <http://www.ietf.org/rfc/rfc4293.txt>

173 IETF RFC 4944: Transmission of IPv6 Packets over IEEE 802.15.4 Networks. Edited by G.
174 Montenegro, N. Kushalnagar, D. Culler. September 2007. Available from
175 <http://www.ietf.org/rfc/rfc4944.txt>

176 IETF RFC 4995: The RObust Header Compression (ROHC) Framework. Edited by G.
177 Pelletier, K. Sandlund. July 2007. Available from <http://www.ietf.org/rfc/rfc4995.txt>

178 IETF RFC 4996: RObust Header Compression (ROHC): A Profile for TCP/IP (ROHC-TCP).
179 Edited by G. Pelletier, K. Sandlund, M. West. July 2007. Available from
180 <http://www.ietf.org/rfc/rfc4996.txt>

181 IETF RFC 5225: RObust Header Compression Version 2 (ROHCv2): Profiles for RTP, UDP,
182 IP, ESP and UDP-Lite. Edited by G. Pelletier, K. Sandlund. April 2008. Available from
183 <http://www.ietf.org/rfc/rfc5225.txt>

184 NOTE The following IETF documents are in the draft stage.

185 IETF draft-daniel-6lowpan-mib-01: 6LoWPAN Management Information Base. Edited by K.
186 Kim, H. Mukhtar, S. Joo, S. Yoo, S. Daniel. October 26, 2009. Available from:
187 <http://www.ietf.org/rfc/draft-daniel-6lowpan-mib-.txt>

188 4 Terms and definitions

189 For the purposes of this document, definitions of IEEE 802.15.4-2006 and RFC 4944, apply.

190 5 Acronyms

ACK	ACKnowledge
BPSK	Binary Phase Shift Keying
CENELEC	European Committee for Electrotechnical Standardization
DBPSK	Differential Binary Phase Shift Keying
DQPSK	Differential Quadrature Phase Shift Keying
DLMS	Device Language Message Specification
D8PSK	Differential Eight Phase Shift Keying

FCH	Frame Control Header
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
IP	Internet Protocol
LBP	LoWPAN Bootstrapping Protocol
MAC	Media Access Control
MIB	Management Information Base
OFDM	Orthogonal Frequency Division Multiplexing
PAN	Personal Area Network
PHY	PHYSical layer
PIB	PAN Information Base
PLC	Power Line Communication
PN	Pseudo-Noise Sequence
PPDU	PHY Protocol Data Unit
PSDU	PHY Service Data Unit
RES	Reserved (bit fields)
ROHC	Robust Header Compression
SNMP	Simple Network Management Protocol
TFTP	Trivial File Transfer Protocol
UDP	User Datagram Protocol
6LoWPAN	IPv6 over Low power Wireless Personal Area Networks

191 Furthermore, the abbreviations given in the following clauses apply also:

- 192 • Clause 4 of IEEE 802.15.4-2006;
193 • Clause 1.2 of RFC 4944.

194 **6 Conventions**

195 Through the document, the applicability of each provision from the reference documents is
196 given using the following convention:

- 197 • I = "Informative". The statements of the reference document are provided for information
198 only;
- 199 • N = "Normative": The statements of the reference document apply without modifications or
200 remarks;
- 201 • S = "Selection": The statements of the reference document apply with the selections
202 specified;
- 203 • E = "Extension": The statements of the reference document apply with the extensions
204 specified;
- 205 • N/R = "Not Relevant": The statements of the reference document do not apply. An
206 explanation may be given under the part title.

207 **7 Overview**

208 The present standard constitutes the specification for PLC OFDM Type 2 communication
209 profile for metering purposes based on OFDM modulation and DLMS/COSEM.

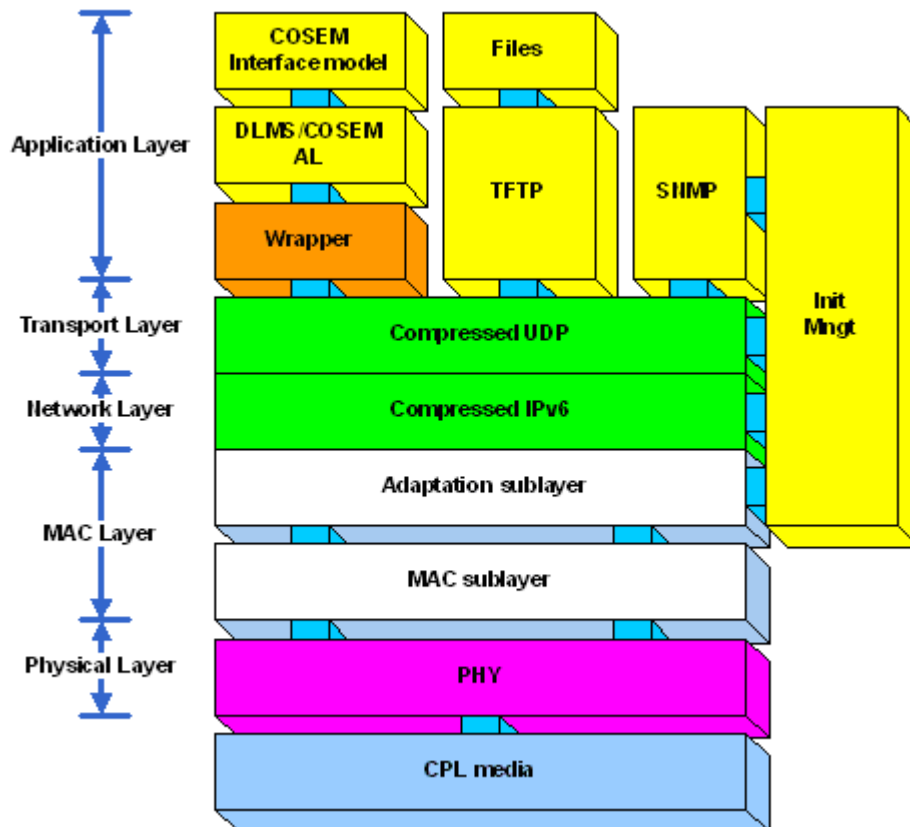
210 This standard has been developed to meet the following aims:

- 211 • Robustness: the communication profile must be suited to severe environments;
- 212 • Performance: it must take full advantage of the CENELEC A band;
- 213 • Simplicity: it must be simple to implement, install (Plug and Play), operate and maintain;
- 214 • Flexibility: it must be compatible with diverse applications and network topologies;
- 215 • Security: it must offer a safe environment for the promotion of Value Added services;
- 216 • Openness: it must be based on open standards in order to support multi-supplier
- 217 solutions;
- 218 • Scalability: it must support all future metering developments.

219 To this end, the OFDM PLC protocol stack aggregates several layers and sublayers that form
220 the PLC OFDM Type 2 metering profile:

- 221 – A robust high-performance PHY layer based on OFDM and adapted to the PLC
- 222 environment;
- 223 – A MAC layer of the IEEE type, well suited to low data rates;
- 224 – IPv6, the new generation of IP (Internet Protocol), which widely opens the range of
- 225 potential applications and services;
- 226 – And to allow good IPv6 and MAC interoperability, an adaptation sublayer taken from the
- 227 Internet world and called 6LoWPAN;
- 228 – The Application layer comprises two broad classes of applications: the Metering
- 229 Application based on DLMS/COSEM and the Application ensuring the Management of the
- 230 meter.

231 Figure 1 gives an overall view of the DLMS/COSEM PLC OFDM Type 2 metering
232 communication profile.



233

234

Figure 1 – PLC OFDM Type 2 metering communication profile

235 **8 Lower layers: Physical and Data link layers**

236 **8.1 Physical layer**

237 The OFDM PLC PHY layer is specified in prEN/TS 5V VVVV-2.

238 **8.2 MAC layer**

239 The PLC OFDM Type 2 data link layer specification comprises two sublayers:

- 240 – The MAC sublayer based on IEEE 802.15.4; and
- 241 – The Adaptation layer based on RFC 4944: Transmission of IPv6 Packets over IEEE
242 802.15.4 Networks (6LowPan).

243 prEN/TS 5V VVVV-2 specifies the necessary selections from and extensions to these standards.

244 **9 Internet and Transport layers**

245 **9.1 Introduction**

246 The proposed communication model natively integrates a network layer and an IP suite
247 transport layer which opens the way to a vast range of Internet applications and ensures great
248 flexibility in the system architecture. It provides the possibility of having:

- 249 • Either a decentralized architecture, where the data concentrator acts as an application
250 relay, with more or less autonomy. The exchanges at transport level in this case are
251 limited to the dialogue between the meters and the concentrators;
- 252 • Or to have a more centralized architecture in which the concentrator simply acts as a
253 network gateway and the meters dialogue directly with servers.

254 Mixed architectures are of course also possible. A centralized architecture can thus be used
255 for the most sensitive functions, and distributed architecture used for the others.

256 The chosen Internet layer is based on the IPv6 protocol (RFC 2460) to ensure the long-term
257 continuity of the model.

258 The protocol used for the transport layer is UDP (RFC 768), which provides unreliable
259 transport to datagram's in non-connected mode. Reliability of exchanges within the PLC
260 network is brought by the subjacent layers.

261 There is no identified need for the TCP protocol (RFC 793) which provides reliable transport
262 in connected mode to flows of bytes produced by the Applications. This being said, there is
263 nothing to prevent its introduction later on.

264 In order not to compromise the speed of the PLC OFDM links, the IPv6 and UDP headers are
265 compressed. The 6LoWPAN specification (RFC 4944) includes a simple and robust static
266 compression which, for example, reduces the IPv6 and UDP headers from 48 bytes to 5
267 bytes.

268 Likewise, other compression schemes shall be usable if necessary, such as adaptive
269 ROHCv2 compression (RFC 4995) with its specific profiles for TCP/IP (RFC 4996) and
270 UDP/IP (RFC 5225). In most cases ROHCv2 manages to reduce header size to 2 bytes. This
271 compression is moreover extendable to other protocols.

272 **10 Metering application layer**

273 **10.1 Overview**

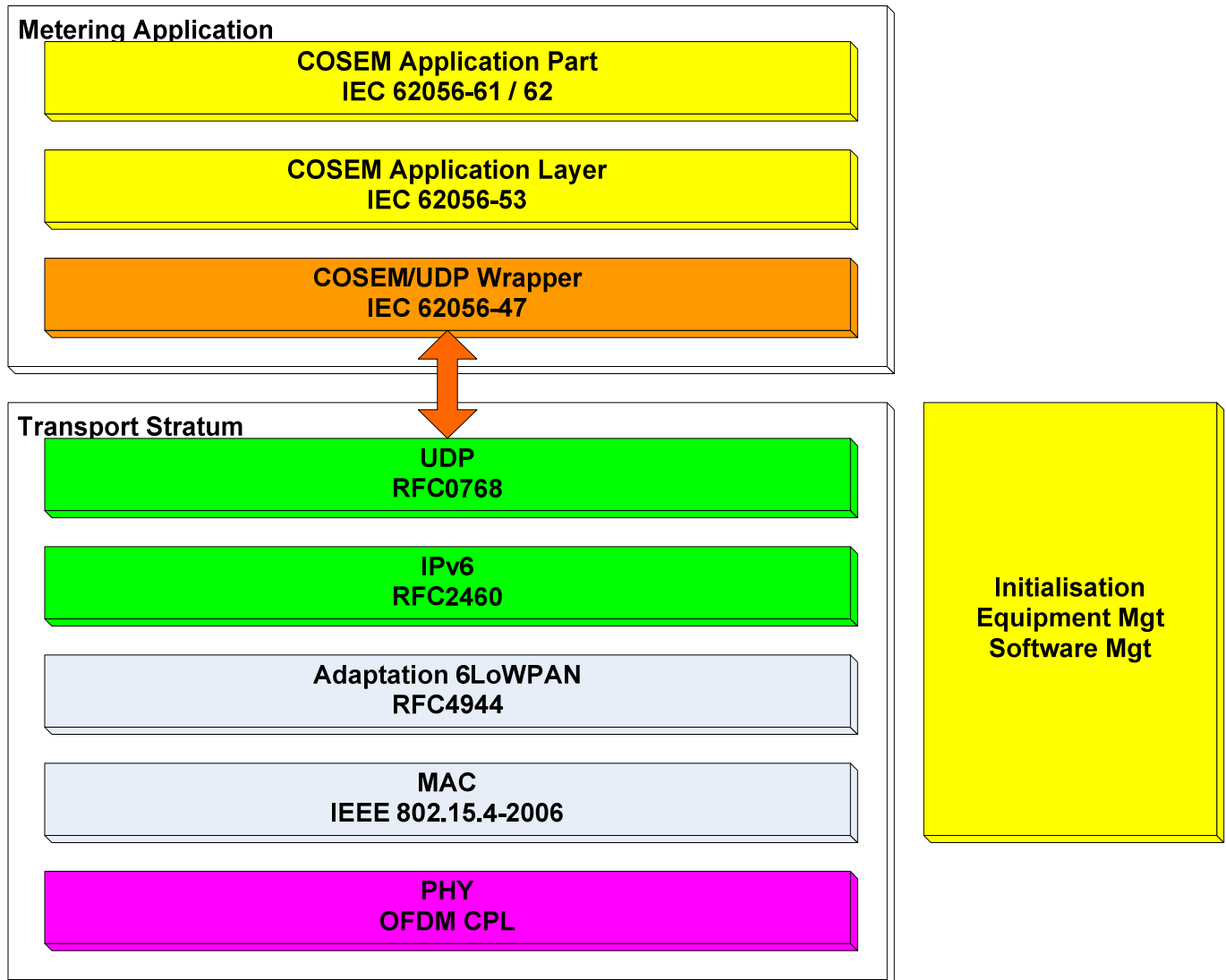
274 The Metering application covers layers 5 to 7 in the OSI model. As described in Figure 2, the
275 model proposed for metering comprises two broad classes of Applications: the Metering
276 Application proper and the Applications ensuring the Management of the meter.

277 It will be noted that all these applications rely natively on UDP, but there is nothing to prevent
278 the future introduction of Applications that use TCP.

279 In the PLC OFDM Type 2 profile, the DLMS/COSEM Application strictly complies with the
280 existing standards, namely:

- 281 • "COSEM Application Part" as specified in IEC 62056-6-1 and IEC 62056-6-2;
- 282 • "DLMS/COSEM Application Layer" as specified in IEC 62056-5-3;
- 283 • Security at Application level is ensured by the processes specified in IEC 62056-5-3.

284 Transport of the DLMS/COSEM Application protocol by UDP requires the interposition of a
285 "Wrapper" in accordance with future IEC 62056-4-7 Amd1. The use of this wrapper allows one
286 to take advantage of the compression proposed by 6LoWPAN (see section A.3.2). This is a
287 very simple stateless protocol that enables the number of ports to be scaled down. The
288 header it introduces should be able to be compressed in the future.



290 **Figure 2 – Metering Application in the PLC OFDM Type 2 profile**

291 **10.2 UDP/DLMS/COSEM Wrapper**

292 The UDP / DLMS/COSEM wrapper for IPv6 as described in future IEC 62056-4-7 Amd1 apply,
293 with the selections specified in Table 1.

294 **Table 1 – Selections from future IEC 62056-4-7 Amd1**

295 NOTE References are to IEC 62056-47.

Clause	Title and remarks/modifications	Statement
1	Scope	N
2	Normative references	N
3	Terms, definitions and abbreviations	N
3.1	Terms and definitions	N
3.2	Abbreviations	N
4	Overview	N
5	The COSEM connection-less, UDP-based transport layer	N
5.1	General	N
5.2	Service specification for the COSEM UDP-based transport layer	N
5.2.1	General	N
5.2.2	The UDP-DATA services	N
5.2.2.1	UDP-DATA.request - The UDP server port number used by the 'DLMS/COSEM Server Application Layer' equals 61616 (0xF0B0) in order to take full advantage of the compression of the UDP headers by the 6LoWPAN adaptation sublayer (see prEN/TS 5VVVV-2 for more details). - The UDP client port number used by the 'DLMS/COSEM Client Application Layer' can take any value between 1024 and 65535. Ideally this value will be between 61617 (0xF0B1) and 61631 (0xF0BF) in order to take full advantage of the compression of the UDP headers by the 6LoWPAN adaptation sublayer (see prEN/TS 5VVVV-2 for more details).	S
5.2.2.2	UDP-DATA.indication - The same remarks as for the UDP-DATA.request primitive apply for the 'Local_UDP_Port' and 'Remote_UDP_Port' parameters.	S
5.2.2.3	UDP-DATA.confirm - The local generation of a UDP-DATA.confirm primitive does not provide a gain at functional level for the PLC OFDM Type 2 standard therefore it is ignored.	N/R
5.3	Protocol specification for the COSEM UDP-based transport layer	N
5.3.1	General	N
5.3.2	The wrapper protocol data unit (WPDU)	N
5.3.3	The COSEM UDP-based transport layer protocol data unit	N
5.3.4	Reserved wrapper port numbers (wPorts) - The number of the wrapper port for the DLMS/COSEM Public server (i.e. without ciphering of the data) is 0x0011 - The number of the wrapper port for the DLMS/COSEM Administration server (i.e. with ciphering of the data at DLMS/COSEM level) is 0x0012	S
5.3.5	Protocol state machine	N
6	The COSEM connection-oriented, TCP-based transport layer	N/R
6.1	General	N/R
6.2	Service specification for the COSEM TCP-based transport layer	N/R
6.2.1	General	N/R

Clause	Title and remarks/modifications	Statement
6.2.2	The TCP-CONNECT services	N/R
6.2.2.1	TCP-CONNECT.request	N/R
6.2.2.2	TCP-CONNECT.indication	N/R
6.2.2.3	TCP-CONNECT.response	N/R
6.2.2.4	TCP-CONNECT.confirm	N/R
6.2.3	The TCP-DISCONNECT services	N/R
6.2.3.1	TCP-DISCONNECT.request	N/R
6.2.3.2	TCP-DISCONNECT.indication	N/R
6.2.3.3	TCP-DISCONNECT.response	N/R
6.2.3.4	TCP-DISCONNECT.confirm	N/R
6.2.4	The TCP-ABORT service	N/R
6.2.4.1	General	N/R
6.2.4.2	TCP-ABORT.indication	N/R
6.2.5	The TCP-DATA services	N/R
6.2.5.1	TCP-DATA.request	N/R
6.2.5.2	TCP-DATA.indication	N/R
6.2.5.3	TCP-DATA.confirm	N/R
6.3	Protocol specification for the COSEM TCP-based transport layer	N/R
6.3.1	General	N/R
6.3.2	The wrapper protocol data unit (WPDU)	N/R
6.3.3	The COSEM TCP-based transport layer data unit	N/R
6.3.4	Reserved wrapper port numbers	N/R
6.3.5	Definition of the procedures	N/R
6.3.5.1	Setting up the TCP connection	N/R
6.3.5.2	Disconnecting the TCP connection	N/R
6.3.5.3	TCP connection abort	N/R
6.3.5.4	Data communication – using the TCP-DATA services	N/R
6.3.5.5	High-level state transition diagram of the wrapper sub-layer	N/R
Annex A	Converting OSI-style transport layer servicesto and from RFC-style TCP function calls	N/R

296

297 **10.3 Communication profile for TCP-UDP/IP networks**

298 The communication profile for UDP/IP networks as described in IEC 62056-9-7 Ed.1.0 apply,
299 with the selections specified in Table 2 .

300 **Table 2 – Selections from IEC 62056-9-7 Ed.1.0**

301 NOTE References are to IEC 62056-9-7 Ed.1.0.

Clause	Title and remarks/modifications	Statement
1	Scope	I
2	Normative references	N
3	Terms, definitions and abbreviations	N
4	Targeted communication environments	N
5	The structure of the profile(s)	S

Clause	Title and remarks/modifications	Statement
	- Only the IPv6 network layer and UDP transport layer are applicable for this standard.	
6	Identification and addressing scheme - For UDP and wrapper ports definition applicable to this standard, see 10.2.	S
7	Supporting layer services and service mapping - Only UDP services are supported by this standard	S
8	Communication profile specific service parameters of the COSEM AL services - Only UDP parameters are supported by this standard	S
9	Specific considerations / constraints	N
9.1	Confirmed and unconfirmed AAs and service invocations, packet types used	N
9.2	Releasing application associations: using RLRQ/RLRE is mandatory	N
9.3	Service parameters of the COSEM-OPEN / -RELEASE / -ABORT services	N
9.4	xDLMS client/server type services	N
9.5	The EventNotification Service and the TriggerEventNotificationSending service	N
9.6	Transporting long messages	N
9.7	Allowing COSEM servers to establish the TCP connection	N/R
9.8	The COSEM TCP-UDP/IP profile and real-world IP networks	N

302

303 11 Meter Management Applications

304 11.1 Overview

305 The Meter Management Applications feature three large functional blocks:

- 306 • A Management Agent;
- 307 • A software downloading system;
- 308 • An Initialization and Supervision system.

309 11.2 Management Agent

310 11.2.1 General

311 The Management Agent operates under the supervision of a Manager function. Depending on
312 the chosen architecture, it may be implemented in the Concentrator or centralized. Together,
313 they must address the different functional domains:

- 314 • Configuration Management, which allows the loading and reading (GET/SET) of the
315 parameters that control the functioning of the Meter. It will be noted that some of these
316 parameters are also set by the LBP protocol during initial configuration (see prEN/TS
317 5VVVV-2 for more details);
- 318 • Fault and Alarm Management which ensures the supervision of functioning of the meter,
319 the detection, recording and signalling of faults which are presented as Alarms;
- 320 • Statistics Management, which counts and logs all the marking events.

321 To ensure communications between the entities, two options are allowed:

- 322 a) Either by using SNMP protocol;
- 323 b) Or, by using DLMS protocol.

324 **11.2.2 Protocol SNMP**

325 The protocol used for exchanges between Management Agent and Manager may be SNMP in
326 its latest version RFC 3416.

327 Implementation must take into account the good practices defined by RFC 3584 to allow the
328 coexistence of several versions of SNMP within a given network. The security functions of
329 SNMPv3 (RFC 3414) turn out to be relatively difficult to use. To maintain simplicity of
330 deployment, it is preferable not to activate them and to rely on the security functions offered
331 by the PLC OFDM Type 2 at MAC level.

332 If a new need arises, later upgrading to the security model SNMPv3 (RFC 3414) remains
333 possible thanks to software downloading.

334 All the information is modelled in the form of an MIB (*Management Information Base*) as
335 defined in Annex A.

336 **11.2.3 Protocol DLMS/COSEM**

337 Associated with COSEM objects specified in IEC 62056-6-2 and in IEC 62056-6-1, the DLMS
338 protocol specified in IEC 62056-5-3 may be used for exchanges between Management Agent
339 and Manager.

340 **11.3 Software (firmware) downloading system**

341 **11.3.1 General**

342 Teledistribution must be able to be total or incremental in order to optimise updating times.

343 The firmware memory images are stored in a File Server, which may be implemented in the
344 Concentrator or be centralized, depending on the chosen architecture.

345 Two recommended protocol may be implemented to ensure this use case:

- 346 a) Either TFTP protocol;
347 b) Or DLMS protocol.

348 **11.3.2 Protocol TFTP**

349 The first protocol option to manage the downloading procedure is TFTP (RFC 1350) and its
350 options: RFC 2347, RFC 2348 and RFC 2349. It is usually used for unicast downloading, but
351 a multicast version RFC 2090 is also specified.

352 The downloading mechanism proper provides for two methods:

- 353 • Unmanaged downloading. The file server contacts the equipment directly by sending it a
354 TFTP Write-Request (WRQ) message. In this case the transfer can only be unicast;
- 355 • Managed downloading: the Managers sets the necessary parameters in the equipment
356 (URL of file to download, timeout, etc.) then gives the equipment the order to start the
357 downloading. The equipment then contacts the file server by sending it a TFTP RRQ
358 (*Read-Request*) message. Transfer can then take place in unicast or multicast mode after
359 negotiation. The equipment can propose multicast mode by including an option in its
360 request. The server can accept it by returning a TFTP OACK (*Option-Acknowledge*)
361 message.

362 Multicast mode is particularly effective when it is necessary to distribute given software to an
363 entire equipment pool.

364 A variant of managed downloading appears during bootstrapping. The equipment receives the
365 parameters necessary for a possible reloading via the LBP protocol (see prEN/TS 5VVVV-2).
366 It checks whether proposed firmware version is more recent than that of the embedded
367 firmware, and if it is, it contacts the file server by sending it an RRQ message as before.

368 The Memory Image files thus transferred must have the following characteristics:

- 369 • They must be natively in S format as defined in RFC 4194;
- 370 • They must be compressed to GZIP format as defined in RFC 1952;
- 371 • They must then be constituted in packets signed. Each packet comprises:
 - 372 – A header including a preamble, the type of packet (version) and the lengths of the
 - 373 list of commands and of the payload;
 - 374 – A list of commands that contains the instructions necessary for the extraction and
 - 375 installation of the files contained in the packet: description, version, role of the file,
 - 376 actions on the file system (reformatting, erasure, addition, replacement, etc, with
 - 377 the version number taken into account or not), timeouts, bootstrap, etc.;
 - 378 – A block of signatures and;
 - 379 – The payload, which contains one or more files.

380 The overall security of the transfers depends on the security mechanisms at MAC level.
381 Moreover, the meters must be able to check the authenticity and integrity of the downloaded
382 files through signatures whose keys are transferred through the Protected Channel carried by
383 EAP and defined earlier.

384 The downloading mechanism is of general usage. It will subsequently be able to be extended
385 to file transfers in both directions: parameter setting files for the backing up / restoring of
386 complete configurations, statistics files, trace files, etc.

387 **11.3.3 Protocol DLMS**

388 The other way to manage the downloading procedure is to use the Image Transfer procedure
389 defined in clause 5.3.4 of IEC 62056-6-2.

390 **11.4 Initialization and Supervision system**

391 This system is responsible for :

- 392 – sequencing the actions when bootstrapping the meter, such as "active scan",
- 393 – launching of the LBP/EAP/EAP-PSK protocol suite for authentication,
- 394 – distributing the keys and the initial configuration as defined in prEN/TS 5VVVV-2.

395 It is moreover in relation with the SNMP agent or COSEM object following the profile chosen
396 and the different blocks and protocol layers for the aggregation of the information within the
397 MIB.

398
399
400

Annex A (normative) Structure of the SNMP-MIB

401 A.1 Overview

402 All the information for the SNMP protocol is modelled as an MIB (Management Information
403 Base) which groups:

- 404 • The MIB-II (RFC 1213), updated, which is the common section of any SNMP MIB;
- 405 • The information specific to each layer of the Transport layers: PHY, MAC and Adaptation
406 6LoWPAN (prEN/TS 5V VVVV-2);
- 407 • The information specific to each of the blocks of the Applications layers (apart from the
408 DLMS/COSEM Metering Application).

409 A.2 MIB-II (based on RFC 1213)

410 MIB-II (RFC 1213) constitutes the trunk of the MIB associated with the "Metering" profile. It is
411 made up of several Object Groups whose status for this specification is given in tables 3, 4, 5,
412 6 and 7.

413 **Table 3 – Status of the different Groups of the MIB-II**

Name of group and Remarks/Modifications	Status
System group - Group obsolete, redefined in RFC 3418	N/R
Interface group - Group obsolete, redefined in RFC 2863	N/R
Address Translation group - Group obsolete	N/R
IP group - Group obsolete, redefined in RFC 4293	N/R
ICMP group - Group obsolete, redefined in RFC 4293	N/R
TCP group - Group obsolete, redefined in RFC 4022. - For possible future utilization	N/R
UDP group - Group obsolete, redefined in RFC 4113	N/R
EGP group	N/R
Transmission group	N
SNMP group - Group obsolete, redefined in RFC 3418.	N/R

414 A.2.1 IF-MIB

415 **Table 4 – Status of the different Groups of the Interfaces MIB (RFC 2863)**

Name of group and Remarks/Modifications	Status
ifGeneralInformationGroup	N
linkUpDownNotificationsGroup	N

Name of group and Remarks/Modifications	Status
ifFixedLengthGroup	N/R
ifHCFixedLengthGroup	N/R
ifPacketGroup	N
ifHCPacketGroup	N/R
ifVHCPacketGroup	N/R
ifCounterDiscontinuityGroup	N
ifStackGroup2	N/R
ifRcvAddressGroup	N/R

416 **A.2.2 IP-ICMP MIB**

417 **Table 5 – Status of the different Groups of the IP-ICMP MIB (RFC 4293)**

Name of group and Remarks/Modifications	Status
ipSystemStatsGroup	N
ipAddressGroup	N
ipNetToPhysicalGroup	N
ipDefaultRouterGroup	N
icmpStatsGroup	N
ipSystemStatsHCOctetGroup	N/R
ipSystemStatsHCPacketGroup	N/R
ipIfStatsGroup	N/R
ipIfStatsHCOctetGroup	N/R
ipIfStatsHCPacketGroup	N/R
ipv4GeneralGroup	N/R
ipv4IfGroup	N/R
ipv4SystemStatsGroup	N/R
ipv4SystemStatsHCPacketGroup	N/R
ipv4IfStatsGroup	N/R
ipv4IfStatsHCPacketGroup	N/R
ipv6GeneralGroup2	N
ipv6IfGroup	N
ipAddressPrefixGroup	N
ipv6ScopeGroup	N/R
ipv6RouterAdvertGroup	N/R
ipLastChangeGroup	N/R

418 **A.2.3 UDP-MIB**

419 **Table 6 – Status of the different Groups of the UDP MIB (RFC 4113)**

Name of group and Remarks/Modifications	Status
udpBaseGroup	N
udpHCGroup	N/R
udpEndpointGroup	N

420 **A.2.4 SNMP-MIB**

421

422 **Table 7 – Status of the different Groups of the SNMP MIB RFC 3418)**

Name of group and Remarks/Modifications	Status
systemGroup	N
snmpGroup	N
snmpSetGroup	N
snmpBasicNotificationsGroup	N
snmpCommunityGroup	N/R
snmpWarmStartNotificationGroup	N/R

423 **A.3 Transport layers MIB**

424 **A.3.1 MAC/PHY PLC OFDM Type 2 MIB (PLC-OFDM-TYPE2-MIB)**

425 The MAC Information Base (MAC PIB) is specified in clause 7.3.4 of prEN/TS 5V VVVV-2.

426 The structure of the Neighbour Table is specified in clause 7.3.5.2 of prEN/TS 5V VVVV-2.

427 The translation to SNMP MIB in accordance with SMIv2 (RFC 2578) is provided in Annex B.

428 **A.3.2 IPv6LOWPAN-MIB ADAPTATION (IPv6-LOWPAN-MIB)**

429 The 6LoWPAN Application Information Base is specified in clause 7.4.2 of prEN/TS 5V VVVV-2.

430 The translation to SNMP MIB is provided by draft-daniel-6lowpan-mib-01 with the remarks and
431 modifications listed in Table 8.

432 **Table 8 – Status of the different elements of the 6LoWPAN MIB (draft-daniel-6lowpan-
433 mib-01)**

Name of group and Remarks/Modifications	Status
lowpanRoutingTable	N
lowpanNeighborTable Replaced by the NeighbourTable of PLC-OFDM-TYPE2-MIB	N/R
Other objects	N

434 If given equipment item supports several PLC OFDM Type 2 interfaces, this MIB must be
435 instantiated and form the subject of tables indexed by the interface number (ifIndex of IF-
436 MIB).

437 **A.4 Applications layers MIBs**

438 The translation to SNMP MIB in accordance with SMIv2 RFC 2578 is provided in Annex B.

439
440
441

**Annex B
(normative)
MIB of the PHY and MAC levels: PLC-OFDM-TYPE2-MIB**

442 This annex specifies the portion of the MIB, called PLC-OFDM-TYPE2-MIB that is devolved to
443 the management of the PHY and MAC levels of the PLC OFDM Type 2 interface.

444 **B.1 Relation with the Interfaces MIB**

445 The Interfaces MIB (RFC 2863) requires that all the MIBs that are added to it clarify certain
446 points that are intentionally left vague in its definition. Table 9 provides the clarifications
447 necessary for the case of the PLC OFDM Type 2 interface.

448 **Table 9 – Relation with the Interfaces MIB RFC 2863**

Item IF-MIB	Application to the PLC OFDM Type 2 interface
Layering Model	No distinction is made between the PHY, MAC and 6LoWPAN layers and sublayers
Virtual Circuits	Not applicable
ifIndex	Each PLC OFDM Type 2 interface is represented by an ifEntry. The tables of the PLC-OFDM-TYPE2-MIB are indexed by ifIndex.
ifDescr	See RFC 2863
ifType	Is provisionally set at 200.
ifMtu	Is set at 1280
ifSpeed	Not applicable
ifPhysAddress	The short 16-bit address the equipment uses to communicate in the PAN. If the equipment is the PAN coordinator, this value must be chosen before starting the PAN. Otherwise, the address is assigned during the Bootstrap procedure. The value 'FFFF'h indicates that the equipment has no address.
ifAdminStatus	Not applicable
ifOperStatus	The operational status of the interface. The 'testing', 'dormant', and 'lowerLayerDown' statuses are not applicable
ifLastChange	See RFC 2863
ifInOctets	The number of bytes received in valid MAC frames (Data + Command + Beacon) including the MAC header and the FCS.
ifInUcastPkts	The number of unicast packets received from the interface and transmitted to the higher layers or relayed
ifInDiscards	See RFC 2863
ifInErrors	See RFC 2863
ifInUnknownProtos	See RFC 2863
ifOutOctets	The number of bytes transmitted in the valid MAC frames (Data + Command + Beacon) including the MAC header and the FCS.
ifOutUcastPkts	The number of unicast packets received from the higher layers or relayed and transmitted by the interface
ifOutDiscards	See RFC 2863
ifOutErrors	See RFC 2863
ifName	A name having a local meaning (i.e. 'Cpl0')
ifInMulticastPkts	The number of multicast packets received from the interface and transmitted to the higher layers or relayed
ifInBroadcastPkts	The number of broadcast packets received from the interface and

Item IF-MIB	Application to the PLC OFDM Type 2 interface
	transmitted to the higher layers or relayed
ifOutMulticastPkts	The number of multicast packets received from the higher layers or relayed and transmitted by the interface
ifOutBroadcastPkts	The number of broadcast packets received from the higher layers or relayed and transmitted by the interface
ifLinkUpDownTrapEnable	See RFC 2863. The default value is 'disable'
ifHighSpeed	Is set to 0
ifPromiscuousMode	Is set to 'true'
ifConnectorPresent	Is set to 'true'
ifAlias	See RFC 2863
ifCounterDiscontinuityTime	See RFC 2863. A discontinuity affects the PLC-OFDM-TYPE2-MIB meters like those of the IF-MIB.
ifStackHigherLayer	Not applicable for this interface
ifStackLowerLayer	Ditto
ifStackStatus	Ditto
ifRcvAddressAddress	The table contains the short unicast, multicast and broadcast addresses from which this interface must accept the packets and transfer them to the higher layers. See adpGroupTable in prEN/TS 5VVVV-2
ifRcvAddressStatus	Ditto
ifRcvAddressType	Ditto

449 **B.2 Definitions**

```

450 PLC-OFDM-TYPE2-MIB DEFINITIONS ::= BEGIN
451
452     IMPORTS
453         ifIndex
454         FROM IF-MIB
455
456     OBJECT-GROUP, MODULE-COMPLIANCE
457     FROM SNMPv2-CONF
458     mib-2, Integer32, Unsigned32, Counter32, OBJECT-TYPE,
459     MODULE-IDENTITY
460     FROM SNMPv2-SMI
461     TruthValue, MacAddress, TEXTUAL-CONVENTION
462     FROM SNMPv2-TC;
463
464
465     plcOfdmType2MIB MODULE-IDENTITY
466     LAST-UPDATED "200811120000Z"
467     ORGANIZATION
468         ""
469     CONTACT-INFO
470         ""
471     DESCRIPTION
472         "The MIB module for management of PHY, MAC and 6LoWPAN
473         Adaptation Layers in PLC OFDM metering devices."
474     REVISION "200811120000Z"
475     DESCRIPTION
476         "Initial version, published as part of Metering Profile Specification."
477     ::= { mib-2 201 }
478
479
480 --
481 -- Textual conventions

```

```
482 --
483
484 Eui64Address ::= TEXTUAL-CONVENTION
485     DISPLAY-HINT
486     "2x:2x:2x:2x:2x:2x:2x:2x"
487     STATUS current
488     DESCRIPTION
489     "A 64-bit MAC Address"
490     SYNTAX OCTET STRING (SIZE (8))
491
492 ShortAddress ::= TEXTUAL-CONVENTION
493     DISPLAY-HINT
494     "4x"
495     STATUS current
496     DESCRIPTION
497     "A 16-bit MAC or 6LoWPAN short Address"
498     SYNTAX OCTET STRING (SIZE (2))
499
500 ToneArray ::= TEXTUAL-CONVENTION
501     DISPLAY-HINT
502     "18x"
503     STATUS current
504     DESCRIPTION
505     "A 72-bit string.
506     The 70 first bits referred each to an OFDM tone.
507     The two last bits are meaningless"
508     SYNTAX OCTET STRING (SIZE (9))
509
510
511 --
512 -- Node definitions
513 --
514
515     plcOfdmType2Notifications OBJECT IDENTIFIER ::= { plcOfdmType2MIB 0 }
516 -- No TRAP in this MIB
517
518     plcOfdmType2Objects OBJECT IDENTIFIER ::= { plcOfdmType2MIB 1 }
519
520 --
521 -- The MAC Layer objects
522 --
523     plcOfdmType2Mac OBJECT IDENTIFIER ::= { plcOfdmType2Objects 1 }
524
525 --
526 -- MAC Statistics Table
527 --
528     plcOfdmType2MacTable OBJECT-TYPE
529     SYNTAX SEQUENCE OF PlcOfdmType2MacEntry
530     MAX-ACCESS not-accessible
531     STATUS current
532     DESCRIPTION
533     "MAC objects for a collection of PLC OFDM Type 2 interfaces
534     attached to a particular system.
535     There will be one row in this table for each PLC OFDM Type 2
536     interface in the system."
537     ::= { plcOfdmType2Mac 1 }
538
539     plcOfdmType2MacEntry OBJECT-TYPE
540     SYNTAX PlcOfdmType2MacEntry
541     MAX-ACCESS not-accessible
542     STATUS current
543     DESCRIPTION
```

```
544     "MAC objects for a particular interface to PLC medium."
545     INDEX { ifIndex }
546     ::= { plcOfdmType2MacTable 1 }
547
548     PlcOfdmType2MacEntry ::=
549     SEQUENCE {
550         plcOfdmType2MacAssociationPermit
551             TruthValue,
552         plcOfdmType2MacAckWaitDuration
553             Unsigned32,
554         plcOfdmType2MacAssociatedPanCoord
555             TruthValue,
556         plcOfdmType2MacBsn
557             Unsigned32,
558         plcOfdmType2MacCoordShortAddress
559             ShortAddress,
560         plcOfdmType2MacPanCoordShortAddress
561             ShortAddress,
562         plcOfdmType2MacDsn
563             Unsigned32,
564         plcOfdmType2MacMaxBe
565             Unsigned32,
566         plcOfdmType2MacMaxCsmaBackoffs
567             Unsigned32,
568         plcOfdmType2MacMaxFrameTotalWaitTime
569             Unsigned32,
570         plcOfdmType2MacMaxFrameRetries
571             Unsigned32,
572         plcOfdmType2MacMinBe
573             Unsigned32,
574         plcOfdmType2MacPanId
575             Unsigned32,
576         plcOfdmType2MacResponseWaitTime
577             Unsigned32,
578         plcOfdmType2MacSecurityEnabled
579             TruthValue,
580         plcOfdmType2MacAddress
581             MacAddress,
582         plcOfdmType2MacHighPriorityWindowSize
583             Unsigned32,
584         plcOfdmType2MacToneMask
585             ToneArray
586     }
587
588     plcOfdmType2MacAssociationPermit OBJECT-TYPE
589     SYNTAX TruthValue
590     MAX-ACCESS read-write
591     STATUS current
592     DESCRIPTION
593     "Indication of whether a coordinator (PAN coordinator or FFD) is
594     currently allowing association. A value of true indicates that
595     association is permitted.
596     Not relevant for a RFD."
597     REFERENCE
598     "IEEE802.15.4, clause 7.4.2"
599     DEFVAL { false }
600     ::= { plcOfdmType2MacEntry 2 }
601
602     plcOfdmType2MacAckWaitDuration OBJECT-TYPE
603     SYNTAX Unsigned32
604     UNITS "symbols"
605     MAX-ACCESS read-write
```

606 STATUS current
607 DESCRIPTION
608
609 "The maximum number of symbols to wait for an acknowledgment
610 frame to arrive following a transmitted data frame. "
611 REFERENCE
612 "IEEE802.15.4, clause 7.4.2"
613 ::= { plcOfdmType2MacEntry 3 }
614
615 plcOfdmType2MacBsn OBJECT-TYPE
616 SYNTAX Unsigned32 (0..255)
617 MAX-ACCESS read-only
618 STATUS current
619 DESCRIPTION
620 "The sequence number added to the transmitted beacon frame
621 MAC command frame.
622 Not relevant for a RFD"
623 REFERENCE
624 "IEEE802.15.4, clause 7.4.2"
625 ::= { plcOfdmType2MacEntry 5 }
626
627 plcOfdmType2MacCoordShortAddress OBJECT-TYPE
628 SYNTAX ShortAddress
629 MAX-ACCESS read-only
630 STATUS current
631 DESCRIPTION
632 "The 16-bit short address assigned to the coordinator
633 through which the device is associated. A value of 'FFFF'h
634 indicates that this value is unknown."
635 REFERENCE
636 "IEEE802.15.4, clause 7.4.2"
637 DEFVAL { 'FFFF'h }
638 ::= { plcOfdmType2MacEntry 6 }
639
640
641 plcOfdmType2MacPanCoordShortAddress OBJECT-TYPE
642 SYNTAX ShortAddress
643 MAX-ACCESS read-only
644 STATUS current
645 DESCRIPTION
646 "The 16-bit short address assigned to the PAN coordinator
647 A value of '0000'h indicates no PAN coordinator"
648 REFERENCE
649 "IEEE802.15.4, clause 7.4.2"
650 DEFVAL { 'FFFF'h }
651 ::= { plcOfdmType2MacEntry 7 }
652
653 plcOfdmType2MacDsn OBJECT-TYPE
654 SYNTAX Unsigned32 (0..255)
655 MAX-ACCESS read-only
656 STATUS current
657 DESCRIPTION
658 "The sequence number added to the transmitted data or
659 MAC command frame."
660 REFERENCE
661 "IEEE802.15.4, clause 7.4.2"
662 ::= { plcOfdmType2MacEntry 8 }
663
664 plcOfdmType2MacMaxBe OBJECT-TYPE
665 SYNTAX Unsigned32 (3..8)
666 MAX-ACCESS read-write
667 STATUS current

668 DESCRIPTION
669 "The maximum value of the backoff exponent (BE) in the
670 CSMA-CA algorithm."
671 REFERENCE
672 "IEEE802.15.4, clause 7.4.2"
673 DEFVAL { 5 }
674 ::= { plcOfdmType2MacEntry 10 }
675
676 plcOfdmType2MacMaxCsmaBackoffs OBJECT-TYPE
677 SYNTAX Unsigned32 (0..5)
678 MAX-ACCESS read-write
679 STATUS current
680 DESCRIPTION
681 "The maximum number of backoffs the CSMA-CA algorithm
682 will attempt before declaring a channel access failure."
683 REFERENCE
684 "IEEE802.15.4, clause 7.4.2"
685 DEFVAL { 4 }
686 ::= { plcOfdmType2MacEntry 11 }
687
688 plcOfdmType2MacMaxFrameTotalWaitTime OBJECT-TYPE
689 SYNTAX Unsigned32
690 UNITS "symbols"
691 MAX-ACCESS read-write
692 STATUS current
693 DESCRIPTION
694 "The maximum number of symbols to wait for a frame
695 intended as a response to a data request frame"
696 REFERENCE
697 "IEEE802.15.4, clause 7.4.2"
698 ::= { plcOfdmType2MacEntry 12 }
699
700 plcOfdmType2MacMaxFrameRetries OBJECT-TYPE
701 SYNTAX Unsigned32 (0..7)
702 MAX-ACCESS read-write
703 STATUS current
704 DESCRIPTION
705 "The maximum number of retries allowed after a
706 transmission failure."
707 REFERENCE
708 "IEEE802.15.4, clause 7.4.2"
709 DEFVAL { 3 }
710 ::= { plcOfdmType2MacEntry 13 }
711
712 plcOfdmType2MacMinBe OBJECT-TYPE
713 SYNTAX Unsigned32 (0..8)
714 MAX-ACCESS read-write
715 STATUS current
716 DESCRIPTION
717 "The minimum value of the backoff exponent (BE) in the
718 CSMA-CA algorithm (must be less or equal plcOfdmType2MacMaxBe "
719 REFERENCE
720 "IEEE802.15.4, clause 7.4.2"
721 DEFVAL { 3 }
722 ::= { plcOfdmType2MacEntry 14 }
723
724 plcOfdmType2MacPanId OBJECT-TYPE
725 SYNTAX Unsigned32 (0..65535)
726 MAX-ACCESS read-write
727 STATUS current
728 DESCRIPTION
729 "The 16-bit identifier of the PAN on which the device is

730 operating. If this value is 'FFFF'h, the device is not
731 associated.
732 MAX-ACCESS is read-write for a PAN coordinator and read-only
733 for a FFD or RFD."
734 REFERENCE
735 "IEEE802.15.4, clause 7.4.2"
736 DEFVAL { 'FFFF'h }
737 ::= { plcOfdmType2MacEntry 15 }
738
739 plcOfdmType2MacResponseWaitTime OBJECT-TYPE
740 SYNTAX Unsigned32 (2..64)
741 UNITS "aBaseSuperframeDuration"
742 MAX-ACCESS read-only
743 STATUS current
744 DESCRIPTION
745 "The maximum time, in multiples of aBaseSuperframeDuration,
746 a device shall wait for a response command frame to be
747 available following a request command frame."
748 REFERENCE
749 "IEEE802.15.4, clause 7.4.2"
750 DEFVAL { 32 }
751 ::= { plcOfdmType2MacEntry 16 }
752
753 plcOfdmType2MacSecurityEnabled OBJECT-TYPE
754 SYNTAX TruthValue
755 MAX-ACCESS read-only
756 STATUS current
757 DESCRIPTION
758 "Indication of whether the MAC sublayer has security
759 enabled.
760 A value of 'true' indicates that security is enabled, while
761 a value of 'false' indicates that security is disabled."
762 REFERENCE
763 "IEEE802.15.4, clause 7.4.2"
764 DEFVAL { false }
765 ::= { plcOfdmType2MacEntry 17 }
766
767 --
768 -- The 16-bit address that the device uses to communicate
769 -- in the PAN may be accessed via the IF-MIB.
770 --
771 plcOfdmType2MacAddress OBJECT-TYPE
772 SYNTAX MacAddress
773 MAX-ACCESS read-only
774 STATUS current
775 DESCRIPTION
776 "The EUI-48 MAC address allocated to the device during the
777 manufacturing process "
778 ::= { plcOfdmType2MacEntry 18 }
779
780 plcOfdmType2MacHighPriorityWindowSize OBJECT-TYPE
781 SYNTAX Unsigned32 (0..7)
782 UNITS "slots"
783 MAX-ACCESS read-write
784 STATUS current
785 DESCRIPTION
786 "The high priority contention window size in number of
787 slots"
788 DEFVAL { 7 }
789 ::= { plcOfdmType2MacEntry 19 }
790
791 plcOfdmType2MacToneMask OBJECT-TYPE

```
792     SYNTAX ToneArray
793     MAX-ACCESS read-write
794     STATUS current
795     DESCRIPTION
796     "The Tone Mask to use during symbol formation."
797     DEFVAL { '3FFFFFFFFFFFFFFFFF'h }
798     ::= { plcOfdmType2MacEntry 20 }
799
800 cpl3gMacStatsTable OBJECT-TYPE
801     SYNTAX SEQUENCE OF Cpl3gMacStatsEntry
802     MAX-ACCESS not-accessible
803     STATUS current
804     DESCRIPTION
805     "MAC statistics for a collection of PLC OFDM Type 2 interfaces
806     attached to a particular system.
807     There will be one row in this table for each PLC OFDM Type 2
808     interface in the system."
809     ::= { plcOfdmType2Mac 2 }
810
811 cpl3gMacStatsEntry OBJECT-TYPE
812     SYNTAX Cpl3gMacStatsEntry
813     MAX-ACCESS not-accessible
814     STATUS current
815     DESCRIPTION
816     "MAC objects for a particular interface to PLC medium.
817
818     Other counters may be accessed via the IF-MIB:
819     * successfully transmitted unicast data packets
820     * successfully received unicast data packets
821     * successfully transmitted multicast packets
822     * successfully received multicast packets
823     * successfully transmitted broadcast packets
824     * successfully received broadcast packets
825     * packets discarded during transmission
826     * packets in error during transmission
827     * packets discarded during reception
828     * packets in error during reception
829     * received packets referring to an unknown protocol"
830     INDEX { ifIndex }
831     ::= { cpl3gMacStatsTable 1 }
832
833 Cpl3gMacStatsEntry ::=
834     SEQUENCE {
835         plcOfdmType2MacStatsTxCmdPacketCount
836             Counter32,
837         plcOfdmType2MacStatsRxCmdPacketCount
838             Counter32,
839         plcOfdmType2MacStatsCsmaFailCount
840             Counter32,
841         plcOfdmType2MacStatsCsmaCollisionCount
842             Counter32,
843         plcOfdmType2MacStatsPanConflictCount
844             Counter32
845     }
846
847 plcOfdmType2MacStatsTxCmdPacketCount OBJECT-TYPE
848     SYNTAX Counter32
849     MAX-ACCESS read-only
850     STATUS current
851     DESCRIPTION
852     "The number of successfully transmitted command packets"
853     ::= { cpl3gMacStatsEntry 1 }
```

```
854
855 plcOfdmType2MacStatsRxCmdPacketCount OBJECT-TYPE
856     SYNTAX Counter32
857     MAX-ACCESS read-only
858     STATUS current
859     DESCRIPTION
860         "The number of successfully received command packets"
861     ::= { cpl3gMacStatsEntry 2 }
862
863 plcOfdmType2MacStatsCsmaFailCount OBJECT-TYPE
864     SYNTAX Counter32
865     MAX-ACCESS read-only
866     STATUS current
867     DESCRIPTION
868         "The number of failed CSMA transmit attempts"
869     ::= { cpl3gMacStatsEntry 3 }
870
871 plcOfdmType2MacStatsCsmaCollisionCount OBJECT-TYPE
872     SYNTAX Counter32
873     MAX-ACCESS read-only
874     STATUS current
875     DESCRIPTION
876         "The number of collisions due to busy channel or
877         failed transmission"
878     ::= { cpl3gMacStatsEntry 4 }
879
880 plcOfdmType2MacStatsPanConflictCount OBJECT-TYPE
881     SYNTAX Counter32
882     MAX-ACCESS read-only
883     STATUS current
884     DESCRIPTION
885         "The number of frames received with a bad CRC"
886     ::= { cpl3gMacStatsEntry 5 }
887
888 --
889 -- The Neighbor Table
890 --
891 plcOfdmType2MacNeighborTable OBJECT-TYPE
892     SYNTAX SEQUENCE OF PlcOfdmType2MacNeighborEntry
893     MAX-ACCESS not-accessible
894     STATUS current
895     DESCRIPTION
896         "The Neighbor table contains information on the way
897         to transmit a frame to every neighbour device"
898     ::= { plcOfdmType2Mac 27 }
899
900 plcOfdmType2MacNeighborEntry OBJECT-TYPE
901     SYNTAX PlcOfdmType2MacNeighborEntry
902     MAX-ACCESS not-accessible
903     STATUS current
904     DESCRIPTION
905         "An entry (conceptual row) in the plcOfdmType2MacNeighborTable."
906     INDEX { ifIndex, plcOfdmType2MacNeighborShortAddress }
907     ::= { plcOfdmType2MacNeighborTable 1 }
908
909 PlcOfdmType2MacNeighborEntry ::=
910     SEQUENCE {
911         plcOfdmType2MacNeighborShortAddress
912             ShortAddress,
913         plcOfdmType2MacNeighborPanId
914             Unsigned32,
915         plcOfdmType2MacNeighborDeviceType
```

```
916     INTEGER,
917     plcOfdmType2MacNeighborIsParent
918     TruthValue,
919     plcOfdmType2MacNeighborToneMapIndex
920     Unsigned32,
921     plcOfdmType2MacNeighborModulation
922     INTEGER,
923     plcOfdmType2MacNeighborToneMap
924     ToneArray,
925     plcOfdmType2MacNeighborGain
926     Unsigned32,
927     plcOfdmType2MacNeighborPreemphasisGain
928     Unsigned32,
929     plcOfdmType2MacNeighborLqi
930     Unsigned32,
931     plcOfdmType2MacNeighborPhase
932     Integer32,
933     plcOfdmType2MacNeighborAge
934     Unsigned32
935 }
936
937 plcOfdmType2MacNeighborShortAddress OBJECT-TYPE
938     SYNTAX ShortAddress
939     MAX-ACCESS not-accessible
940     STATUS current
941     DESCRIPTION
942         "The short address of the Neighbor"
943     ::= { plcOfdmType2MacNeighborEntry 1 }
944
945 plcOfdmType2MacNeighborPanId OBJECT-TYPE
946     SYNTAX Unsigned32 (0..65535)
947     MAX-ACCESS read-only
948     STATUS current
949     DESCRIPTION
950         "The PAN Identifier of the Neighbor"
951     DEFVAL { 'FFFF'h }
952     ::= { plcOfdmType2MacNeighborEntry 2 }
953
954
955 plcOfdmType2MacNeighborDeviceType OBJECT-TYPE
956     SYNTAX INTEGER
957     {
958         coordinator(0),
959         router(1),
960         endDevice(2)
961     }
962     MAX-ACCESS read-only
963     STATUS current
964     DESCRIPTION
965         "The device type of the neighbor entry:
966         (1) means PAN coordinator
967         (2) means full function device
968         (3) means reduced function device"
969     DEFVAL { router }
970     ::= { plcOfdmType2MacNeighborEntry 3 }
971
972 plcOfdmType2MacNeighborIsParent OBJECT-TYPE
973     SYNTAX TruthValue
974     MAX-ACCESS read-only
975     STATUS current
976     DESCRIPTION
977         "The value 'true' indicates that the neighbour is a topological parent of the device"
```

```
978 ::= { plcOfdmType2MacNeighborEntry 4 }
979
980 plcOfdmType2MacNeighborToneMapIndex OBJECT-TYPE
981 SYNTAX Unsigned32 (0..2047)
982 MAX-ACCESS read-only
983 STATUS current
984 DESCRIPTION
985     "The Index of the Tone Map to use when transmitting
986     a frame to the Neighbor"
987 DEFVAL { 0 }
988 ::= { plcOfdmType2MacNeighborEntry 5 }
989
990 plcOfdmType2MacNeighborModulation OBJECT-TYPE
991 SYNTAX INTEGER
992 {
993     robo(0),
994     dbpsk(1),
995     dqpsk(2)
996     d8psk(3)
997 }
998 MAX-ACCESS read-only
999 STATUS current
1000 DESCRIPTION
1001     "The modulation type to use when transmitting a frame
1002     to the Neighbor"
1003 DEFVAL { robo }
1004 ::= { plcOfdmType2MacNeighborEntry 6 }
1005
1006 plcOfdmType2MacNeighborToneMap OBJECT-TYPE
1007 SYNTAX ToneArray
1008 MAX-ACCESS read-only
1009 STATUS current
1010 DESCRIPTION
1011     "The Tone Map to use when transmitting a frame to the
1012     Neighbor"
1013 DEFVAL { '3FFFFFFFFFFFFFFFFF'h }
1014 ::= { plcOfdmType2MacNeighborEntry 7 }
1015
1016 plcOfdmType2MacNeighborGain OBJECT-TYPE
1017 SYNTAX Unsigned32 (0..63)
1018 MAX-ACCESS read-only
1019 STATUS current
1020
1021 DESCRIPTION
1022     "The gain to use when transmitting a frame to the Neighbor"
1023 DEFVAL { 63 }
1024 ::= { plcOfdmType2MacNeighborEntry 8 }
1025
1026 plcOfdmType2MacNeighborPreemphasisGain OBJECT-TYPE
1027 SYNTAX Unsigned32
1028 MAX-ACCESS read-only
1029 STATUS current
1030 DESCRIPTION
1031     "An array of eight times 4 bits to control the gain for
1032     each 10 kHz-wide spectrum band when transmitting a frame
1033     to the Neighbor"
1034 DEFVAL { 'FFFFFFFF'h }
1035 ::= { plcOfdmType2MacNeighborEntry 9 }
1036
1037 plcOfdmType2MacNeighborLqi OBJECT-TYPE
1038 SYNTAX Unsigned32 (0..255)
1039 MAX-ACCESS read-only
```

```
1040     STATUS current
1041     DESCRIPTION
1042         "The Link Quality Indicator when transmitting a frame to the
1043         Neighbor"
1044     DEFVAL { 0 }
1045     ::= { plcOfdmType2MacNeighborEntry 10 }
1046
1047     plcOfdmType2MacNeighborPhase OBJECT-TYPE
1048         SYNTAX Integer32 (-180..180)
1049         UNITS "Degrees"
1050         MAX-ACCESS read-only
1051         STATUS current
1052         DESCRIPTION
1053             "The Phase difference on the 50 Hz AC signal
1054             Delta_Ph = (local_Ph - neighbor_Ph)"
1055         ::= { plcOfdmType2MacNeighborEntry 11 }
1056
1057     plcOfdmType2MacNeighborAge OBJECT-TYPE
1058         SYNTAX Unsigned32 (0..255)
1059         UNITS "minutes"
1060         MAX-ACCESS read-only
1061         STATUS current
1062         DESCRIPTION
1063             "The remaining lifetime of this entry in minutes.
1064             Upon successful reception of a ToneMap.response, the value
1065             is set to adpMaxAgeTime. When it reaches 0, a ToneMap.request
1066             should be associated to the next frame sent to the Neighbor"
1067         DEFVAL { 0 }
1068         ::= { plcOfdmType2MacNeighborEntry 12 }
1069
1070     plcOfdmType2Conformance OBJECT IDENTIFIER ::= { plcOfdmType2MIB 2 }
1071
1072     plcOfdmType2Compliances OBJECT IDENTIFIER ::= {      plcOfdmType2Conformance 1 }
1073
1074     plcOfdmType2Compliance MODULE-COMPLIANCE
1075         STATUS current
1076         DESCRIPTION
1077             "The compliance statement for Devices that implement PLC OFDM          Type 2. All groups
1078         are mandatory."
1079         MODULE -- this module
1080             MANDATORY-GROUPS { plcOfdmType2MacObjectGroup,
1081                             plcOfdmType2MacStatsGroup,
1082                             plcOfdmType2MacNeighborGroup }
1083         ::= { plcOfdmType2Compliances 1 }
1084
1085     plcOfdmType2Groups OBJECT IDENTIFIER ::= { plcOfdmType2Conformance 2 }
1086
1087     plcOfdmType2MacObjectGroup OBJECT-GROUP
1088         OBJECTS { plcOfdmType2MacAssociationPermit,
1089     plcOfdmType2MacAckWaitDuration,
1090         plcOfdmType2MacAssociatedPanCoord, plcOfdmType2MacBsn,
1091         plcOfdmType2MacCoordShortAddress,
1092     plcOfdmType2MacPanCoordShortAddress,
1093         plcOfdmType2MacDsn, plcOfdmType2MacMaxBe,
1094     plcOfdmType2MacMaxCdmaBackoffs,
1095         plcOfdmType2MacMaxFrameTotalWaitTime,
1096     plcOfdmType2MacMaxFrameRetries,
1097         plcOfdmType2MacMinBe, plcOfdmType2MacPanId,
1098     plcOfdmType2MacResponseWaitTime,
1099         plcOfdmType2MacSecurityEnabled, plcOfdmType2MacAddress,
1100         plcOfdmType2MacHighPriorityWindowSize,
1101     plcOfdmType2MacToneMask }
```

```
1102     STATUS current
1103     DESCRIPTION
1104         "A collection of objects for managing the PLC OFDM Type 2
1105         MAC layer."
1106     ::= { plcOfdmType2Groups 1 }
1107
1108     plcOfdmType2MacStatsGroup OBJECT-GROUP
1109     OBJECTS { plcOfdmType2MacStatsTxCmdPacketCount,
1110             plcOfdmType2MacStatsRxCmdPacketCount,
1111             plcOfdmType2MacStatsCsmaFailCount,
1112             plcOfdmType2MacStatsCsmaCollisionCount,
1113             plcOfdmType2MacStatsPanConflictCount }
1114     STATUS current
1115     DESCRIPTION
1116         "A collection of objects for managing the PLC OFDM Type 2
1117         MAC Statistics."
1118     ::= { plcOfdmType2Groups 2 }
1119
1120     plcOfdmType2MacNeighborGroup OBJECT-GROUP
1121     OBJECTS { plcOfdmType2MacNeighborPanId,
1122     plcOfdmType2MacNeighborDeviceType,
1123             plcOfdmType2MacNeighborIsParent,
1124     plcOfdmType2MacNeighborToneMapIndex,
1125             plcOfdmType2MacNeighborModulation,
1126     plcOfdmType2MacNeighborToneMap,
1127             plcOfdmType2MacNeighborGain,
1128     plcOfdmType2MacNeighborPreemphasisGain,
1129             plcOfdmType2MacNeighborLqi,
1130     plcOfdmType2MacNeighborPhase,
1131             plcOfdmType2MacNeighborAge }
1132     STATUS current
1133     DESCRIPTION
1134         "A collection of objects for managing the Neighbor Table"
1135     ::= { plcOfdmType2Groups 3 }
1136
1137
1138     END
1139
```

1140
1141
1142

Annex C
(normative)
File Transfer Management MIB: FLM-PLC-OFDM-TYPE2-MIB

1143 This annex specifies the portion of the MIB, called FLM-PLC-OFDM-TYPE2-MIB that is
1144 devolved to the management of File Transfers.

1145 **C.1 Definitions**

```
1146
1147 FLM-PLC-OFDM-TYPE2-MIB DEFINITIONS ::= BEGIN
1148
1149 IMPORTS
1150     OBJECT-GROUP, MODULE-COMPLIANCE
1151     FROM SNMPv2-CONF
1152     mib-2, Unsigned32, OBJECT-TYPE, MODULE-IDENTITY
1153     FROM SNMPv2-SMI
1154     DisplayString, DateAndTime, TruthValue
1155     FROM SNMPv2-TC;
1156
1157 flmplcOfdmType2MIB MODULE-IDENTITY
1158     LAST-UPDATED "200811120000Z"
1159     ORGANIZATION
1160         "Sagem Communications"
1161     CONTACT-INFO
1162         "Email: support@sagem.com"
1163     DESCRIPTION
1164         "The MIB module for management of Files Transfers in PLC OFDM
1165         metering devices."
1166     REVISION "200811120000Z"
1167     DESCRIPTION
1168         "Initial version, published as part of Metering Profile
1169         Specification."
1170 ::= { mib-2 200 }
1171
1172
1173
1174
1175 --
1176 -- Node definitions
1177 --
1178
1179 --
1180 -- Notifications
1181 --
1182 flmplcOfdmType2Notifications OBJECT IDENTIFIER ::= { flmplcOfdmType2MIB 0 }
1183 -- No TRAP in this MIB
1184
1185 flmplcOfdmType2Objects OBJECT IDENTIFIER ::= { flmplcOfdmType2MIB 1 }
1186
1187 --
1188 -- The Device Management objects
1189 --
1190 flmplcOfdmType2Dev OBJECT IDENTIFIER ::= { flmplcOfdmType2Objects 1 }
1191
1192 flmplcOfdmType2DevSerialNumber OBJECT-TYPE
1193     SYNTAX DisplayString (SIZE (64))
1194     MAX-ACCESS read-only
1195     STATUS current
1196     DESCRIPTION
```

1197 " Serial number of the Device."
1198 REFERENCE
1199 "BBF TR-106, clause 3.4"
1200 ::= { flmplcOfdmType2Dev 1 }
1201
1202 flmplcOfdmType2DevHardwareVersion OBJECT-TYPE
1203 SYNTAX DisplayString (SIZE (64))
1204 MAX-ACCESS read-only
1205 STATUS current
1206 DESCRIPTION
1207 " A string identifying the particular Device model and
1208 version."
1209 REFERENCE
1210 "BBF TR-106, clause 3.4"
1211 ::= { flmplcOfdmType2Dev 2 }
1212
1213 flmplcOfdmType2DevSoftwareVersion OBJECT-TYPE
1214 SYNTAX DisplayString (SIZE (64))
1215 MAX-ACCESS read-only
1216 STATUS current
1217 DESCRIPTION
1218 " A string identifying the software version currently
1219 installed in the Device.
1220 To allow version comparisons, this element SHOULD be in the
1221 form of dot-delimited integers, where each successive integer
1222 represents a more minor category of variation. For example,
1223 3.0.21 where the components mean: Major.Minor.Build."
1224 REFERENCE
1225 "BBF TR-106, clause 3.4"
1226 ::= { flmplcOfdmType2Dev 3 }
1227
1228 flmplcOfdmType2DevDateTime OBJECT-TYPE
1229 SYNTAX DateAndTime
1230 MAX-ACCESS read-write
1231 STATUS current
1232 DESCRIPTION
1233 "The current date and time, with time zone information (if
1234 known).
1235 If the real data and time cannot be determined, this shall
1236 represent elapsed time from boot relative to the standard
1237 epoch '1970-1-1,0:0:0.0'. In other words, if this agent has
1238 been up for 3 minutes and not been able to determine what the
1239 actual date and time are, this object will return the value
1240 '1970-1-1,0:03:0.0'.
1241 ::= { flmplcOfdmType2Dev 4 }
1242
1243 --
1244 -- The File Transfer Control objects
1245 --
1246 flmplcOfdmType2Ctl OBJECT IDENTIFIER ::= { flmplcOfdmType2Objects 2 }
1247
1248 -- Managed upgrades
1249 flmplcOfdmType2CtlUpgradesManaged OBJECT-TYPE
1250 SYNTAX TruthValue
1251 MAX-ACCESS read-write
1252 STATUS current
1253 DESCRIPTION
1254 "Indicates whether or not the Manager will manage upgrades
1255 for the Device. If true, the Device must not accept unmanaged
1256 upgrades. If false, the Device should accept unmanaged
1257 upgrades."
1258 ::= { flmplcOfdmType2Ctl 1 }

1259
1260 flmplcOfdmType2CtlAdminStatus OBJECT-TYPE
1261 SYNTAX INTEGER
1262 {
1263 running(1),
1264 upgradesNow(2),
1265 rebootNow(3)
1266 }
1267 MAX-ACCESS read-write
1268 STATUS current
1269 DESCRIPTION
1270 "Indicates the desired state of the Device.
1271 When a Device initializes, it is placed in the running (1)
1272 state. If placed in the upgradeNow (2) state, the Device must
1273 launch an upgrade process as defined by the following objects.
1274 If placed in the rebootNow (3), the Device must reboot
1275 immediately"
1276 ::= { flmplcOfdmType2Ctl 2 }
1277
1278 flmplcOfdmType2CtlCommandKey OBJECT-TYPE
1279 SYNTAX DisplayString (SIZE (64))
1280 MAX-ACCESS read-write
1281 STATUS current
1282 DESCRIPTION
1283 " A string identifying a specific action to proceed.
1284 This object should be provisioned prior to the modification
1285 of flmplcOfdmType2CtlAdminStatus "
1286 REFERENCE
1287 "BBF TR-069, clause A.3.3"
1288 ::= { flmplcOfdmType2Ctl 3 }
1289
1290 flmplcOfdmType2CtlFileType OBJECT-TYPE
1291 SYNTAX INTEGER { firmware(1) }
1292 MAX-ACCESS read-write
1293 STATUS current
1294 DESCRIPTION
1295 "The type of the file to transfer.
1296 Initially, a single value is defined: firmware (1) indicating
1297 a firmware Upgrade Image.
1298 This object should be provisioned prior to the modification
1299 of flmplcOfdmType2CtlAdminStatus "
1300 REFERENCE
1301 "BBF TR-069, clause A.3.3"
1302 ::= { flmplcOfdmType2Ctl 4 }
1303
1304 flmplcOfdmType2CtlUrl OBJECT-TYPE
1305 SYNTAX DisplayString (SIZE (256))
1306 MAX-ACCESS read-write
1307 STATUS current
1308 DESCRIPTION
1309 "URL specifying the file location in the file server.
1310 It must be in the form: ftp://host:port/path
1311 The host portion of the URL must be the IPv6 address of the
1312 file server in lieu of a host name.
1313 If the Device receives multiple Download requests with the
1314 same source URL, the Device MUST perform each download as
1315 requested, and MUST NOT assume that the content of the file
1316 to be downloaded is the same each time.
1317 This object should be provisioned prior to the modification
1318 of flmplcOfdmType2CtlAdminStatus "
1319 REFERENCE
1320 "BBF TR-069, clause A.3.3"

1321 ::= { flmplcOfdmType2Ctl 5 }
1322
1323 flmplcOfdmType2CtlFileSize OBJECT-TYPE
1324 SYNTAX Unsigned32
1325 MAX-ACCESS read-write
1326 STATUS current
1327 DESCRIPTION
1328 "The size of the file to be downloaded in bytes.
1329 The FileSize argument is intended as a hint to the Device,
1330 which the Device MAY use to determine if it has sufficient
1331 space for the file to be downloaded, or to prepare space to
1332 accept the file.
1333 The Manager MAY set this value to zero. The Device MUST
1334 interpret a zero value to mean that that the Manager has
1335 provided no information about the file size. In this case,
1336 the Device MUST attempt to proceed with the download under
1337 the presumption that sufficient space is available, though
1338 during the course of download, the Device might determine
1339 otherwise.
1340 The Manager SHOULD set the value of this parameter to the
1341 exact size of the file to be downloaded. If the value is
1342 non-zero, the Device MAY reject the Download request on the
1343 basis of insufficient space. If the Device attempts to
1344 proceed with the download based on the value of this object,
1345 but the actual file size differs from the value of this
1346 object, this could result in a failure of the download.
1347 However, the Device MUST NOT cause the download to fail
1348 solely because it determines that the value of this argument
1349 is inaccurate.
1350 This object should be provisioned prior to the modification
1351 of flmplcOfdmType2CtlAdminStatus "
1352 REFERENCE
1353 "BBF TR-069, clause A.3.3"
1354 ::= { flmplcOfdmType2Ctl 6 }
1355
1356 flmplcOfdmType2CtlDeviceFileName OBJECT-TYPE
1357 SYNTAX DisplayString (SIZE (256))
1358 MAX-ACCESS read-write
1359 STATUS current
1360 DESCRIPTION
1361 " The name of the file to be used on the Device file system.
1362 This argument MAY be left empty if the file name can be
1363 extracted from the downloaded file itself, or from the URL
1364 object, or if no file name is needed. If this value is
1365 specified, but the file name is also indicated by another
1366 source (for example, if it is extracted from the downloaded
1367 file itself), this object value MUST be ignored.
1368 If the file name is used, the downloaded file would replace
1369 any existing file of the same name.
1370 This object should be provisioned prior to the modification
1371 of flmplcOfdmType2CtlAdminStatus "
1372 REFERENCE
1373 "BBF TR-069, clause A.3.3"
1374 ::= { flmplcOfdmType2Ctl 7 }
1375
1376 flmplcOfdmType2CtlDelaySeconds OBJECT-TYPE
1377 SYNTAX Unsigned32
1378 MAX-ACCESS read-write
1379 STATUS current
1380 DESCRIPTION
1381 " This argument has different meanings for Unicast and
1382 Multicast downloads. For Unicast downloads it is the number

1383 of seconds before the Device will initiate the download.
1384 For Multicast downloads the Device will initiate the download
1385 immediately and it is the number of seconds available for
1386 initiating, performing and applying the download.
1387 The Device MUST attempt to perform the download within the
1388 time window specified above even if the Device reboots one or
1389 more times prior to that time.
1390 This object should be provisioned prior to the modification
1391 of flmplcOfdmType2CtlAdminStatus "
1392 REFERENCE
1393 "BBF TR-069, clause A.3.3"
1394 ::= { flmplcOfdmType2Ctl 8 }
1395
1396 -- Transfer status
1397 flmplcOfdmType2CtlOperStatus OBJECT-TYPE
1398 SYNTAX INTEGER
1399 {
1400 inProgress(1),
1401 complete(2),
1402 failed(3),
1403 other(4)
1404 }
1405 MAX-ACCESS read-only
1406 STATUS current
1407 DESCRIPTION
1408 "Provides the current state of the Device:
1409 inProgress (1) indicates the action mentioned in ParameterKey
1410 is in progress
1411 complete (2) indicates its full completion
1412 failed (3) indicates the action has failed."
1413 ::= { flmplcOfdmType2Ctl 9 }
1414
1415 flmplcOfdmType2CtlParameterKey OBJECT-TYPE
1416 SYNTAX DisplayString (SIZE (64))
1417 MAX-ACCESS read-only
1418 STATUS current
1419 DESCRIPTION
1420 "A string identifying the last action."
1421 REFERENCE
1422 "BBF TR-106, clause 3.4"
1423 ::= { flmplcOfdmType2Ctl 10 }
1424
1425 flmplcOfdmType2CtlStartTime OBJECT-TYPE
1426 SYNTAX DateAndTime
1427 MAX-ACCESS read-only
1428 STATUS current
1429 DESCRIPTION
1430 "The date and time transfer was started in UTC. The Device
1431 SHOULD record this information and report it in this object,
1432 but if this information is not available, the value of this
1433 object MUST be set to the Unknown Time value:
1434 '1970-1-1,0:0:0.0'.
1435 REFERENCE
1436 "BBF TR-069, clause A.3.3"
1437 ::= { flmplcOfdmType2Ctl 11 }
1438
1439 flmplcOfdmType2CtlCompleteTime OBJECT-TYPE
1440 SYNTAX DateAndTime
1441 MAX-ACCESS read-only
1442 STATUS current
1443 DESCRIPTION
1444 "The date and time transfer was completed and applied in UTC.

```
1445     The Device SHOULD record this information and report it in
1446     this object, but if this information is not available, the
1447     value of this object MUST be set to the Unknown Time value:
1448     '1970-1-1,0:0:0.0'."
1449     REFERENCE
1450     "BBF TR-069, clause A.3.3"
1451     ::= { flmplcOfdmType2Ctl 12 }
1452
1453 --
1454 -- Conformance statements
1455 --
1456 flmplcOfdmType2Conformance OBJECT IDENTIFIER ::= { flmplcOfdmType2MIB 2 }
1457
1458 --
1459 -- Compliances
1460 --
1461 flmplcOfdmType2Compliances OBJECT IDENTIFIER ::= { flmplcOfdmType2Conformance 1 }
1462
1463 flmplcOfdmType2Compliance MODULE-COMPLIANCE
1464     STATUS current
1465     DESCRIPTION
1466     "The compliance statement for Devices that implement
1467     the management of file transfers in PLC OFDM devices.
1468     All groups are mandatory."
1469     MODULE -- this module
1470     MANDATORY-GROUPS { flmplcOfdmType2DevObjectGroup, flmplcOfdmType2CtlObjectGroup }
1471     ::= { flmplcOfdmType2Compliances 1 }
1472
1473 --
1474 -- Compliance groups
1475 --
1476 flmplcOfdmType2Groups OBJECT IDENTIFIER ::= { flmplcOfdmType2Conformance 2 }
1477
1478 flmplcOfdmType2DevObjectGroup OBJECT-GROUP
1479     OBJECTS { flmplcOfdmType2DevSerialNumber,
1480             flmplcOfdmType2DevHardwareVersion,
1481             flmplcOfdmType2DevSoftwareVersion,
1482             flmplcOfdmType2DevDateTime }
1483     STATUS current
1484     DESCRIPTION
1485     "A collection of objects for managing the main Device
1486     information."
1487     ::= { flmplcOfdmType2Groups 1 }
1488
1489 flmplcOfdmType2CtlObjectGroup OBJECT-GROUP
1490     OBJECTS { flmplcOfdmType2CtlUpgradesManaged,
1491             flmplcOfdmType2CtlAdminStatus,
1492             flmplcOfdmType2CtlCommandKey,
1493             flmplcOfdmType2CtlFileType,
1494             flmplcOfdmType2CtlUrl,
1495             flmplcOfdmType2CtlFileSize,
1496             flmplcOfdmType2CtlDeviceFileName,
1497             flmplcOfdmType2CtlDelaySeconds,
1498             flmplcOfdmType2CtlOperStatus,
1499             flmplcOfdmType2CtlParameterKey,
1500             flmplcOfdmType2CtlStartTime,
1501             flmplcOfdmType2CtlCompleteTime }
1502     STATUS current
1503     DESCRIPTION
1504     "A collection of objects for controlling the file transfers
1505     in PLC OFDM devices."
1506     ::= { flmplcOfdmType2Groups 2 }
```

1507
1508
1509 END
1510

1511
1512
1513

**Annex D
(normative)
Initial Configuration and Configuration Management**

1514 Table 10 defines the correspondence between the initial configuration parameters used by
1515 LBP and those contained in the MIB.

1516 **Table 10 – Correspondence between LBP parameters and MIB objects**

LBP Parameter	Attr-ID	M	Description	MIB Object
PAN_ID	1	P	PAN identifier	plcOfdmType2MacPanId
PAN_type	2	P	Secured / closed / open. Normally 'secured' and never 'open' in the case of PLC OFDM Type 2	plcOfdmType2MacSecurityEnabled
Address_of_LBS	3	P	16-bit address of the PAN coordinator	plcOfdmType2MacPanCoordShortAddress
Join_Time	4	P	Indicates the moment at which the equipment must start the procedure to join the target PAN	Not used initially by PLC OFDM Type 2
Role_of_Device	5	D	Indicates whether the equipment must play the role of agent (and allow the association of other equipment items)	plcOfdmType2MacAssociationPermit
Allow_LBA_To_Send_PSI	6	P	Allows the equipment to add the PSIs	Not applicable in the MIB. Functioning internal to the LBP protocol
Short_Addr	7	D	16-bit address assigned to the equipment	ifPhysAddress
Short_Addr_Distribution	8	P	Centralized or distributed assignment of the 16-bit address	Not applicable. Always centralized for PLC OFDM Type 2.
Date_Time	32	P	The current time and date	flmplcOfdmType2DevDateTime
IPv6_Addr	33	D	Set of parameters relative to the assignment of the IPv6 address. See the IAADDR option of DHCPv6.	ipAddressAddr
Router_Advertisement	34	P	Set of routing parameters.	ipv6IpDefaultHopLimit ipAddressPrefixPrefix ipAddressPrefixLength ipAddressPrefixAdvPreferredLifetime

LBP Parameter	Attr-ID	M	Description	MIB Object
				ipAddressPrefixAdvValidLifetime ipDefaultRouterAddress
MAC_Attributes	35	P	Set of MAC configuration parameters	plcOfdmType2MacAckWaitDuration plcOfdmType2MacMaxBe plcOfdmType2MacMaxCsmaBackoffs plcOfdmType2MacMaxFrameTotalWaitTime plcOfdmType2MacMaxFrame retries plcOfdmType2MacMinBe plcOfdmType2MacResponseWaitTime plcOfdmType2MacHighPriorityWindowSize
ADP_Attributes	36	P	Set of 6LoWPAN configuration parameters	lowpanAckTimeout lowpanBroadcastRetries
SW_Attributes	37	P	Set parameters allowing the initial updating of the firmware	flmplcOfdmType2CtlUpgradesManaged flmplcOfdmType2CtlCommandKey flmplcOfdmType2CtlUrl flmplcOfdmType2CtlDelaySeconds
DHCPv6_Container	38	P	DHCPv6 options container	
DHCPv4_Container	39	P	DHCPv4 options container	