

Smart Metering Implementation Programme

Smart Metering Equipment Technical Specifications 2 (SMETS2)

Version 3.1*

8th November 2018

* Note that whilst this document is entitled SMETS2, each version of SMETS is uniquely identifiable by reference only to the version number of the document.

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3 Introduction¹

The requirement to install and maintain metering equipment in Great Britain which complies with these Smart Metering Equipment Technical Specifications 2 (SMETS2) arises from standard licence conditions 39, 40 and 50.10 of electricity supply licences and standard conditions 33, 34 and 44.10 of gas supply licences.

Whilst this document is entitled 'Smart Metering Equipment Technical Specifications 2 (SMETS2)', each Version of SMETS is uniquely identifiable by reference solely to its version number. In the title of this document, the '2' in SMETS2 does not form part of the version number and is used only to describe the family of SMETS documents to which this document belongs. Any functionality within Data and Communications Company systems which requires the identification of a particular version of SMETS with which a Device complies, will operate by reference solely to the version number.

Section 4 of this document describes the minimum physical, functional, interface, data, testing and certification requirements of Gas Smart Metering Equipment that a gas Supplier is required to install and maintain to comply with standard condition 33 (or 44.10) of its gas supply licence.

Section 5 of this document describes the minimum physical, functional, interface and data, testing and certification requirements of Electricity Smart Metering Equipment that an electricity Supplier is required to install and maintain to comply with standard condition 39 (or 50.10) of its electricity supply licence.

Section 6 of this document constitutes the In-Home Display (IHD) Technical Specifications, which describe the minimum physical, functional, interface, data, testing and certification requirements of an IHD maintained to comply with standard condition 34 of the gas supply licence or standard condition 40 of the electricity supply licence.

Section 7 of this document constitutes the Prepayment Interface Device Technical Specifications (PPMID), which describe the minimum physical, functional, interface, data, testing and certification requirements of a PPMID maintained to comply with standard condition 46 of the gas supply licence or standard condition 52 of the electricity supply licence.

Section 8 of this document constitutes the HAN Connected Auxiliary Load Control Switch (HCALCS) Technical Specifications, which describe the minimum physical, functional, interface, testing and certification requirements of an HCALCS maintained to comply with standard condition 52 of the electricity supply licence.

SMETS was notified to the European Commission in accordance with the requirements of the Technical Standards and Regulations Directive² laying down a procedure for the provision of information in the field of technical regulations and rules on Information Society services.

This document should be read in conjunction with any other relevant supply licence conditions and with regard to the wider statutory and regulatory framework applying to devices installed for the purpose of energy supply to Premises, for example; the Measuring Instruments (Active Electrical Energy Meters) Regulations 2006 and the Measuring Instruments (Gas Meters) Regulations 2006³.

¹ Sections 1 and 2 of this document are not used

² SMETS was notified (2017/0350/UK) under Article 8 of Directive 98/34/EC of the European Parliament and of the Council (OJ L 204, 21.7.1998, p. 37) as amended by Directive 98/48/EC of the European Parliament and of the Council (OJ L 217, 5.8.1998, p. 18). Directive 98/34/EC has now been replaced by Directive 2015/1535/EU of the European Parliament and of the Council (OJ L 241, 17.9.2015, p.1), which came into force on 7 October 2015

³ These regulations transpose the Measuring Instruments Directive (2004/22/EC)

43 The Smart Metering technical and security architecture is based on a suite of agreed, open
44 standards, reflecting the UK Government strategy to facilitate the development of third party
45 innovative solutions for consumer devices.

46 **Mutual recognition:** Any requirement for any device to comply with any of the technical
47 specifications contained or referred to in this document shall be satisfied by compliance with:

- 48 • a relevant standard or code of practice of a national standards body or equivalent body
49 of any EEA State or Turkey; or
- 50 • any relevant international standard recognised for use in any EEA State or Turkey; or
- 51 • any relevant technical regulation with mandatory or de facto mandatory application for
52 marketing or use in any EEA State or Turkey,

53 in so far as compliance with the standard, code of practice or technical regulation in question
54 enables the equipment to achieve, in an equivalent manner, all of the physical, functional,
55 interface and data capabilities that are achieved by compliance with the requirements of any
56 of the technical specifications contained or referred to in this document.

57 4 Gas Smart Metering Equipment 58 Technical Specifications

59 4.1 Overview

60 *Section 4* of this document describes the minimum physical, minimum functional, minimum
61 interface, minimum data and minimum testing and certification requirements of Gas Smart
62 Metering Equipment (GSME) that a gas Supplier is required to install and maintain to comply
63 with standard condition 33 of its gas supply licence.

64 Any requirements to Lock, Enable, Disable or Arm Supply set out in this *Section 4*, only
65 apply to Gas Smart Metering Equipment other than Large Gas Meters installed at Domestic
66 Premises.

67 4.2 SMETS Testing and Certification Requirements

68 4.2.1 Conformance with the SMETS

69 GSME shall have been tested to ensure that it meets the requirements described in this
70 *Section 4*, and evidence must be available to confirm such testing and conformance.

71 4.2.2 Conformance with the Great Britain Companion Specification

72 GSME shall meet the requirements described in the Great Britain Companion Specification.

73 GSME shall have been certified by the ZigBee Alliance as being compliant with those
74 ZigBee SEP requirements that are identified as being required in the Great Britain
75 Companion Specification and that were certifiable under the ZigBee SEP certification
76 scheme on 31 August 2017.

77 4.2.3 Conformance with the Commercial Product Assurance 78 Security Characteristics for GB Smart Metering

79 GSME shall meet the requirements described in the Commercial Product Assurance
80 Security Characteristic Gas Smart Metering Equipment.

81 GSME shall be certified by NCSC as compliant with the Commercial Product Assurance
82 Security Characteristic Gas Smart Metering Equipment.

83 4.3 Physical requirements

84 GSME shall as a minimum include the following components:

- 85 i. a Clock;
- 86 ii. a Data Store;
- 87 iii. a Gas Meter;
- 88 iv. a HAN Interface;
- 89 v. a Random Number Generator;
- 90 vi. a User Interface;
- 91 vii. where installed at Domestic Premises and is not a Large Gas Meter, a Valve; and
- 92 viii. where installed with a Communications Hub provided by the Data and
93 Communications Company, a Communications Hub Physical Interface (this may
94 comprise a Communications Hub Physical Interface forming part of ESME where
95 present at the time of installation in the Premises).

96 The Communications Hub Physical Interface shall as a minimum include a physical interface
97 that meets the requirements defined by the Data and Communications Company at the time
98 of installation (available on the Data and Communications Company's website) and includes
99 provision for a DC power supply to the Communications Hub.

100 GSME shall include a power source. GSME shall be capable of automatically resuming
101 operation after loss of power in its operating state prior to such failure.

102 To the extent that it is mains powered, GSME shall be capable of performing the minimum
103 functional, interface and data requirements set out in *Sections 4.4, 4.5 and 4.6* respectively
104 operating at a nominal voltage of 230VAC without consuming more than an average of 1
105 watt of electricity under normal operating conditions.

106 GSME shall:

- 107 ix. permanently display the *GSME Identifier(4.6.1.1)* on the GSME; and
- 108 x. have a Secure Perimeter.

109 The HAN Interface of GSME shall be capable of joining a ZigBee SEP Smart Metering Home
110 Area Network which:

- 111 xi. operates within the 2400 – 2483.5 MHz harmonised frequency band or Sub GHz
112 Bands; and
- 113 xii. supports the Communications Links described in *Sections 4.5.1 and 4.5.3*.

114 On joining a ZigBee SEP Smart Metering Home Area Network GSME shall be capable of
115 generating and sending an Alert to that effect via its HAN Interface.

116 GSME shall be designed taking all reasonable steps so as to prevent Unauthorised Physical
117 Access and Unauthorised communications through its Secure Perimeter that could
118 compromise the Confidentiality and / or Data Integrity of:

- 119 xiii. Personal Data;
- 120 xiv. Consumption data used for billing;
- 121 xv. Security Credentials;
- 122 xvi. Random Number Generator;
- 123 xvii. Cryptographic Algorithms;
- 124 xviii. the Gas Meter; and
- 125 xix. Firmware and data essential for ensuring its integrity,

126 stored or executing on GSME.

127 GSME shall be capable of detecting any attempt at Unauthorised Physical Access through
128 its Secure Perimeter that could compromise such Confidentiality and / or Data Integrity and
129 on such detection shall be capable of:

- 130 xx. providing evidence of such an attempt through the use of tamper evident coatings or
131 seals,

132 and where reasonably practicable:

- 133 xxi. generating an entry to that effect in the *Security Log(4.6.5.17)*;
- 134 xxii. generating and sending an Alert to that effect via its HAN Interface; and
- 135 xxiii. where the *Supply Tamper State(4.6.4.26)* is configured to require Locking, sending
136 an Alert that the Supply is being disabled for this reason via its HAN Interface, and
137 establishing a Locked state whereby the Supply is Disabled and can only be Armed
138 in response to a Command to Arm the Supply (as described in *Section 4.5.3.7*).

139 When operating within Sub GHz Bands, the GSME shall:

- 140 xxiv. be capable of supporting Frequency Agility; and

141 xxv. not exceed a transmit power of 25 mW.

142 4.4 Functional requirements

143 This Section describes the minimum functions that GSME shall be capable of performing.

144 4.4.1 Clock

145 The Clock forming part of GSME shall be capable of operating so as to be accurate to within
146 10 seconds of the UTC date and time under normal operating conditions.

147 GSME shall be capable of comparing its date and time with the Communications Hub Date
148 and Time, and making adjustments to its date and time. Where the difference between
149 GSME date and time and the Communications Hub Date and Time is more than 10 seconds
150 GSME shall be capable of:

- 151 i. not adjusting its date and time;
- 152 ii. generating an entry in the *Security Log(4.6.5.17)* to that effect; and
- 153 iii. generating and sending an Alert via its HAN interface.

154 Except when executing a *Set Clock(4.5.3.20)* Command, GSME shall not be capable of
155 making adjustments to its date and time more than once within any 24 hour time period.

156 4.4.2 Communications

157 GSME, and any device forming part of it, shall be capable of ensuring that the security
158 characteristics of all Communications Links it establishes meet the requirements described
159 in *Section 4.4.10.5*.

160 GSME shall only be capable of establishing a Communications Link with a Gas Proxy
161 Function, and a PPMID with Security Credentials in the *Device Log(4.6.4.11)* and with the
162 exception of a Communications Hub Function shall not be capable of establishing a
163 Communications Link via its HAN Interface with any other Devices.

164 When any Command addressed to GSME is received via any Communications Link GSME
165 shall be capable of:

- 166 i. using the Security Credentials GSME holds, Authenticating to a Trusted Source the
167 Command;
- 168 ii. verifying in accordance with *Section 4.4.10.2.3* that the sender of the Command is
169 Authorised to execute the Command; and
- 170 iii. verifying the integrity of the Command.

171 On failure of any of (i) to (iii) above, GSME shall be capable of generating an entry in the
172 *Security Log(4.6.5.17)* to that effect, discarding the Command without execution and without
173 either generating or sending a Response, and generating and sending an Alert to that effect
174 via its HAN Interface.

175 When executing an immediate Command, GSME shall be capable of generating and
176 sending a Response via its HAN Interface, which shall either confirm successful execution of
177 the Command or shall detail why it has failed to execute the Command.

178 Where the Command is not due to be executed immediately, GSME shall be capable of
179 generating and sending a Response via its HAN Interface to confirm successful receipt.
180 When executing a future dated Command GSME shall be capable of generating and
181 sending an Alert via its HAN Interface which shall either confirm successful execution of the
182 Command or shall detail why it has failed to execute the Command.

183 GSME shall only be capable of addressing a Response to the sender of the relevant
184 Command.

185 GSME shall be capable of restricting the generation and sending of Alerts for each Alert
 186 described in this *Section 4* and for each event, which this *Section 4* requires the GSME to be
 187 capable of logging in the event log and which is not a Critical Event according to the *Alerts*
 188 *Configuration Settings(4.6.4.1)*.

189 For each event which this *Section 4* requires the GSME to be capable of logging in the event
 190 log and which is not a Critical Event, the GSME shall be capable of:

- 191 iv. sounding an Alarm; and
- 192 v. logging the event in the event log

193 according to the *Events Configuration Settings(4.6.4.34)*.

194 **4.4.2.1 Communications Links with a PPMID via its HAN Interface**

195 GSME shall be capable of establishing and maintaining Communications Links via its HAN
 196 Interface with a minimum of one PPMID.

197 GSME shall be capable of supporting the following types of Communications Links:

- 198 i. receiving the Commands (set out in *Section 7.5.4*) that may be sent from a PPMID
 199 every 30 minutes; and
- 200 ii. generating and sending the Responses (set out in *Section 4.5.3*) to a PPMID.

201 **4.4.2.2 Communications Links with a Communications Hub Function via its HAN** 202 **Interface**

203 GSME shall be capable of establishing and maintaining Communications Links via its HAN
 204 Interface with one Communications Hub Function.

205 GSME shall be capable of receiving the Communications Hub Date and Time from the
 206 Communications Hub Function.

207 **4.4.2.3 Communications with a Gas Proxy Function via its HAN Interface**

208 GSME shall be capable of establishing and maintaining a Communications Link via its HAN
 209 Interface with a Gas Proxy Function.

210 GSME shall be capable of generating and sending the information (set out in *Section 4.5.1*)
 211 to a Gas Proxy Function.

212 **4.4.3 Data storage**

213 GSME shall be capable of retaining all information held in its Data Store at all times,
 214 including on loss of power.

215 **4.4.4 Privacy PIN Protection**

216 GSME shall be capable of preventing the display on the User Interface of items annotated
 217 [PIN] in *Section 4.4.5*, and preventing access on the User Interface to the Commands
 218 annotated [PIN] in *Section 4.5.2*, except on successful execution of an *Allow Access to User*
 219 *Interface Command (4.5.2.3)* via the User Interface.

220 **4.4.5 Display of information**

221 GSME shall be capable of displaying the following up to date information on its User
 222 Interface:

- 223 i. the *Payment Mode(4.6.4.21)* currently in operation, being Prepayment Mode or
 224 Credit Mode [PIN];
- 225 ii. the *Tariff TOU Register Matrix(4.6.5.20)* with appropriate precision and the *Tariff*
 226 *Block Counter Matrix(4.6.5.19)* with appropriate precision;
- 227 iii. the *Consumption Register(4.6.5.4)* with appropriate precision;

- 228 iv. the *Meter Balance*(4.6.5.11) [PIN];
 229 v. the Debt to Clear (calculated as set out in *Section 4.4.7.2*) [PIN];
 230 vi. the *Customer Identification Number*(4.6.4.7) [PIN];
 231 vii. whether Emergency Credit is available for activation [PIN];
 232 viii. whether GSME has suspended the Disablement of Supply during a period defined in
 233 the *Non-Disablement Calendar*(4.6.4.20) (as set out in *Section 4.4.7.2*) [PIN];
 234 ix. the *Emergency Credit Balance*(4.6.5.8) where Emergency Credit is activated [PIN];
 235 x. any low credit condition [PIN];
 236 xi. where GSME includes a Battery, any low battery condition;
 237 xii. the *Supply State*(4.6.5.18);
 238 xiii. any time-based debts and Time-based Debt Recovery rates [PIN];
 239 xiv. any payment-based debt [PIN];
 240 xv. any accumulated debt recorded in the *Accumulated Debt Register*(4.6.5.1) [PIN];
 241 xvi. the *Meter Point Reference Number (MPRN)*(4.6.4.19) [PIN];
 242 xvii. the Local Time;
 243 xviii. any *Standing Charge*(4.6.4.23) [PIN];
 244 xix. the *Contact Details*(4.6.4.4);
 245 xx. the *Active Tariff Price*(4.6.5.2) [PIN]; and
 246 xxi. the *Event Log*(4.6.5.9) (with the exception of any Personal Data).

247 GSME shall be capable of displaying the *Security Log*(4.6.5.17) on its User Interface
 248 following physical access through the Secure Perimeter of GSME.

249 GSME shall be capable of displaying Currency Units in GB Pounds and European Central
 250 Bank Euro.

251 **4.4.5.1 Presentation of information on the User Interface**

252 For each of the values currently stored in the *Consumption Register*(4.6.5.4), the *Tariff Block*
 253 *Counter Matrix*(4.6.5.19) and the *Tariff ToU Register Matrix*(4.6.5.20), GSME shall be capable
 254 of displaying a value calculated from the stored value by:

- 255 i. converting the stored value in to a decimal, integer number of thousandths of metres
 256 cubed, rounding the stored value down to the nearest thousandth of a metre cubed;
 257 ii. discarding all except the eight least significant decimal digits so produced;
 258 iii. adding leading zeros (if necessary) so that there are exactly eight decimal digits;
 259 and
 260 iv. placing the decimal point separator between the fourth and third least significant
 261 digits.

262 **4.4.6 Monitoring**

263 **4.4.6.1 Battery capacity**

264 Where GSME includes a Battery, it shall be capable of estimating the remaining Battery
 265 capacity in days (to facilitate replacement of the Battery before it is fully depleted) and
 266 storing the estimate in *Remaining Battery Capacity*(4.6.5.16).

267 If the *Remaining Battery Capacity*(4.6.5.16) falls below ten percent of the nominal Battery
 268 capacity GSME shall be capable of:

- 269 i. generating an entry to that effect in the *Event Log*(4.6.5.9); and
 270 ii. generating and sending an Alert to that effect via its HAN Interface.

271 **4.4.6.2 GSME power supply**

272 Prior to or at the loss of power, GSME shall be capable of:

- 273 i. in circumstances where the *Supply Depletion State*(4.6.4.25) is configured to require
274 Locking, establishing a Locked state whereby the Supply is Disabled and can only
275 be Armed in response to a Command to Arm the Supply (as described in *Section*
276 *4.5.3.7*); and
277 ii. generating and sending an Alert to that effect via its HAN Interface.

278 **4.4.6.3 GSME Operational Integrity**

279 GSME shall be capable of taking all reasonable steps to detect conditions affecting its Smart
280 Meter Operational Integrity and on such detection shall be capable of generating an entry to
281 that effect in the *Event Log*(4.6.5.9) and generating and sending an Alert to that effect via its
282 HAN Interface where reasonably practicable, including in the Alert information relating to the
283 nature of the condition detected.

284 **4.4.7 Payment Mode**

285 GSME shall be capable of operating in Credit Mode and Prepayment Mode and of being
286 remotely switched from one mode to the other.

287 **4.4.7.1 Credit Mode**

288 GSME, when operating in Credit Mode, shall be capable of maintaining a calculation of the
289 *Meter Balance*(4.6.5.11) based on:

- 290 i. the Consumption in the *Tariff TOU Register Matrix*(4.6.5.20) converted by *Calorific*
291 *Value*(4.6.4.3) and *Conversion Factor*(4.6.4.5) and the Prices in the *Tariff TOU Price*
292 *Matrix*(4.6.4.32) and, if operating Time-of-use with Block Pricing, the Consumption in
293 the *Tariff Block Counter Matrix*(4.6.5.19) converted by *Calorific Value*(4.6.4.3) and
294 *Conversion Factor*(4.6.4.5) and the Prices in the *Tariff Block Price Matrix*(4.6.4.29);
295 and
296 ii. the *Standing Charge*(4.6.4.23).

297 **4.4.7.2 Prepayment Mode**

298 GSME shall be capable of operating in Prepayment Mode, including during periods of loss of
299 its Communications Link via its HAN Interface, and maintaining a balance of credit and
300 reflecting any reduction in credit based on Consumption, standing charge and Time-based
301 Debt Recovery.

302 GSME shall be capable of adding credit to the *Meter Balance*(4.6.5.11) (as set out in
303 *Sections 4.5.2.2* and *4.5.3.3*) and reducing the amount of credit in the *Meter*
304 *Balance*(4.6.5.11).

305 GSME shall be capable of making Emergency Credit available to the Consumer (by means
306 of the *Emergency Credit Balance*(4.6.5.8)) if the *Meter Balance*(4.6.5.11) is below the
307 *Emergency Credit Threshold*(4.6.4.14). GSME shall be capable of displaying the availability
308 of Emergency Credit on its User Interface and of generating and sending an Alert indicating
309 the availability of Emergency Credit via its HAN Interface. The amount of Emergency Credit
310 made available to the Consumer shall be equal to the *Emergency Credit Limit*(4.6.4.13).

311 GSME shall be capable of reducing the amount of credit in the *Emergency Credit*
312 *Balance*(4.6.5.8) where Emergency Credit is activated by the Consumer (as set out in
313 *Sections 4.5.2.1* and *4.5.3.1*) and the *Meter Balance*(4.6.5.11) is exhausted. Any
314 Emergency Credit used shall be repaid when credit is added to GSME (as set out in
315 *Sections 4.5.2.2* and *4.5.3.3*).

316 GSME shall be capable of reducing the *Meter Balance*(4.6.5.11) until it reaches the
317 *Disablement Threshold*(4.6.4.12) followed by reducing the *Emergency Credit*
318 *Balance*(4.6.5.8), where activated, until exhausted, on the basis of:

- 319 i. the Consumption in the *Tariff TOU Register Matrix*(4.6.5.20) converted by *Calorific*
 320 *Value*(4.6.4.3) and *Conversion Factor*(4.6.4.5) and the Prices in the *Tariff TOU Price*
 321 *Matrix*(4.6.4.32) and, if operating Time-of-use with Block Pricing, the Consumption in
 322 the *Tariff Block Counter Matrix*(4.6.5.19) converted by *Calorific Value*(4.6.4.3) and
 323 *Conversion Factor*(4.6.4.5) and the Prices in the *Tariff Block Price Matrix*(4.6.4.29);
 324 ii. the *Standing Charge*(4.6.4.23); and
 325 iii. the recovery of debt hourly or daily through each of the *Time Debt Registers* [1 ...
 326 2](4.6.5.21) at rates defined by the *Debt Recovery Rates* [1 ... 2](4.6.4.9).

327 Where configured by *Suspend Debt Emergency*(4.6.4.28) to do so and when Emergency
 328 Credit is in use, GSME shall be capable of suspending the application of (ii) and (iii) to the
 329 *Emergency Credit Balance*(4.6.5.8), and accumulating (ii) and (iii) in the *Accumulated Debt*
 330 *Register*(4.6.5.1).

331 GSME shall be capable of recording debt recovered, or accumulated in the *Accumulated*
 332 *Debt Register*(4.6.5.1), in the *Billing Data Log*(4.6.5.3).

333 GSME shall be capable of monitoring the *Meter Balance*(4.6.5.11) and where activated the
 334 *Emergency Credit Balance*(4.6.5.8) and:

- 335 iv. if the combined credit of the *Meter Balance*(4.6.5.11) and *Emergency Credit*
 336 *Balance*(4.6.5.8) falls below the *Low Credit Threshold*(4.6.4.16), displaying an Alert
 337 to that effect on its User Interface and generating and sending an Alert to that effect
 338 via its HAN Interface;
 339 v. if the combined credit of the *Meter Balance*(4.6.5.11) and *Emergency Credit*
 340 *Balance*(4.6.5.8) falls below the *Disablement Threshold*(4.6.4.12):

- 341 a) receiving and executing *Add Credit*(4.5.3.3) and *Activate Emergency*
 342 *Credit*(4.5.3.1) Commands from a PPMID and a Gas Proxy Function; and
 343 b) once any such Commands have been executed if the combined credit of the
 344 *Meter Balance*(4.6.5.11) and *Emergency Credit Balance*(4.6.5.8) remains
 345 below the *Disablement Threshold*(4.6.4.12), Disabling the Supply, displaying
 346 an Alert to that effect on its User Interface and generating and sending an Alert
 347 to that effect via its HAN Interface;

348 vi. where the Supply is Disabled (as set out in (b) above):

- 349 c) where configured by *Suspend Debt Disabled*(4.6.4.27) not to suspend Time-
 350 based Debt Recovery, continuing to apply (ii) and (iii) above to reduce the
 351 *Meter Balance*(4.6.5.11);
 352 d) where configured by *Suspend Debt Disabled*(4.6.4.27) to suspend Time-based
 353 Debt Recovery, suspending the application of (iii) above to the *Meter*
 354 *Balance*(4.6.5.11) and continuing to apply (ii) above to reduce the *Meter*
 355 *Balance*(4.6.5.11); and

356 vii. if the Supply is Enabled, suspending the Disablement of Supply (as set out in (b)
 357 above) during periods defined in the *Non-Disablement Calendar*(4.6.4.20),
 358 continuing to reduce the *Meter Balance*(4.6.5.11) on the basis of (i), (ii) and (iii)
 359 above, displaying on its User Interface an indication that the combined *Meter*
 360 *Balance*(4.6.5.11) and *Emergency Credit Balance*(4.6.5.8) is below the *Disablement*
 361 *Threshold*(4.6.4.12) and that Disablement of Supply due to insufficient credit has
 362 been suspended, and generating and sending an Alert that Disablement of Supply
 363 due to insufficient credit has been suspended via its HAN Interface.

364 If the *Meter Balance*(4.6.5.11) is equal to or below the *Disablement Threshold*(4.6.4.12)
 365 GSME shall be capable of maintaining a calculation of the Debt to Clear based on:

- 366 viii. the difference between the *Meter Balance*(4.6.5.11) and the *Disablement*
367 *Threshold*(4.6.4.12);
- 368 ix. amount of debt accumulated in the *Accumulated Debt Register*(4.6.5.1);
- 369 x. amount of Emergency Credit activated and used by the Consumer; and
- 370 xi. the payment-based debt to be collected based on (viii), (ix) and (x) (as defined by
371 *Debt Recovery per Payment*(4.6.4.8) taking account of the amount remaining in the
372 *Payment Debt Register*(4.6.5.13), the payment-based debt payments in the *Billing*
373 *Data Log*(4.6.5.3) and the *Debt Recovery Rate Cap*(4.6.4.10)).

374 For Time-based Debt Recovery, the GSME shall be capable of recovering the lesser of:

- 375 xii. the amount in the relevant *Time Debt Registers [1 ... 2]*(4.6.5.21); and
- 376 xiii. the corresponding amount determined by the *Debt Recovery Rates [1 ... 2]*
377 (4.6.4.9).

378 For Payment-based Debt Recovery, the GSME shall be capable of recovering the lesser of:

- 379 xiv. the amount defined by *Debt Recovery per Payment*(4.6.4.8) subject to the *Debt*
380 *Recovery Rate Cap*(4.6.4.10); and
- 381 xv. the amount in the *Payment Debt Register*(4.6.5.13).

382 Where an Adjust Debt Command is to reduce the amount in a Debt Register and the amount
383 in the Command is greater than the amount in the Debt Register, GSME shall be capable of
384 setting the amount in the Debt Register to zero then applying the difference in the amounts
385 in the following order:

- 386 xvi. recovering debt accumulated in the *Accumulated Debt Register*(4.6.5.1);
- 387 xvii. repaying Emergency Credit activated and used by the Consumer; and
- 388 xviii. increasing the *Meter Balance*(4.6.5.11).

389 GSME shall be capable of monitoring the *Meter Balance*(4.6.5.11) and, where the Supply is
390 Disabled, GSME shall be capable of Arming the Supply if the *Meter Balance*(4.6.5.11) rises
391 above the *Disablement Threshold*(4.6.4.12), displaying any such change in the *Supply*
392 *State*(4.6.5.18) on its User Interface and generating and sending an Alert that the Supply
393 has been Armed via its HAN Interface.

394 **4.4.8 Pricing**

395 GSME shall be capable of applying Time-of-use Pricing and Time-of-use with Block Pricing.

396 GSME shall be capable of maintaining the *Active Tariff Price*(4.6.5.2).

397 **4.4.8.1 Time-of-use Pricing**

398 GSME shall be capable of recording Consumption according to Time-of-use Bands in one of
399 four Tariff Registers in the *Tariff TOU Register Matrix*(4.6.5.20).

400 GSME shall be capable of switching between different Tariff Registers once per Day. The
401 switching between Time-of-use Bands and thus Tariff Registers shall be based on the
402 switching rules defined in the *Tariff Switching Table*(4.6.4.30).

403 **4.4.8.2 Time-of-use with Block Pricing**

404 GSME shall be capable of recording Consumption according to Time-of-use Bands in one of
405 four Tariff Registers in the *Tariff TOU Register Matrix*(4.6.5.20).

406 GSME shall also be capable of accumulating Consumption in one of four Block Counters in
407 the *Tariff Block Counter Matrix*(4.6.5.19) for the first Time-of-use Band. GSME shall be
408 capable of switching between Block Counters according to the Consumption thresholds in
409 the *Tariff Threshold Matrix*(4.6.4.31).

410 GSME shall be capable of switching between different Tariff Registers once per Day. The
 411 switching between Time-of-use Bands and thus Tariff Registers shall be based on the
 412 switching rules set out in the *Tariff Switching Table*(4.6.4.30).

413 4.4.9 Recording

414 4.4.9.1 Billing data

415 In accordance with the timetable set out in the *Billing Calendar*(4.6.4.2) GSME shall be
 416 capable of taking a UTC date and time stamped copy of:

- 417 i. the *Tariff TOU Register Matrix*(4.6.5.20);
- 418 ii. the *Tariff Block Counter Matrix*(4.6.5.19); and
- 419 iii. the *Consumption Register*(4.6.5.4),

420 and where in Prepayment mode:

- 421 iv. the *Meter Balance*(4.6.5.11);
- 422 v. the *Emergency Credit Balance*(4.6.5.8);
- 423 vi. the *Payment Debt Register*(4.6.5.13);
- 424 vii. the *Time Debt Registers [1 ... 2]*(4.6.5.21); and
- 425 viii. the *Accumulated Debt Register*(4.6.5.1),

426 in the *Billing Data Log*(4.6.5.3), then immediately resetting the Block Counters in the *Tariff*
 427 *Block Counter Matrix*(4.6.5.19) and if operating in Credit Mode immediately resetting the
 428 *Meter Balance*(4.6.5.11).

429 4.4.9.2 Consumption data

430 GSME shall be capable of recording cumulative Consumption in the *Consumption*
 431 *Register*(4.6.5.4).

432 GSME shall be capable of recording to the *Cumulative and Historical Value Store*(4.6.5.5) in
 433 kWh:

- 434 i. Energy Consumption on each of the eight Days prior to the current Day;
- 435 ii. Energy Consumption in the Week in which the calculation is performed;
- 436 iii. Energy Consumption in each of the five Weeks prior to such Week;
- 437 iv. Energy Consumption in the month in which the calculation is performed; and
- 438 v. Energy Consumption in the thirteen months prior to such month.

439 GSME shall be capable of recording to the *Cumulative Current Day Value Store*(4.6.5.6) in
 440 kWh the Energy Consumption on the Day up to the Local Time.

441 4.4.9.3 Cost of Consumption data

442 GSME shall be capable of calculating and recording in the *Cumulative and Historical Value*
 443 *Store*(4.6.5.5) the cost of:

- 444 i. Consumption on each of the eight Days prior to the current Day;
- 445 ii. Consumption in the Week in which the calculation is performed;
- 446 iii. Consumption in each of the five Weeks prior to such Week;
- 447 iv. Consumption in the month in which the calculation is performed; and
- 448 v. Consumption in the thirteen months prior to such month.

449 GSME shall be capable of recording to the *Cumulative Current Day Value Store*(4.6.5.6) the
 450 cost of Consumption on the Day up to the Local Time.

451 GSME shall be capable of calculating cost of Consumption as above on the basis of:

- 452 vi. the Consumption in the *Tariff TOU Register Matrix*(4.6.5.20) converted by *Calorific*
 453 *Value*(4.6.4.3) and *Conversion Factor*(4.6.4.5) and the Prices in the *Tariff TOU Price*

454 *Matrix(4.6.4.32)* and, if operating Time-of-use with Block Pricing, the Consumption in
455 the *Tariff Block Counter Matrix(4.6.5.19)* converted by *Calorific Value(4.6.4.3)* and
456 *Conversion Factor(4.6.4.5)* and the Prices in the *Tariff Block Price Matrix(4.6.4.29)*;
457 and
458 vii. the *Standing Charge(4.6.4.23)*.

459 **4.4.9.4 Daily read data**

460 GSME shall be capable of taking a copy of and storing the *Tariff TOU Register*
461 *Matrix(4.6.5.20)*, the *Tariff Block Counter Matrix(4.6.5.19)* and the *Consumption*
462 *Register(4.6.5.4)* together with a UTC date and time stamp in the *Daily Read Log(4.6.5.4)*
463 every day at midnight UTC.

464 If operating in Prepayment Mode GSME shall be capable of recording the *Meter*
465 *Balance(4.6.5.11)*, *Emergency Credit Balance(4.6.5.8)*, *Accumulated Debt Register(4.6.5.1)*,
466 *Payment Debt Register(4.6.5.13)* and *Time Debt Registers [1 ... 2](4.6.5.21)* in the
467 *Prepayment Daily Read Log(4.6.5.14)* every day at midnight UTC.

468 **4.4.9.5 Half hour profile data**

469 GSME shall be capable of recording Consumption in each thirty minute period (commencing
470 at the start of minutes 00 and 30 in each hour), including the UTC date and time at the end
471 of the 30 minute period to which the Consumption relates, in the *Profile Data Log(4.6.5.15)*.

472 **4.4.10 Security**

473 **4.4.10.1 General**

474 GSME shall be designed taking all reasonable steps so as to ensure that any failure or
475 compromise of its integrity shall not compromise the Security Credentials or Personal Data
476 stored on it or compromise the integrity of any other Device to which it is connected by
477 means of a Communications Link.

478 GSME shall be capable of securely disabling Critical Commands other than those
479 Commands set out in *Section 4.5* that are Critical Commands.

480 GSME shall be capable of verifying its Firmware at power-on and prior to activation of the
481 Firmware, to verify that the Firmware, at that time, is in the form originally received. On
482 failure of verification GSME shall be capable of:

- 483 i. generating an entry to that effect in the *Security Log(4.6.5.17)*; and
- 484 ii. generating and sending an Alert to that effect via its HAN Interface.

485 Where GSME comprises more than one device, each device other than the Gas Meter shall
486 be capable of verifying its Firmware at power-on and prior to activation of the Firmware, to
487 verify that the Firmware, at that time, is in the form originally received. On failure of
488 verification GSME shall be capable of:

- 489 iii. generating an entry to that effect in the *Security Log(4.6.5.17)*; and
- 490 iv. generating and sending an Alert to that effect via its HAN Interface.

491 GSME shall be capable of logging in the *Security Log(4.6.5.17)* the occurrence and type of
492 any Sensitive Event.

493 **4.4.10.2 Security Credentials**

494 **4.4.10.2.1 Meter Private Keys**

495 GSME shall be capable of generating Public-Private Key Pairs to support the Cryptographic
496 Algorithms set out in *Section 4.4.10.3*.

497 GSME shall be capable of securely storing such Private Keys and shall be capable of
498 formatting and sending via its HAN Interface a Certificate Signing Request containing the
499 corresponding Public Key and the *GSME Identifier*(4.6.1.1).

500 GSME shall be capable of securely storing Key Agreement values.

501 **4.4.10.2.2 Public Key Certificates**

502 GSME shall be capable of securely storing Security Credentials from Certificates including
503 for use in the Cryptographic Algorithms as set out in *Section 4.4.10.3*.

504 During the replacement of any *GSME Security Credentials*(4.6.4.15) (as set out in *Section*
505 *4.5.3.18*) GSME shall be capable of ensuring that the *GSME Security Credentials*(4.6.4.15)
506 being replaced remain usable until the successful completion of the replacement.

507 **4.4.10.2.3 Role Based Access Control (RBAC)**

508 GSME shall be capable of restricting Authorisation to execute Commands and of issuing
509 Alerts according to Role permissions.

510 **4.4.10.3 Cryptographic Algorithms**

511 GSME shall be capable of supporting the following Cryptographic Algorithms:

- 512 i. Elliptic Curve DSA;
- 513 ii. Elliptic Curve DH; and
- 514 iii. SHA-256.

515 In executing and creating any Command, Response or Alert, GSME shall be capable of
516 applying Cryptographic Algorithms (alone or in combination) for:

- 517 iv. Digital Signing;
- 518 v. Digital Signature verification;
- 519 vi. Hashing;
- 520 vii. Message Authentication; and
- 521 viii. Encryption and Decryption.

522 **4.4.10.4 Firmware**

523 GSME shall only be capable of activating Firmware on receipt of an Activate Firmware
524 Command (as set out in *Section 4.5.3.2*).

525 **4.4.10.5 Communications**

526 GSME shall be capable of preventing and detecting, on all of its interfaces, Unauthorised
527 access that could compromise the Confidentiality and / or Data Integrity of:

- 528 i. Personal Data whilst being transferred via an interface;
- 529 ii. Consumption data used for billing whilst being transferred via an interface;
- 530 iii. Security Credentials whilst being transferred via an interface; and
- 531 iv. Firmware and data essential for ensuring its integrity whilst being transferred via an
532 interface,

533 and any Command that could compromise the Confidentiality and / or Data Integrity of:

- 534 v. Personal Data;
- 535 vi. Consumption data used for billing;
- 536 vii. Security Credentials; and
- 537 viii. Firmware and data essential for ensuring its integrity,

538 stored or executing on GSME, and on such detection shall be capable of:

- 539 ix. generating an entry to that effect in the *Security Log*(4.6.5.17); and

- 540 x. generating and sending an Alert to that effect via its HAN Interface.
- 541 GSME shall be capable of employing techniques to protect against Replay Attacks relating
542 to Commands received.
- 543 GSME shall not be capable of executing a Command to modify or delete entries from the
544 *Security Log*(4.6.5.17).

545 4.5 Interface requirements

546 This Section describes the minimum required interactions which GSME shall be capable of
547 undertaking via its HAN Interface and its User Interface (including with Devices as set out in
548 *Sections 4.4.2.1 and 4.4.2.3*).

549 4.5.1 Gas Proxy Function information provision

550 GSME shall be capable, immediately upon establishment of a Communications Link with a
551 Gas Proxy Function (as set out in *Section 4.4.2.3*), of providing the Operational Data (set out
552 in *Section 4.6.5*) to that Gas Proxy Function (and with the exception of the *Cumulative and*
553 *Historical Value Store*(4.6.5.5) and the *Profile Data Log*(4.6.5.15), updates of any changes in
554 that data every 30 minutes thereafter).

555 4.5.2 User Interface Commands

556 GSME shall be capable of executing immediately the Commands set out in this *Section*
557 *4.5.2* following their receipt via its User Interface.

558 GSME shall be capable of logging all such Commands received and Outcomes in the *Event*
559 *Log*(4.6.5.9).

560 4.5.2.1 Activate Emergency Credit [PIN]

561 A Command to activate Emergency Credit when GSME is operating in Prepayment Mode
562 where Emergency Credit is available (as set out in *Section 4.4.7.2*).

563 In executing the Command, if the Supply is Disabled, GSME shall be capable of Arming the
564 Supply if the combined credit of the *Meter Balance*(4.6.5.11) and *Emergency Credit*
565 *Balance*(4.6.5.8) rises above the *Disablement Threshold*(4.6.4.12) and displaying any such
566 change in the *Supply State*(4.6.5.18) on its User Interface and generating and sending an
567 Alert that the Supply has been Armed via its HAN Interface.

568 4.5.2.2 Add Credit

569 A Command to accept credit to be applied to GSME when GSME is operating in Prepayment
570 Mode on input of a UTRN. In executing the Command, GSME shall be capable of:

- 571 i. comparing the credit value of the UTRN with the *Maximum Credit*
572 *Threshold*(4.6.4.17) and rejecting the UTRN where the credit value is greater than
573 that threshold;
- 574 ii. comparing the projected new *Meter Balance*(4.6.5.11) (calculated on the basis of
575 (xii) to (xv) below and the credit value of the UTRN and rejecting the UTRN where
576 the projected new *Meter Balance*(4.6.5.11) is greater than the *Maximum Meter*
577 *Balance Threshold*(4.6.4.18);
- 578 iii. verifying the Authenticity of the UTRN;
- 579 iv. verifying that GSME is the intended recipient of the UTRN;
- 580 v. using the UTRN to generate a UTRN Counter, and comparing this against the last
581 100 verified UTRN Counters and rejecting duplicate presentation of verified UTRNs;
582 and
- 583 vi. controlling the number of invalid UTRN entries entered and processed.

584 GSME shall be capable of generating an entry in the *Security Log*(4.6.5.17):

- 585 vii. where the UTRN is rejected as set out in (i) above;
- 586 viii. where the UTRN is rejected as set out in (ii) above;
- 587 ix. on failure of (iii) above;
- 588 x. on failure of (iv) above; and
- 589 xi. where duplicates are rejected as set out in (v) above.

590 In executing the Command, GSME shall be capable of applying the credit added in the
591 following order:

- 592 xii. recovery of payment-based debt of an amount defined by *Debt Recovery per*
593 *Payment*(4.6.4.8) from the *Payment Debt Register*(4.6.5.13) subject to the *Debt*
594 *Recovery Rate Cap*(4.6.4.10);
- 595 xiii. recovery of debt accumulated in the *Accumulated Debt Register*(4.6.5.1);
- 596 xiv. repayment of Emergency Credit activated and used by the Consumer; and
- 597 xv. adding remaining credit (the credit after deduction of (xii), (xiii) and (xiv) above) to
598 the *Meter Balance*(4.6.5.11).

599 In executing the Command, GSME shall be capable of Arming the Supply if the *Meter*
600 *Balance*(4.6.5.11) rises above the *Disablement Threshold*(4.6.4.12) and displaying any such
601 change in the *Supply State*(4.6.5.18) on its User Interface and generating and sending an
602 Alert that the Supply has been Armed via its HAN Interface.

603 In executing the Command, GSME shall be capable of:

- 604 xvi. recording the credit applied to the *Meter Balance*(4.6.5.11) and the amount of
605 payment-based debt recovered (as set out in (xii)) in the *Billing Data Log*(4.6.5.3);
606 and
- 607 xvii. generating and sending an Alert containing the UTC date and time of the last update
608 of the *Meter Balance*(4.6.5.11) via its HAN Interface.

609 **4.5.2.3 Allow Access to User Interface**

610 Where Privacy PIN Protection is enabled, a Command to enable temporary access to the
611 restricted display items annotated [PIN] in *Section 4.4.5* and the restricted User Interface
612 Commands annotated [PIN] in *Section 4.5.2* on input of a number that matches the *Privacy*
613 *PIN*(4.6.3.1).

614 **4.5.2.4 Check for HAN Interface Commands**

615 A Command to check immediately for any pending *Add Credit*(4.5.3.3) and *Activate*
616 *Emergency Credit*(4.5.3.1) Commands. If there are any such pending Commands GSME
617 shall be capable of executing the Commands as set out in *Section 4.5.3*.

618 **4.5.2.5 Disable Privacy PIN Protection [PIN]**

619 A Command to disable Privacy PIN Protection.

620 **4.5.2.6 Enable Supply [PIN]**

621 A Command to Enable the Supply if the Supply is Armed.

622 In executing the Command, GSME shall be capable of detecting when the flow rate exceeds
623 a level defined by *Uncontrolled Gas Flow Rate*(4.6.4.33) and where the flow rate is
624 exceeded, of Disabling the Supply and then Arming the Supply, sending an Alert to that
625 effect via its HAN interface and sounding an Alarm via its User Interface.

626 **4.5.2.7 Reset Remaining Battery Capacity**

627 A Command to reset the *Remaining Battery Capacity*(4.6.5.16). The Command shall only
628 be available following physical access through the Secure Perimeter of GSME.

629 In executing the Command GSME shall be capable of:

- 630 i. generating an entry to that effect in the *Security Log(4.6.5.17)*; and
- 631 ii. generating and sending an Alert to that effect via its HAN Interface.

632 **4.5.2.8 Find Smart Metering Home Area Network and Re-establish**

633 **Communications Links**

634 A Command to seek the frequency at which a ZigBee SEP Smart Metering Home Area
635 Network is operating and then:

- 636 i. re-establish the Communications Links set out in *Sections 4.4.2.1, 4.4.2.2 and*
637 *4.4.2.3*;
- 638 ii. generate an entry to that effect in the *Event Log(4.6.5.9)*; and
- 639 iii. generate and send an Alert to that effect via its HAN Interface.

640 Where the GSME has Communications Links set out in (i) GSME shall be capable of not
641 executing the Command.

642 **4.5.2.9 Set Privacy PIN [PIN]**

643 A Command to set a new value of the *Privacy PIN(4.6.3.1)*.

644 In executing the Command where Privacy PIN Protection is disabled GSME shall be capable
645 of enabling Privacy PIN Protection.

646 **4.5.2.10 Test Valve**

647 Where GSME includes a Valve, a Command to:

- 648 i. where the *Supply State(4.6.5.18)* is Enabled, Disable the Supply for one minute and
649 then Arm the Supply and set the *Supply State(4.6.5.18)* accordingly;
- 650 ii. where the *Supply State(4.6.5.18)* is Armed, Enable the Supply for one minute and
651 then Arm the Supply and set the *Supply State(4.6.5.18)* accordingly; and
- 652 iii. where the *Supply State(4.6.5.18)* is Disabled, Enable the Supply for one minute and
653 then Disable the Supply and set the *Supply State(4.6.5.18)* accordingly.

654 The Command shall only be available following physical access through the Secure
655 Perimeter of GSME. In executing the Command GSME shall be capable of:

- 656 iv. generating an entry to that effect in the *Event Log(4.6.5.9)*; and
- 657 v. generating and sending an Alert to that effect via its HAN.

658 **4.5.3 HAN Interface Commands**

659 GSME shall be capable of executing the Commands set out in this Section. GSME shall be
660 capable of logging all Commands received and Outcomes in the *Event Log(4.6.5.9)*.

661 GSME shall be capable of executing Commands immediately on receipt ('immediate
662 Commands') and where specified in the Great Britain Companion Specification at a future
663 date ('future dated Commands'). A future dated Command shall include the UTC date and
664 time at which the Command shall be executed by GSME.

665 GSME shall be capable of cancelling a future dated Command. A future dated Command
666 shall be capable of being cancelled by an Authorised party, subject to RBAC (as set out in
667 *Section 4.4.10.2.3*). GSME shall be capable of generating and sending a Response
668 acknowledging that a future dated Command has been successfully cancelled.

669 **4.5.3.1 Activate Emergency Credit**

670 A Command to activate Emergency Credit when GSME is operating in Prepayment Mode
671 where Emergency Credit is available (as set out in *Section 4.4.7.2*).

672 In executing the Command where the Supply is Disabled GSME shall be capable of Arming
 673 the Supply if the combined credit of the *Meter Balance*(4.6.5.11) and *Emergency Credit*
 674 *Balance*(4.6.5.8) rises above the *Disablement Threshold*(4.6.4.12) and displaying any such
 675 change in the *Supply State*(4.6.5.18) on its User Interface and generating and sending an
 676 Alert that the Supply has been Armed via its HAN Interface.

677 When operating in Credit Mode, GSME shall be capable of not executing the Command and
 678 generating and sending a Response to that effect via its HAN Interface.

679 **4.5.3.2 Activate Firmware**

680 A Command to activate Firmware.

681 In executing the Command GSME shall be capable of installing new Firmware using a
 682 mechanism that is robust against failure and loss of data.

683 The new Firmware shall include version information. Where new Firmware is successfully
 684 installed, GSME shall be capable of recording the version information of that new Firmware
 685 in *Firmware Version*(4.6.5.10).

686 **4.5.3.3 Add Credit**

687 A Command to accept credit to be applied to GSME when GSME is operating in Prepayment
 688 Mode on receipt of a UTRN from a PPMID or a UTRN from an Authorised party.

689 In executing the Command following receipt of a UTRN from a PPMID GSME shall be
 690 capable of applying credit as set out in *Section 4.5.2.2*.

691 In executing the Command following receipt of a UTRN from an Authorised party, GSME
 692 shall be capable of:

- 693 i. comparing the credit value of the UTRN with the *Maximum Credit*
 694 *Threshold*(4.6.4.17) and rejecting the UTRN where the credit value is greater than
 695 that threshold;
- 696 ii. comparing the projected new *Meter Balance*(4.6.5.11) (calculated on the basis of
 697 (xii) to (xv) below and the credit value of the UTRN and rejecting the UTRN where
 698 the projected new *Meter Balance*(4.6.5.11) is greater than the *Maximum Meter*
 699 *Balance Threshold*(4.6.4.18);
- 700 iii. verifying the Authenticity of the UTRN;
- 701 iv. verifying that GSME is the intended recipient of the UTRN;
- 702 v. comparing the UTRN Counter against the last 100 verified UTRN Counters and
 703 rejecting duplicate presentation of verified UTRNs; and
- 704 vi. controlling the number of invalid UTRN entries entered and processed.

705 GSME shall be capable of generating an entry in the *Security Log*(4.6.5.17):

- 706 vii. where the UTRN is rejected as set out in (i) above;
- 707 viii. where the UTRN is rejected as set out in (ii) above;
- 708 ix. on failure of (iii) above;
- 709 x. on failure of (iv) above; and
- 710 xi. where duplicates are rejected as set out in (v) above.

711 In executing the Command, GSME shall be capable of applying the credit added in the
 712 following order:

- 713 xii. recovery of payment-based debt of an amount defined by *Debt Recovery per*
 714 *Payment*(4.6.4.8) from the *Payment Debt Register*(4.6.5.13) subject to the *Debt*
 715 *Recovery Rate Cap*(4.6.4.10);
- 716 xiii. recovery of debt accumulated in the *Accumulated Debt Register*(4.6.5.1);
- 717 xiv. repayment of Emergency Credit activated and used by the Consumer; and

718 xv. adding remaining credit (the credit after deduction of (xii), (xiii) and (xiv) above) to
719 the *Meter Balance*(4.6.5.11).

720 In executing the Command, GSME shall be capable of Arming the Supply if the *Meter*
721 *Balance*(4.6.5.11) rises above the *Disablement Threshold*(4.6.4.12), displaying any such
722 change in the *Supply State*(4.6.5.18) on its User Interface and generating and sending an
723 Alert that the Supply has been Armed via its HAN Interface.

724 In executing the Command, GSME shall be capable of recording the credit applied to the
725 *Meter Balance*(4.6.5.11) and the amount of payment-based debt recovered (as set out in
726 (xii)) in the *Billing Data Log*(4.6.5.3).

727 In executing the Command from a PPMID, GSME shall be capable of generating and
728 sending an Alert containing the UTC date and time stamp of the last update of the *Meter*
729 *Balance*(4.6.5.11) via its HAN Interface.

730 When operating in Credit Mode, GSME shall be capable of not executing the Command and
731 generating and sending a Response to that effect via its HAN Interface.

732 **4.5.3.4 Add Device Security Credentials**

733 A Command to add Security Credentials for a PPMID or a Gas Proxy Function to the *Device*
734 *Log*(4.6.4.11).

735 In executing the Command, GSME shall be capable of:

- 736 i. verifying the Security Credentials; and
- 737 ii. recording the Command and Outcome to the *Security Log*(4.6.5.17).

738 **4.5.3.5 Adjust Debt**

739 A Command to apply positive and negative adjustments to the *Time Debt Registers* [1 ...
740 2](4.6.5.21) and the *Payment Debt Register*(4.6.5.13) when operating in Prepayment Mode.

741 When operating in Credit Mode, GSME shall be capable of not executing the Command and
742 generating and sending a Response to that effect via its HAN Interface.

743 **4.5.3.6 Adjust Meter Balance**

744 A Command to apply positive and negative adjustments to the *Meter Balance*(4.6.5.11).

745 In executing the Command where GSME is operating in Prepayment Mode and where,
746 following any such adjustment, the *Meter Balance*(4.6.5.11) rises above the *Disablement*
747 *Threshold*(4.6.4.12), GSME shall be capable of Arming the Supply, displaying any such
748 change in the *Supply State*(4.6.5.18) on its User Interface and generating and sending an
749 Alert that the Supply has been Armed via its HAN Interface.

750 **4.5.3.7 Arm Supply**

751 A Command to return GSME from a Locked state to an Unlocked state.

752 In executing the Command where the state of the Supply is Enabled or Armed, GSME shall
753 Arm the Supply and shall set the *Supply State*(4.6.5.18) to Armed.

754 In executing the Command where the state of the Supply is only Disabled as a result of:

- 755 i. a Disable Supply Command;
- 756 ii. an attempt at Unauthorised Physical Access through its Secure Perimeter and the
757 *Supply Tamper State*(4.6.4.26); or
- 758 iii. GSME power supply and the *Supply Depletion State*(4.6.4.25),

759 GSME shall Arm the Supply and shall set the *Supply State*(4.6.5.18) to Armed; otherwise
760 GSME shall not Arm the Supply.

761 **4.5.3.8 Clear Event Log**

762 A Command to clear all entries from the *Event Log*(4.6.5.9). GSME shall be capable of
763 logging that the Command has been executed in the *Security Log*(4.6.5.17).

764 **4.5.3.9 Disable Privacy PIN Protection**

765 A Command to disable Privacy PIN Protection.

766 **4.5.3.10 Disable Supply**

767 A Command to establish a Locked state whereby the Supply is Disabled and can only be
768 Armed in response to a Command to Arm the Supply (as described in *Section 4.5.3.7*).

769 In executing the Command GSME shall be capable of setting the *Supply State*(4.6.5.18) to
770 Disabled.

771 **4.5.3.11 Issue GSME Security Credentials**

772 A Command to generate a Public-Private Key Pair and issue a corresponding Certificate
773 Signing Request.

774 **4.5.3.12 Read Configuration Data**

775 A Command to read the value of one or more of the configuration data items set out in
776 *Section 4.6.4*.

777 In executing the Command, GSME shall be capable of sending such value(s) in a Response
778 via its HAN Interface.

779 **4.5.3.13 Read Constant Data**

780 A Command to read the value of one or more of the constant data items set out in *Section*
781 *4.6.1*.

782 In executing the Command, GSME shall be capable of sending such value(s) in a Response
783 via its HAN Interface.

784 **4.5.3.14 Read Operational Data**

785 A Command to read the value of one or more of the operational data items set out in *Section*
786 *4.6.5*.

787 In executing the Command, GSME shall be capable of sending such value(s) in a Response
788 via its HAN Interface.

789 **4.5.3.15 Receive Firmware**

790 A Command to receive Firmware.

791 In executing the Command GSME shall be capable of:

- 792 i. only accepting new Firmware from an Authorised and Authenticated source; and
- 793 ii. verifying the Authenticity and integrity of new Firmware before installation.

794 **4.5.3.16 Record Network Data**

795 A Command to initiate the recording of UTC date and time-stamped Consumption data for
796 each six minute interval over a period of four hours in the *Network Data Log*(4.6.5.12).

797 **4.5.3.17 Remove Device Security Credentials**

798 A Command to remove Security Credentials for a PPMID or a Gas Proxy Function from the
799 *Device Log*(4.6.4.11).

800 In executing the Command GSME shall be capable of recording the Command and
801 Outcome to the *Security Log*(4.6.5.17).

802 **4.5.3.18 Replace GSME Security Credentials**

803 A Command to replace *GSME Security Credentials*(4.6.4.15).

804 In executing the Command GSME shall be capable of:

- 805 i. maintaining the Command's Transactional Atomicity; and
- 806 ii. recording the Command and Outcome to the *Security Log*(4.6.5.17).

807 **4.5.3.19 Reset Meter Balance**

808 A Command to reset the *Meter Balance*(4.6.5.11) to zero.

809 In executing the Command, GSME shall reset the *Accumulated Debt Register*(4.6.5.1), the
810 Emergency Credit activated and used, and the *Emergency Credit Balance*(4.6.5.8).

811 **4.5.3.20 Set Clock**

812 A Command to set the Clock date and time via its HAN Interface.

813 In executing the Command, GSME shall be capable of comparing the date and time
814 specified in the Command with the Communications Hub Date and Time. Where the
815 difference is:

- 816 i. within the tolerance specified in the Command GSME shall be capable of adjusting
817 its date and time to the Communications Hub Date and Time and generating an
818 entry to that effect in the *Event Log*(4.6.5.9); and
- 819 ii. outside the tolerance specified in the Command GSME shall be capable of not
820 adjusting its date and time and:
 - 821 a) generating an entry to that effect in the Event Log(4.6.5.9); and
 - 822 b) generating and sending an Alert to that effect via its HAN Interface.

823 GSME shall be capable of ensuring that any adjustments do not cause calendar-based
824 events to be missed or future-dated Commands to be missed or repeated.

825 **4.5.3.21 Set Payment Mode**

826 A Command to set the payment mode as either Prepayment Mode or Credit Mode and to
827 record the mode of operation in *Payment Mode*(4.6.4.21).

828 In executing the Command, GSME shall be capable of taking a UTC date and time stamped
829 copy of:

- 830 i. the *Tariff TOU Register Matrix*(4.6.5.20);
- 831 ii. the *Tariff Block Counter Matrix*(4.6.5.19); and
- 832 iii. the *Consumption Register*(4.6.5.4),

833 and unless in Credit Mode both before and after execution of the Command:

- 834 iv. the *Meter Balance*(4.6.5.11);
- 835 v. the *Emergency Credit Balance*(4.6.5.8);
- 836 vi. the *Payment Debt Register*(4.6.5.13);
- 837 vii. the *Time Debt Registers [1 ... 2]*(4.6.5.21); and
- 838 viii. the *Accumulated Debt Register*(4.6.5.1),

839 in the *Billing Data Log*(4.6.5.3).

840 **4.5.3.22 Set Tariff**

841 A Command to accept new values for *Tariff TOU Price Matrix*(4.6.4.32), *Tariff Block Price*
842 *Matrix*(4.6.4.29), *Tariff Switching Table*(4.6.4.30) and *Tariff Threshold Matrix*(4.6.4.31).

843 In executing the Command, GSME shall be capable of taking a UTC date and time stamped
844 copy of:

- 845 i. the *Tariff TOU Register Matrix*(4.6.5.20);
- 846 ii. the *Tariff Block Counter Matrix*(4.6.5.19); and
- 847 iii. the *Consumption Register*(4.6.5.4),

848 and where in Prepayment mode:

- 849 iv. the *Meter Balance*(4.6.5.11);
- 850 v. the *Emergency Credit Balance*(4.6.5.8);
- 851 vi. the *Payment Debt Register*(4.6.5.13);
- 852 vii. the *Time Debt Registers [1 ... 2]*(4.6.5.21); and
- 853 viii. the *Accumulated Debt Register*(4.6.5.1),

854 in the *Billing Data Log*(4.6.5.3).

855 **4.5.3.23 Write Configuration Data**

856 A Command to record one or more new values of the configuration data items set out in
857 *Section 4.6.4*.

858 In executing the Command, GSME shall be capable of generating an entry to that effect in
859 the *Event Log*(4.6.5.9).

860 **4.6 Data requirements**

861 This Section describes the minimum information which GSME shall be capable of holding in
862 its Data Store.

863 **4.6.1 Constant data**

864 Describes data that remains constant and unchangeable at all times.

865 **4.6.1.1 GSME Identifier**

866 A globally unique identifier used to identify GSME based on the EUI-64 Institute of Electrical
867 and Electronic Engineers standard.

868 **4.6.1.2 Manufacturer Identifier**

869 An identifier used to identify the manufacturer of GSME.

870 **4.6.1.3 Model Type**

871 An identifier used to identify the model of GSME.

872 **4.6.2 This Section is not used**873 **4.6.3 Locally Set Configuration Data**

874 Describes data that is configured by execution of a User Interface Command and that is not
875 accessible via any GSME interface.

876 **4.6.3.1 Privacy PIN**

877 A number comprising four digits used by the Consumer to enable temporary access to a
878 specified set of display items and Commands via the User Interface of GSME.

879 **4.6.4 Configuration data**

880 Describes data that configures the operation of various functions of GSME.

881 **4.6.4.1 Alerts Configuration Settings**

882 Settings to control whether to generate and send an Alert.

883 **4.6.4.2 Billing Calendar**

884 A calendar defining billing dates for the storage of billing related information in the *Billing Data Log*(4.6.5.3).

886 **4.6.4.3 Calorific Value**

887 The value used in the conversion of gas volume to kWh usage, based on the energy stored
888 in one cubic metre of gas released when burnt at a standard temperature and pressure.

889 **4.6.4.4 Contact Details**

890 The name and contact telephone number of the current gas Supplier.

891 **4.6.4.5 Conversion Factor**

892 The value used in the conversion of gas volume to kWh usage, based on the temperature,
893 pressure and compressibility of the gas.

894 **4.6.4.6 Currency Units**

895 The Currency Units currently used by GSME, which shall be either GB Pounds or European
896 Central Bank Euro.

897 **4.6.4.7 Customer Identification Number**

898 A number issued to GSME for display on the User Interface.

899 **4.6.4.8 Debt Recovery per Payment**

900 The percentage of a payment to be recovered against debt when GSME is operating
901 Payment-based Debt Recovery in Prepayment Mode.

902 **4.6.4.9 Debt Recovery Rates [1 ... 2]**

903 Two debt recovery rates in Currency Units per unit time for when GSME is using Time-based
904 Debt Recovery in Prepayment Mode.

905 **4.6.4.10 Debt Recovery Rate Cap**

906 The maximum amount in Currency Units per unit time that can be recovered through
907 Payment-based Debt Recovery when GSME is operating in Prepayment Mode.

908 **4.6.4.11 Device Log**

909 The Security Credentials and Device identifier for each of the Gas Proxy Function and
910 PPMID with which GSME can establish Communications Links.

911 **4.6.4.12 Disablement Threshold**

912 The threshold in Currency Units for controlling when to Disable the Supply.

913 **4.6.4.13 Emergency Credit Limit**

914 The amount of Emergency Credit in Currency Units to be made available to a Consumer
915 where Emergency Credit is activated by the Consumer.

916 **4.6.4.14 Emergency Credit Threshold**

917 The threshold in Currency Units below which *Emergency Credit Balance*(4.6.5.8) may be
918 activated by the Consumer if so configured when GSME is operating in Prepayment Mode.

919 **4.6.4.15 GSME Security Credentials**

920 The Security Credentials for GSME and parties Authorised to establish Communications
921 Links with it.

922 **4.6.4.16 Low Credit Threshold**

923 The threshold in Currency Units below which a low credit Alert is signalled.

924 **4.6.4.17 Maximum Credit Threshold**

925 The maximum credit which can be applied by any Add Credit Command.

926 **4.6.4.18 Maximum Meter Balance Threshold**

927 The *Meter Balance*(4.6.5.11) threshold in Currency Units above which an Add Credit
928 Command is rejected.

929 **4.6.4.19 Meter Point Reference Number (MPRN)**

930 The reference number identifying a gas metering point.

931 **4.6.4.20 Non-Disablement Calendar**

932 A Switching Table comprising a set of rules specifying periods during which the Supply will
933 not be Disabled due to the combined credit of the *Meter Balance*(4.6.5.11) and *Emergency*
934 *Credit Balance*(4.6.5.8) falling below the *Disablement Threshold*(4.6.4.12) when GSME is
935 operating in Prepayment Mode.

936 The rules stored within the table shall specify which of five Day Profiles should be used to
937 specify Non-Disablement Periods for each day according to:

- 938 i. where the day is one of 20 Special Days, the Day Profile specified for that day; or
939 ii. where the day is not a Special Day, the Day Profile specified by the active Season
940 Profile and Week Profile.

941 A Day Profile shall contain up to one contiguous time period during which the Supply may be
942 Disabled due to the combined credit of the *Meter Balance*(4.6.5.11) and *Emergency Credit*
943 *Balance*(4.6.5.8) falling below the *Disablement Threshold*(4.6.4.12) when GSME is operating
944 in Prepayment Mode.

945 The Switching Table shall support three Season Profiles and two Week Profiles. Each Week
946 Profile shall support two Day Profiles.

947 All dates and times shall be specified as UTC.

948 **4.6.4.21 Payment Mode**

949 The current mode of operation, being Prepayment Mode or Credit Mode.

950 **4.6.4.22 Public Key Security Credentials Store**

951 A store for Security Credentials relating to Public Keys.

952 **4.6.4.23 Standing Charge**

953 A charge to be levied in Currency Units per unit time when operating in Credit Mode and
954 Prepayment Mode.

955 **4.6.4.24 Supplier Message**

956 A message issued to, and held on, GSME for provision to the Consumer.

957 **4.6.4.25 Supply Depletion State**958 A setting to control the state of the Supply in the case of loss of power to GSME, being
959 Locked or unchanged.960 **4.6.4.26 Supply Tamper State**961 A setting to control the state of the Supply in the case of Unauthorised Physical Access
962 being detected, being Locked or unchanged.963 **4.6.4.27 Suspend Debt Disabled**964 A setting controlling whether debt should be collected when GSME is operating in
965 Prepayment Mode and Supply is Disabled.966 **4.6.4.28 Suspend Debt Emergency**967 A setting controlling whether standing charges and debt should be deducted from the
968 *Emergency Credit Balance*(4.6.5.8) when GSME is operating in Prepayment Mode and
969 Emergency Credit is in use.970 **4.6.4.29 Tariff Block Price Matrix**

971 A 4 x 1 matrix containing Prices for Block Pricing.

972 **4.6.4.30 Tariff Switching Table**973 A set of rules for allocating daily Consumption to a Tariff Register for Time-of-use Pricing
974 and Time-of-use with Block Pricing. The rules stored within the table shall specify which of
975 four Day Profiles should be used to allocate Consumption to a Tariff Register according to:

- 976 i. where the day is one of 20 Special Days, the Day Profile specified for that day; or
- 977 ii. where the day is not a Special Day, the Day Profile specified by the active Season
- 978 Profile and Week Profile.

979 The Switching Table shall support three Season Profiles and two Week Profiles.

980 All dates shall be specified as UTC.

981 **4.6.4.31 Tariff Threshold Matrix**

982 A 3 x 1 matrix capable of holding thresholds in kWh for controlling Block Tariffs.

983 **4.6.4.32 Tariff TOU Price Matrix**

984 A 1 x 4 matrix containing Prices for Time-of-use Pricing.

985 **4.6.4.33 Uncontrolled Gas Flow Rate**986 The flow rate in units of volume per unit time used in the detection of uncontrolled flow of gas
987 on Enablement of Supply.988 **4.6.4.34 Events Configuration Settings**989 Settings to control, for each Alert described in this *Section 4* and for each event which this
990 *Section 4* requires the GSME to be capable of logging in the event log which is not a Critical
991 Event, whether an Alarm is sounded and whether an event log entry is created.992 **4.6.5 Operational data**

993 Describes data used by the functions of GSME for output of information.

994 **4.6.5.1 Accumulated Debt Register**

995 The debt resulting from the collection of *Standing Charge*(4.6.4.23) and / or time-based debt
996 when Emergency Credit is in Use as configured by *Suspend Debt Emergency*(4.6.4.28),
997 when operating in Prepayment Mode.

998 **4.6.5.2 Active Tariff Price**

999 The Price currently active.

1000 **4.6.5.3 Billing Data Log**

1001 A log capable of storing the following UTC date and time stamped entries:

1002 i. twelve entries comprising *Tariff TOU Register Matrix*(4.6.5.20), the *Consumption*
1003 *Register*(4.6.5.4) and *Tariff Block Counter Matrix*(4.6.5.19);

1004 and where in Prepayment mode:

1005 ii. five entries comprising the value of prepayment credits;
1006 iii. ten entries comprising the value of payment-based debt payments; and
1007 iv. twelve entries comprising *Meter Balance*(4.6.5.11), *Emergency Credit*
1008 *Balance*(4.6.5.8), *Accumulated Debt Register*(4.6.5.1), *Payment Debt*
1009 *Register*(4.6.5.13) and *Time Debt Registers [1 ... 2]*(4.6.5.21),

1010 each of (i) to (iv) arranged as a circular buffer such that when full, further writes shall cause
1011 the oldest entry to be overwritten.

1012 **4.6.5.4 Consumption Register**

1013 The register recording cumulative Consumption.

1014 **4.6.5.5 Cumulative and Historical Value Store**

1015 A store capable of holding the following values:

1016 i. eight Days of Energy Consumption comprising the prior eight Days, in kWh and
1017 Currency Units;
1018 ii. six Weeks of Energy Consumption comprising the current Week and the prior five
1019 Weeks, in kWh and Currency Units; and
1020 iii. fourteen months of Energy Consumption comprising the current month and the prior
1021 thirteen months, in kWh and Currency Units.

1022 **4.6.5.6 Cumulative Current Day Value Store**

1023 A store capable of holding the value of Energy Consumption on the current Day, in kWh and
1024 Currency Units.

1025 **4.6.5.7 Daily Read Log**

1026 A log capable of storing thirty one UTC date and time stamped entries of the *Tariff TOU*
1027 *Register Matrix*(4.6.5.20), the *Tariff Block Counter Matrix*(4.6.5.19) and the *Consumption*
1028 *Register*(4.6.5.4) arranged as a circular buffer such that when full, further writes shall cause
1029 the oldest entry to be overwritten.

1030 **4.6.5.8 Emergency Credit Balance**

1031 The amount of Emergency Credit available to the Consumer after it has been activated by
1032 the Consumer.

1033 **4.6.5.9 Event Log**

1034 A log capable of storing one hundred UTC date and time stamped entries of non-security
1035 related information for diagnosis and auditing, arranged as a circular buffer such that when
1036 full, further writes shall cause the oldest entry to be overwritten.

1037 **4.6.5.10 Firmware Version**

1038 The active version of Firmware of GSME.

1039 **4.6.5.11 Meter Balance**

1040 The amount of money in Currency Units as determined by GSME. If operating in
1041 Prepayment Mode, the Meter Balance represents GSME's determination of the amount of
1042 credit available to the Consumer (excluding any *Emergency Credit Balance*(4.6.5.8)). If
1043 operating in Credit Mode, it represents GSME's determination of the amount of money due
1044 from the Consumer since the Meter Balance was last reset.

1045 **4.6.5.12 Network Data Log**

1046 A log capable of storing four hours of UTC date and time stamped six minute Consumption
1047 data arranged as a circular buffer such that when full, further writes shall cause the oldest
1048 entry to be overwritten.

1049 **4.6.5.13 Payment Debt Register**

1050 A Debt Register recording Debt to be recovered as a percentage of payment when using
1051 Payment-based Debt Recovery in Prepayment Mode.

1052 **4.6.5.14 Prepayment Daily Read Log**

1053 A log capable of storing thirty one UTC date and time stamped entries of *Meter*
1054 *Balance*(4.6.5.11), *Emergency Credit Balance*(4.6.5.8), *Accumulated Debt Register*(4.6.5.1),
1055 *Payment Debt Register*(4.6.5.13) and *Time Debt Registers [1 ... 2]*(4.6.5.21) arranged as a
1056 circular buffer such that when full, further writes shall cause the oldest entry to be
1057 overwritten.

1058 **4.6.5.15 Profile Data Log**

1059 A log capable of storing a minimum of three months of UTC date and time stamped half
1060 hourly Consumption data arranged as a circular buffer such that when full, further writes
1061 shall cause the oldest entry to be overwritten.

1062 **4.6.5.16 Remaining Battery Capacity**

1063 Where GSME includes a Battery, the remaining Battery capacity in days.

1064 **4.6.5.17 Security Log**

1065 A log capable of storing one hundred UTC date and time stamped entries of security related
1066 information for diagnosis and auditing arranged as a circular buffer such that when full,
1067 further writes shall cause the oldest entry to be overwritten.

1068 **4.6.5.18 Supply State**

1069 The state of the Supply, being Enabled, Disabled or Armed.

1070 **4.6.5.19 Tariff Block Counter Matrix**

1071 A 4 x 1 matrix for storing Block Counters for Block Pricing.

1072 **4.6.5.20 Tariff TOU Register Matrix**

1073 A 1 x 4 matrix for storing Tariff Registers for Time-of-use Pricing.

1074 **4.6.5.21 Time Debt Registers [1 ... 2]**

1075 Two Debt Registers recording independent debts to be recovered over time when operating
1076 Time-based Debt Recovery in Prepayment Mode.

1077 5 Electricity Smart Metering Equipment 1078 Technical Specifications

1079 5.1 Introduction

1080 *Section 5* of this document describes the minimum physical, minimum functional, minimum
1081 interface, minimum data and minimum testing and certification requirements of Electricity
1082 Smart Metering Equipment that an electricity Supplier is required to install and maintain to
1083 comply with standard condition 39 of its electricity supply licence.

1084 Part A of this *Section 5* applies to Single Element Electricity Metering Equipment.

1085 Part B of this *Section 5* applies to Twin Element Electricity Metering Equipment.

1086 Part C of this *Section 5* applies to Polyphase Electricity Metering Equipment.

1087 Where an Auxiliary Load Control Switch is installed within ESME, an electricity Supplier must
1088 comply, in addition, with the minimum functional, interface and data requirements described
1089 in Part D of this *Section 5*.

1090 Where the Boost Function is installed within ESME, an electricity Supplier must comply, in
1091 addition, with the minimum functional and data requirements described in Part E of this
1092 *Section 5*.

1093 **Part A - Single Element Electricity Metering** 1094 **Equipment**

1095 **5.2 Overview**

1096 In this Part A ESME shall mean Single Element Electricity Metering Equipment.

1097 **5.3 SMETS Testing and Certification Requirements**

1098 **5.3.1 Conformance with the SMETS**

1099 ESME shall have been tested to ensure that it meets the requirements described in this
1100 *Section 5 Part A*, and evidence must be available to confirm such testing and conformance.

1101 **5.3.2 Conformance with the Great Britain Companion Specification**

1102 ESME shall meet the requirements described in the Great Britain Companion Specification.

1103 ESME shall have been certified:

- 1104 i. by the ZigBee Alliance as being compliant with those ZigBee SEP requirements that
1105 are identified as being required in the Great Britain Companion Specification and
1106 that were certifiable under the ZigBee SEP certification scheme on 31 August 2017;
1107 and
- 1108 ii. by the DLMS User Association as being compliant with those DLMS COSEM
1109 requirements that are identified as being required described in the Great Britain
1110 Companion Specification and that were certifiable under the DLMS COSEM
1111 certification scheme on 31 August 2017.

1112 **5.3.3 Conformance with the Commercial Product Assurance** 1113 **Security Characteristics for GB Smart Metering**

1114 ESME shall meet the requirements described in the Commercial Product Assurance Security
1115 Characteristic Electricity Smart Metering Equipment.

1116 ESME shall be certified by NCSC as compliant with the Commercial Product Assurance
1117 Security Characteristic Electricity Smart Metering Equipment.

1118 **5.4 Physical Requirements**

1119 ESME shall as a minimum include the following components:

- 1120 i. a Clock;
- 1121 ii. a Data Store;
- 1122 iii. an Electricity Meter containing one measuring element;
- 1123 iv. a HAN Interface;
- 1124 v. a Load Switch;
- 1125 vi. a Random Number Generator;
- 1126 vii. a User Interface; and
- 1127 viii. where installed with a Communications Hub provided by the Data and
1128 Communications Company, a Communications Hub Physical Interface (this may
1129 comprise a Communications Hub Physical Interface forming part of GSME where
1130 present at the time of installation in the Premises).

1131 The Communications Hub Physical Interface shall as a minimum include a physical interface
1132 that meets the requirements defined by the Data and Communications Company at the time

1133 of installation (pursuant to section H12 of the Smart Energy Code) and includes provision for
1134 a DC power supply to the Communications Hub.

1135 ESME shall be mains powered and be capable of performing the minimum functional,
1136 interface and data requirements set out in *Sections 5.5, 5.6 and 5.7* respectively operating at
1137 a nominal voltage of 230VAC without consuming more than an average of 4 watts of
1138 electricity under normal operating conditions.

1139 ESME shall be capable of automatically resuming operation after a power failure in its
1140 operating state prior to such failure.

1141 ESME shall:

- 1142 ix. permanently display the *ESME Identifier(5.7.1.1)* on the ESME; and
- 1143 x. have a Secure Perimeter.

1144 The HAN Interface of ESME shall be capable of joining a ZigBee SEP Smart Metering Home
1145 Area Network which:

- 1146 xi. operates within the 2400 – 2483.5 MHz harmonised frequency band; and
- 1147 xii. supports the Communications Links described in *Sections 5.6.1, 5.6.3 and 5.6.4*.

1148 On joining a ZigBee SEP Smart Metering Home Area Network ESME shall be capable of
1149 generating and sending an Alert to that effect via its HAN Interface.

1150 ESME shall be designed taking all reasonable steps so as to prevent Unauthorised Physical
1151 Access and Unauthorised communications through its Secure Perimeter that could
1152 compromise the Confidentiality and / or Data Integrity of:

- 1153 xiii. Personal Data;
- 1154 xiv. Consumption data used for billing;
- 1155 xv. Security Credentials;
- 1156 xvi. Random Number Generator;
- 1157 xvii. Cryptographic Algorithms;
- 1158 xviii. the Electricity Meter; and
- 1159 xix. Firmware and data essential for ensuring its integrity,

1160 stored or executing on ESME.

1161 ESME shall be capable of detecting any attempt at Unauthorised Physical Access through
1162 its Secure Perimeter that could compromise such Confidentiality and / or Data Integrity and
1163 on such detection shall be capable of:

- 1164 xx. providing evidence of such an attempt through the use of tamper evident coatings or
1165 seals,

1166 and where reasonably practicable:

- 1167 xxi. generating an entry to that effect in the *Security Log(5.7.5.31)*;
- 1168 xxii. generating and sending an Alert to that effect via its HAN Interface; and
- 1169 xxiii. where the *Supply Tamper State(5.7.4.44)* is configured to require Locking, sending
1170 an Alert that the Supply is being disabled for this reason via its HAN Interface, and
1171 establishing a Locked state whereby the Supply is Disabled and can only be
1172 Enabled or Armed in response to a Command to Arm the Supply (as described in
1173 *Section 5.6.3.7*) or Enable the Supply (as described in *Section 5.6.3.12*).

1174 5.5 Functional Requirements

1175 This Section describes the minimum functions that ESME shall be capable of performing.

1176 5.5.1 Clock

1177 The Clock forming part of ESME shall be capable of operating so as to be accurate to within
1178 10 seconds of the UTC date and time under normal operating conditions.

1179 ESME shall be capable of comparing its date and time with the Communications Hub Date
1180 and Time, and making adjustments to its date and time. Where the difference between
1181 ESME date and time and the Communications Hub Date and Time is more than 10 seconds
1182 ESME shall be capable of:

- 1183 i. not adjusting its date and time;
- 1184 ii. generating an entry in the *Security Log(5.7.5.31)* to that effect; and
- 1185 iii. generating and sending an Alert via its HAN Interface.

1186 Except when executing a *Set Clock(5.6.3.32)* Command, ESME shall not be capable of
1187 making adjustments to its date and time more than once within any 24 hour time period.

1188 5.5.2 Communications

1189 ESME, and any device forming part of it, shall be capable of ensuring that the security
1190 characteristics of all Communications Links it establishes meet the requirements described
1191 in *Section 5.5.10.5*.

1192 With the exception of a Communications Hub Function ESME shall only be capable of
1193 establishing a Communications Link with a Device with Security Credentials in the *Device*
1194 *Log(5.7.4.14)* and shall not be capable of establishing a Communications Link via its HAN
1195 Interface with any other Devices.

1196 When any Command addressed to ESME is received via any Communications Link ESME
1197 shall be capable of:

- 1198 i. using the Security Credentials ESME holds, Authenticating to a Trusted Source the
1199 Command;
- 1200 ii. verifying in accordance with *Section 5.5.10.2.3* that the sender of the Command is
1201 Authorised to execute the Command; and
- 1202 iii. verifying the integrity of the Command.

1203 On failure of any of (i) to (iii) above, ESME shall be capable of generating an entry in the
1204 *Security Log(5.7.5.31)* to that effect, discarding the Command without execution and without
1205 either generating or sending a Response, and generating and sending an Alert to that effect
1206 via its HAN Interface.

1207 When executing an immediate Command ESME shall be capable of generating and sending
1208 a Response via its HAN Interface which shall either confirm successful execution of the
1209 Command or shall detail why it has failed to execute the Command.

1210 Where the Command is not due to be executed immediately, ESME shall be capable of
1211 generating and sending a Response via its HAN Interface to confirm successful receipt.
1212 When executing a future dated Command ESME shall be capable of generating and sending
1213 an Alert via its HAN Interface which shall either confirm successful execution of the
1214 Command or shall detail why it has failed to execute the Command.

1215 ESME shall only be capable of addressing a Response to the sender of the relevant
1216 Command.

1217 ESME shall be capable of restricting the generation and sending of Alerts for each Alert
1218 described in this *Section 5* and for each event, which this *Section 5* requires the ESME to be
1219 capable of logging in the event log and which is not a Critical Event according to the *Alerts*
1220 *Configuration Settings(5.7.4.1)*.

1221 For each Alert described in this *Section 5* and for each event which this *Section 5* requires
 1222 the ESME to be capable of logging in the *Event Log(5.7.5.16)* or *Power Event Log(5.7.5.25)*
 1223 and which is not a Critical Event, the ESME shall be capable of logging the event in that
 1224 event log according to the *Events Configuration Settings(5.7.4.51)*.

1225 Additionally, if the ESME has the capability to sound an Alarm, the ESME shall be capable of
 1226 sounding such Alarms according to the *Events Configuration Settings(5.7.4.51)*.

1227 **5.5.2.1 Communications Links with a Communications Hub Function via its HAN** 1228 **Interface**

1229 ESME shall be capable of establishing and maintaining Communications Links via its HAN
 1230 Interface with one Communications Hub Function.

1231 ESME shall be capable of receiving the Communications Hub Date and Time from a
 1232 Communications Hub Function.

1233 **5.5.2.2 Communications Links with Type 1 Devices via its HAN Interface**

1234 ESME shall be capable of establishing and maintaining Communications Links via its HAN
 1235 Interface with a minimum of six Type 1 Devices (including a minimum of one PPMID).

1236 ESME shall be capable of supporting up to five Auxiliary Load Control Switches or HAN
 1237 Connected Auxiliary Load Control Switches.

1238 ESME shall be capable of supporting the following types of Communications Links:

- 1239 i. receiving the Commands (set out in *Section 7.5.5* and *Section 8.5.2*) that may be
 1240 sent from each Type 1 Device;
- 1241 ii. sending the Responses (set out in *Section 5.6.3*) to a Type 1 Device;
- 1242 iii. sending the Commands (set out in *Section 5.6.4*) to a Type 1 Device and acting on
 1243 the corresponding Responses from a Type 1 Device;
- 1244 iv. sending the information (set out in *Section 5.6.1*) to a Type 1 Device; and
- 1245 v. sending Alerts to a Type 1 Device.

1246 **5.5.2.3 Communications Links with Type 2 Devices via its HAN Interface**

1247 ESME shall be capable of establishing and maintaining Communications Links via its HAN
 1248 Interface with a minimum of four Type 2 Devices.

1249 ESME shall be capable of supporting the following types of Communications Links:

- 1250 i. sending the information (set out in *Section 5.6.1*) to a Type 2 Device; and
- 1251 ii. sending Alerts to a Type 2 Device.

1252 **5.5.3 Data storage**

1253 ESME shall be capable of retaining all information held in its Data Store at all times,
 1254 including on loss of power.

1255 **5.5.4 Display of information**

1256 ESME shall be capable of displaying the following up to date information on its User
 1257 Interface:

- 1258 i. the *Payment Mode [INFO](5.7.4.31)* currently in operation, being Prepayment Mode
 1259 or Credit Mode [PIN];
- 1260 ii. the *Tariff TOU Register Matrix [INFO](5.7.5.34)* with appropriate precision, the *Tariff*
 1261 *TOU Block Register Matrix(5.7.5.35)* with appropriate precision and the *Tariff Block*
 1262 *Counter Matrix [INFO](5.7.5.33)* with appropriate precision;
- 1263 iii. the *Active Import Register [INFO](5.7.5.3)* with appropriate precision;
- 1264 iv. the *Active Export Register [INFO](5.7.5.2)* with appropriate precision;

- 1265 v. the *Meter Balance* [INFO](5.7.5.22) [PIN];
- 1266 vi. the Debt to Clear (calculated as set out in *Section 5.5.7.2*) [PIN];
- 1267 vii. the *Customer Identification Number* [INFO](5.7.4.10) [PIN];
- 1268 viii. whether Emergency Credit is available for activation [PIN];
- 1269 ix. whether ESME has suspended the Disablement of Supply during a period defined in
- 1270 the *Non-Disablement Calendar* [INFO](5.7.4.30) (as set out in *Section 5.5.7.2*) [PIN];
- 1271 x. the *Emergency Credit Balance* [INFO](5.7.5.15) where Emergency Credit is
- 1272 activated [PIN];
- 1273 xi. any low credit condition [PIN];
- 1274 xii. the *Supply State* [INFO](5.7.5.32);
- 1275 xiii. any time-based debts and Time-based Debt Recovery rates [PIN];
- 1276 xiv. any payment-based debt [PIN];
- 1277 xv. any accumulated debt recorded in the *Accumulated Debt Register* [INFO](5.7.5.1)
- 1278 [PIN];
- 1279 xvi. any *Standing Charge* [INFO](5.7.4.42) [PIN];
- 1280 xvii. the *Meter Point Administration Numbers (MPAN)* [INFO](5.7.4.28) [PIN];
- 1281 xviii. the Local Time;
- 1282 xix. the *Contact Details* [INFO](5.7.4.8);
- 1283 xx. the *Active Tariff Price* [INFO](5.7.5.5) [PIN]; and
- 1284 xxi. the *Event Log*(5.7.5.16) and the *Power Event Log*(5.7.5.25) (with the exception of
- 1285 any Personal Data).

1286 ESME shall be capable of displaying the *Security Log*(5.7.5.31) on its User Interface

1287 following physical access through the Secure Perimeter of ESME.

1288

1289 ESME shall be capable of displaying Currency Units in GB Pounds and European Central

1290 Bank Euro.

1291 **5.5.4.1 Presentation of information on the User Interface**

1292 For each of the values currently stored in the *Active Import Register* [INFO](5.7.5.3), the *Active*

1293 *Export Register* [INFO](5.7.5.2), the *Tariff ToU Register Matrix* [INFO](5.7.5.34), and the *Tariff*

1294 *ToU Block Register Matrix*(5.7.5.35), ESME shall be capable of displaying a value calculated

1295 from the stored value by:

- 1296 i. converting the stored value in to a decimal, integer number of kilowatt hours,
- 1297 rounding the stored value down to the nearest kilowatt hour;
- 1298 ii. discarding all except the five least significant decimal digits so produced; and
- 1299 iii. adding leading zeros (if necessary) so that there are exactly five decimal digits.

1300 **5.5.5 Privacy PIN Protection**

1301 ESME shall be capable of preventing the display on the User Interface of items annotated

1302 [PIN] in *Section 5.5.4*, and preventing access on the User Interface to the Commands

1303 annotated [PIN] in *Section 5.6.2*, except on successful execution of an *Allow Access to User*

1304 *Interface*(5.6.2.3) Command via the User Interface.

1305 **5.5.6 Load limiting**

1306 ESME shall be capable of determining when the *Active Power Import* [INFO](5.7.5.4) is

1307 above, for the *Load Limit Period*(5.7.4.19), the *Load Limit Power Threshold*(5.7.4.20) and on

1308 such an occurrence ESME shall be capable of:

- 1309 i. generating an entry to that effect in the *Event Log*(5.7.5.16);
- 1310 ii. generating and sending an Alert to that effect via its HAN Interface and its User
- 1311 Interface;
- 1312 iii. counting the number of such occurrences in the *Load Limit Counter*(5.7.5.18); and

- 1313 iv. Disabling the Supply in circumstances where the *Load Limit Supply State*(5.7.4.22)
1314 is configured to require Disablement, and then:
- 1315 a) immediately Arming the Supply such that it can be Enabled as set out in
1316 *Section 5.6.2.5*;
- 1317 b) prior to the *Load Limit Restoration Period*(5.7.4.21) elapsing,
- 1318 ▪ disabling the Supply if ESME is in Prepayment Mode, and either:
 - 1319 ○ it is not in a Non-Disablement Period and combined *Meter Balance*
1320 *[INFO]*(5.7.5.22) and *Emergency Credit Balance [INFO]*(5.7.5.15) falls
1321 below the *Disablement Threshold [INFO]*(5.7.4.15); or
 - 1322 ○ a Non-Disablement Period ends and the combined *Meter Balance*
1323 *[INFO]*(5.7.5.22) and *Emergency Credit Balance [INFO]*(5.7.5.15) is
1324 below the *Disablement Threshold [INFO]*(5.7.4.15).
 - 1325 ▪ then placing the Supply in such a state whereby Supply will be Armed
1326 where the combined *Meter Balance [INFO]*(5.7.5.22) and *Emergency*
1327 *Credit Balance [INFO]*(5.7.5.15) rises above the *Disablement Threshold*
1328 *[INFO]*(5.7.4.15).
- 1329 c) after the *Load Limit Restoration Period*(5.7.4.21) has elapsed, unless ESME is
1330 in Prepayment Mode, not in a Non-Disablement Period and the combined
1331 *Meter Balance [INFO]*(5.7.5.22) and *Emergency Credit Balance*
1332 *[INFO]*(5.7.5.15) is below the *Disablement Threshold [INFO]*(5.7.4.15), then:
- 1333 ▪ enabling the Supply, and setting the *Load Limit Supply State*(5.7.4.22) to
1334 unchanged; and
 - 1335 ▪ displaying any such change in the Supply State *[INFO]*(5.7.5.32) on its
1336 User Interface and generating and sending an Alert indicating the change
1337 in state via its HAN Interface.

1338 5.5.7 Payment Mode

1339 ESME shall be capable of operating in Credit Mode and Prepayment Mode and of being
1340 remotely switched from one mode to the other.

1341 5.5.7.1 Credit Mode

1342 ESME, when operating in Credit Mode, shall be capable of maintaining a calculation of the
1343 *Meter Balance [INFO]*(5.7.5.22) based on:

- 1344 i. the Consumption in the *Tariff TOU Register Matrix [INFO]*(5.7.5.34) and the Prices
1345 in the *Tariff TOU Price Matrix [INFO]*(5.7.4.50) and, if operating Time-of-use with
1346 Block Pricing, the Consumption in the *Tariff TOU Block Register Matrix*(5.7.5.35)
1347 and the Prices in the *Tariff Block Price Matrix [INFO]*(5.7.4.47); and
- 1348 ii. the *Standing Charge [INFO]*(5.7.4.42).

1349 5.5.7.2 Prepayment Mode

1350 ESME shall be capable of operating in Prepayment Mode, including during periods of loss of
1351 its Communications Link via its HAN Interface, and maintaining a balance of credit and
1352 reflecting any reduction in credit based on Consumption, standing charge and Time-based
1353 Debt Recovery.

1354 ESME shall be capable of adding credit to the *Meter Balance [INFO]*(5.7.5.22) (as set out in
1355 *Sections 5.6.2.2 and 5.6.3.3*) and reducing the amount of credit in the *Meter Balance*
1356 *[INFO]*(5.7.5.22).

1357 ESME shall be capable of making Emergency Credit available to the Consumer (by means
1358 of the *Emergency Credit Balance [INFO]*(5.7.5.15) if the *Meter Balance [INFO]*(5.7.5.22) is

1359 below the *Emergency Credit Threshold [INFO](5.7.4.17)*). ESME shall be capable of
 1360 displaying the availability of Emergency Credit on its User Interface and of generating and
 1361 sending an Alert indicating the availability of Emergency Credit via its HAN Interface. The
 1362 amount of Emergency Credit made available to the Consumer shall be equal to the
 1363 *Emergency Credit Limit [INFO](5.7.4.16)*. ESME shall be capable of reducing the amount of
 1364 credit in the *Emergency Credit Balance [INFO](5.7.5.15)* where Emergency Credit is
 1365 activated by the Consumer (as set out in *Sections 5.6.2.1* and *5.6.3.1*) and the *Meter*
 1366 *Balance [INFO](5.7.5.22)* is exhausted. Any Emergency Credit used shall be repaid when
 1367 credit is added to ESME (as set out in *Sections 5.6.2.2* and *5.6.3.3*).

1368 ESME shall be capable of reducing the *Meter Balance [INFO](5.7.5.22)* until it reaches the
 1369 *Disablement Threshold [INFO](5.7.4.15)* followed by reducing the *Emergency Credit Balance*
 1370 *[INFO](5.7.5.15)*, where activated, until exhausted, on the basis of:

- 1371 i. the Consumption in the *Tariff TOU Register Matrix [INFO](5.7.5.34)* and the Prices
 1372 in the *Tariff TOU Price Matrix [INFO](5.7.4.50)*, and if operating Time-of-use with
 1373 Block Pricing the Consumption in the *Tariff TOU Block Register Matrix(5.7.5.35)* and
 1374 the Prices in the *Tariff Block Price Matrix [INFO](5.7.4.47)*;
- 1375 ii. the *Standing Charge [INFO](5.7.4.42)*; and
- 1376 iii. the recovery of debt hourly or daily through each of the *Time Debt Registers [1 ... 2]*
 1377 *[INFO](5.7.5.36)* at rates defined by the *Debt Recovery Rates [1 ... 2]*
 1378 *[INFO](5.7.4.12)*.

1379 Where configured by *Suspend Debt Emergency(5.7.4.46)* to do so and when Emergency
 1380 Credit is in use, ESME shall be capable of suspending the application of (ii) and (iii) to the
 1381 *Emergency Credit Balance [INFO](5.7.5.15)*, and of accumulating (ii) and (iii) in the
 1382 *Accumulated Debt Register [INFO](5.7.5.1)*.

1383 ESME shall be capable of recording debt recovered, or accumulated in the *Accumulated*
 1384 *Debt Register [INFO](5.7.5.1)*, in the *Billing Data Log(5.7.5.10)*.

1385 ESME shall be capable of monitoring the *Meter Balance [INFO](5.7.5.22)* and where
 1386 activated the *Emergency Credit Balance [INFO](5.7.5.15)* and:

- 1387 iv. if the combined credit of the *Meter Balance [INFO](5.7.5.22)* and *Emergency Credit*
 1388 *Balance [INFO](5.7.5.15)* falls below the *Low Credit Threshold [INFO](5.7.4.23)*,
 1389 displaying an Alert to that effect on its User Interface and generating and sending an
 1390 Alert to that effect via its HAN Interface;
- 1391 v. if the combined credit of the *Meter Balance [INFO](5.7.5.22)* and *Emergency Credit*
 1392 *Balance [INFO](5.7.5.15)* falls below the *Disablement Threshold [INFO](5.7.4.15)*,
 1393 Disabling the Supply, displaying an Alert to that effect on its User Interface and
 1394 generating and sending an Alert to that effect via its HAN Interface;
- 1395 vi. where the Supply is Disabled (as set out in (v) above):
 - 1396 a) where configured by *Suspend Debt Disabled(5.7.4.45)* not to suspend Time-
 1397 based Debt Recovery, continuing to apply (ii) and (iii) above to reduce the
 1398 *Meter Balance [INFO](5.7.5.22)*;
 - 1399 b) where configured by *Suspend Debt Disabled(5.7.4.45)* to suspend Time-based
 1400 Debt Recovery, suspending the application of (iii) above to the *Meter Balance*
 1401 *[INFO](5.7.5.22)*, and continuing to apply (ii) to reduce the *Meter Balance*
 1402 *[INFO](5.7.5.22)*; and
- 1403 vii. if the Supply is Enabled, suspending the Disablement of Supply (as set out in (v)
 1404 above) during periods defined in the *Non-Disablement Calendar [INFO](5.7.4.30)*,
 1405 continuing to reduce the *Meter Balance [INFO](5.7.5.22)* on the basis of (i), (ii) and
 1406 (iii) above, displaying on its User Interface an indication that the combined *Meter*
 1407 *Balance [INFO](5.7.5.22)* and *Emergency Credit Balance [INFO](5.7.5.15)* is below

1408 the *Disablement Threshold [INFO](5.7.4.15)* and that Disablement of Supply due to
 1409 insufficient credit has been suspended, and generating and sending an Alert that
 1410 Disablement of Supply due to insufficient credit has been suspended via its HAN
 1411 Interface.

1412 If the *Meter Balance [INFO](5.7.5.22)* is equal to or below the *Disablement Threshold*
 1413 *[INFO](5.7.4.15)* ESME shall be capable of maintaining a calculation of the Debt to Clear
 1414 based on:

- 1415 viii. the difference between the *Meter Balance [INFO](5.7.5.22)* and the *Disablement*
 1416 *Threshold [INFO](5.7.4.15)*;
- 1417 ix. amount of debt accumulated in the *Accumulated Debt Register [INFO](5.7.5.1)*;
- 1418 x. amount of Emergency Credit activated and used by the Consumer; and
- 1419 xi. the payment-based debt to be collected based on (viii), (ix) and (x) (as defined by
 1420 *Debt Recovery per Payment [INFO](5.7.4.11)* taking account of the amount
 1421 remaining in the *Payment Debt Register [INFO](5.7.5.23)*, the payment-based debt
 1422 payments in the *Billing Data Log(5.7.5.10)* and the *Debt Recovery Rate Cap*
 1423 *[INFO](5.7.4.13)*).

1424 For Time-based Debt Recovery, the ESME shall be capable of recovering the lesser of:

- 1425 xii. the amount in the relevant *Time Debt Registers [1 ... 2] [INFO](5.7.5.36)*; and
- 1426 xiii. the corresponding amount determined by the *Debt Recovery Rates [1 ... 2]*
 1427 *[INFO](5.7.4.12)*.

1428 For Payment-based Debt Recovery, the ESME shall be capable of recovering the lesser of:

- 1429 xiv. the amount defined by *Debt Recovery per Payment [INFO](5.7.4.11)* subject to the
 1430 *Debt Recovery Rate Cap [INFO](5.7.4.13)*; and
- 1431 xv. the amount in the *Payment Debt Register [INFO](5.7.5.23)*.

1432 Where an Adjust Debt Command is to reduce the amount in a Debt Register and the amount
 1433 in the Command is greater than the amount in the Debt Register, ESME shall be capable of
 1434 setting the amount in the Debt Register to zero then applying the difference in the amounts
 1435 in the following order:

- 1436 xvi. recovering debt accumulated in the *Accumulated Debt Register [INFO](5.7.5.1)*;
- 1437 xvii. repaying Emergency Credit activated and used by the Consumer; and
- 1438 xviii. increasing the *Meter Balance [INFO](5.7.5.22)*.

1439 ESME shall be capable of monitoring the *Meter Balance [INFO](5.7.5.22)* and, where the
 1440 Supply is Disabled, ESME shall be capable of Arming the Supply if the *Meter Balance*
 1441 *[INFO](5.7.5.22)* rises above the *Disablement Threshold [INFO](5.7.4.15)*, displaying any
 1442 such change in the *Supply State [INFO](5.7.5.32)* on its User Interface and generating and
 1443 sending an Alert that the Supply has been Armed via its HAN Interface.

1444 5.5.8 Pricing

1445 ESME shall be capable of applying Time-of-use Pricing and Time-of-use with Block Pricing.

1446 When switching between Time-of-use Bands and Tariff Registers as set out in this Section
 1447 ESME shall be capable of applying the *Randomised Offset(5.7.5.28)*.

1448 ESME shall be capable of maintaining the *Active Tariff Price [INFO](5.7.5.5)*.

1449 5.5.8.1 Time-of-use Pricing

1450 ESME shall be capable of recording Consumption according to Time-of-use Bands in one of
 1451 forty-eight Tariff Registers in the *Tariff TOU Register Matrix [INFO](5.7.5.34)*.

1452 ESME shall be capable of switching between different Tariff Registers once every 30
 1453 minutes. The switching between Time-of-use Bands and thus Tariff Registers shall be
 1454 based on the switching rules defined in the *Tariff Switching Table*(5.7.4.48).

1455 **5.5.8.2 Time-of-use with Block Pricing**

1456 ESME shall be capable of recording Consumption in one of four Block Registers for each of
 1457 eight Time-of-use Bands in the *Tariff TOU Block Register Matrix*(5.7.5.35).

1458 The switching between Time-of-use Bands and sets of Block Registers shall be based on
 1459 the switching rules set out in the *Tariff Switching Table*(5.7.4.48). ESME shall be capable of
 1460 switching between Time-of-use Bands once every 30 minutes.

1461 Switching between the Block Registers within each Time-of-use Band shall be based on
 1462 Consumption accumulated in the *Tariff Block Counter Matrix [INFO]*(5.7.5.33) and
 1463 Consumption thresholds in the *Tariff Threshold Matrix [INFO]*(5.7.4.49).

1464 ESME shall also be capable of accumulating Consumption in one of four Block Counters in
 1465 the *Tariff Block Counter Matrix [INFO]*(5.7.5.33) for each of the eight Time-of-use Bands.
 1466 ESME shall be capable of switching between Block Counters according to the Consumption
 1467 thresholds in the *Tariff Threshold Matrix [INFO]*(5.7.4.49).

1468 ESME shall be capable of resetting the counters in the *Tariff Block Counter Matrix*
 1469 *[INFO]*(5.7.5.33) once per Day and in accordance with the timetable set out in the *Billing*
 1470 *Calendar*(5.7.4.7).

1471 **5.5.9 Recording**

1472 **5.5.9.1 Active Energy Imported**

1473 ESME shall be capable of recording cumulative Active Energy Imported in the *Active Import*
 1474 *Register [INFO]*(5.7.5.3).

1475 **5.5.9.2 Active Energy Exported**

1476 ESME shall be capable of recording cumulative Active Energy Exported in the *Active Export*
 1477 *Register [INFO]*(5.7.5.2).

1478 **5.5.9.3 Billing data**

1479 In accordance with the timetable set out in the *Billing Calendar*(5.7.4.7) ESME shall be
 1480 capable of taking a UTC date and time stamped copy of:

- 1481 i. the *Tariff TOU Register Matrix [INFO]*(5.7.5.34);
- 1482 ii. the *Tariff TOU Block Register Matrix*(5.7.5.35); and
- 1483 iii. the *Active Import Register [INFO]*(5.7.5.3),

1484 and where in Prepayment mode:

- 1485 iv. the *Meter Balance [INFO]*(5.7.5.22);
- 1486 v. the *Emergency Credit Balance [INFO]*(5.7.5.15);
- 1487 vi. the *Payment Debt Register [INFO]*(5.7.5.23);
- 1488 vii. the *Time Debt Registers [1 ... 2] [INFO]*(5.7.5.36); and
- 1489 viii. the *Accumulated Debt Register [INFO]*(5.7.5.1),

1490 in the *Billing Data Log*(5.7.5.10), and:

- 1491 ix. generating and sending an Alert via its HAN Interface containing the most recent
 1492 entries in the *Billing Data Log*(5.7.5.10) of (i) to (iii) above; and
- 1493 x. if operating in Credit Mode, immediately resetting the *Meter Balance*
 1494 *[INFO]*(5.7.5.22).

1495 **5.5.9.4 Consumption data**

1496 ESME shall be capable of recording to:

- 1497 i. the *Cumulative and Historical Value Store [INFO](5.7.5.12)* in kWh:
- 1498 a) Consumption on the Day up to the Local Time;
- 1499 b) Consumption on each of the eight Days prior to such Day;
- 1500 c) Consumption in the Week in which the calculation is performed;
- 1501 d) Consumption in each of the five Weeks prior to such Week;
- 1502 e) Consumption in the month in which the calculation is performed; and
- 1503 f) Consumption in the thirteen months prior to such month.
- 1504 ii. the *Daily Consumption Log [INFO](5.7.5.14)* in kWh, the Consumption on each of
- 1505 the 731 Days prior to the current Day.

1506 **5.5.9.5 Cost of Consumption data**1507 ESME shall be capable of calculating and recording in the *Cumulative and Historical Value*
1508 *Store [INFO](5.7.5.12)* the cost of:

- 1509 i. Consumption on the Day up to the Local Time;
- 1510 ii. Consumption on each of the eight Days prior to such Day;
- 1511 iii. Consumption in the Week in which the calculation is performed;
- 1512 iv. Consumption in each of the five Weeks prior to such Week;
- 1513 v. Consumption in the month in which the calculation is performed; and
- 1514 vi. Consumption in the thirteen months prior to such month.

1515 ESME shall be capable of calculating cost of Consumption as above on the basis of:

- 1516 vii. the Consumption in the *Tariff TOU Register Matrix [INFO](5.7.5.34)* and the Prices
- 1517 in the *Tariff TOU Price Matrix [INFO](5.7.4.50)* and, if operating Time-of-use with
- 1518 Block Pricing, the Consumption in the *Tariff TOU Block Register Matrix(5.7.5.35)*
- 1519 and the Prices in the *Tariff Block Price Matrix [INFO](5.7.4.47)*; and
- 1520 viii. the *Standing Charge [INFO](5.7.4.42)*.

1521 **5.5.9.6 Cost of Instantaneous consumption**1522 ESME shall be capable of calculating and recording the *Cost of Instantaneous Active Power*
1523 *Import(5.7.5.11)* on the basis of:

- 1524 i. the *Active Power Import [INFO](5.7.5.4)*; and
- 1525 ii. the *Active Tariff Price [INFO](5.7.5.5)*.

1526 **5.5.9.7 Daily read data**1527 ESME shall be capable of taking a copy of and storing the *Tariff TOU Register Matrix*
1528 *[INFO](5.7.5.34)*, the *Tariff TOU Block Register Matrix(5.7.5.35)*, the *Active Import*
1529 *Register(5.7.5.3)* and the *Active Export Register [INFO](5.7.5.2)* together with a UTC date
1530 and time stamp in the *Daily Read Log(5.7.5.13)* every day at midnight UTC.1531 If operating in Prepayment Mode ESME shall be capable of recording the *Meter Balance*
1532 *[INFO](5.7.5.22)*, *Emergency Credit Balance [INFO](5.7.5.15)*, *Accumulated Debt Register*
1533 *[INFO](5.7.5.1)*, *Payment Debt Register [INFO](5.7.5.23)* and *Time Debt Registers [1 ... 2]*
1534 *[INFO](5.7.5.36)* in the *Prepayment Daily Read Log(5.7.5.26)* every day at midnight UTC.1535 **5.5.9.8 Daily Consumption data**1536 ESME shall be capable of calculating and storing Consumption for the previous Day together
1537 with a UTC date stamp in the *Daily Consumption Log [INFO](5.7.5.14)* every Day at midnight
1538 UTC.

1539 **5.5.9.9 Half hour profile data**

1540 ESME shall be capable of recording in each 30 minute period (commencing at the start of
 1541 minutes 00 and 30 in each hour), the following information (including the UTC date and time
 1542 at the end of the 30 minute period to which the data relates) in the *Profile Data Log*
 1543 *[INFO](5.7.5.27)*:

- 1544 i. Consumption;
- 1545 ii. Active Energy Exported;
- 1546 iii. Reactive Energy Imported; and
- 1547 iv. Reactive Energy Exported.

1548 **5.5.9.10 Maximum Demand Import data**

1549 ESME shall be capable of calculating the average value of *Active Power Import*
 1550 *[INFO](5.7.5.4)* over each 30 minute period (commencing at the start of minutes 00 and 30 in
 1551 each hour) and recording:

- 1552 i. to the *Maximum Demand Active Power Import Value(5.7.5.19)*, the maximum value
 1553 so calculated since the *Maximum Demand Active Power Import Value(5.7.5.19)* was
 1554 last reset (as set out in *Section 5.6.3.26*) including the UTC date and time at the end
 1555 of the 30 minute period to which the data relates; and
- 1556 ii. to the *Maximum Demand (Configurable Time) Active Power Import Value(5.7.5.20)*,
 1557 the maximum value so calculated in any 30 minute period (commencing at the start
 1558 of minutes 00 and 30 in each hour) within the time period specified in *Maximum*
 1559 *Demand Configurable Time Period(5.7.4.26)* (including the UTC date and time at the
 1560 end of the 30 minute period to which the data relates) since the *Maximum Demand*
 1561 *(Configurable Time) Active Power Import Value(5.7.5.20)* was last reset (as set out
 1562 in *Section 5.6.3.28*).

1563 **5.5.9.11 Maximum Demand Export data**

1564 ESME shall be capable of calculating the average value of Active Power Export over each
 1565 30 minute period (commencing at the start of minutes 00 and 30 in each hour) and recording
 1566 to the *Maximum Demand Active Power Export Value(5.7.5.21)* the maximum value so
 1567 calculated since the *Maximum Demand Active Power Export Value(5.7.5.21)* was last reset
 1568 (as set out in *Section 5.6.3.27*) including the UTC date and time at the end of the 30 minute
 1569 period to which the data relates.

1570 **5.5.9.12 Power Threshold Status**

1571 ESME shall be capable of comparing the *Active Power Import [INFO](5.7.5.4)* against
 1572 thresholds and:

- 1573 i. if the *Active Power Import [INFO](5.7.5.4)* is equal to or lower than the *Low Medium*
 1574 *Power Threshold [INFO](5.7.4.24)*, setting *Power Threshold Status(5.7.5.24)* to low;
- 1575 ii. if the *Active Power Import [INFO](5.7.5.4)* is higher than the *Low Medium Power*
 1576 *Threshold [INFO](5.7.4.24)* and equal to or lower than the *Medium High Power*
 1577 *Threshold [INFO](5.7.4.29)*, setting *Power Threshold Status(5.7.5.24)* to medium;
 1578 and
- 1579 iii. otherwise, setting the *Power Threshold Status(5.7.5.24)* to high.

1580 **5.5.9.13 Reactive Energy Imported**

1581 ESME shall be capable of recording cumulative Reactive Energy Imported in the *Reactive*
 1582 *Import Register(5.7.5.30)*.

1583 **5.5.9.14 Reactive Energy Exported**

1584 ESME shall be capable of recording cumulative Reactive Energy Exported in the *Reactive*
1585 *Export Register*(5.7.5.29).

1586 **5.5.10 Security**

1587 **5.5.10.1 General**

1588 ESME shall be designed taking all reasonable steps so as to ensure that any failure or
1589 compromise of its integrity shall not compromise the Security Credentials or Personal Data
1590 stored on it or compromise the integrity of any other Device to which it is connected by
1591 means of a Communications Link.

1592 ESME shall be capable of securely disabling Critical Commands other than those
1593 Commands set out in *Section 5.6* that are Critical Commands.

1594 ESME shall be capable of verifying its Firmware at power-on and prior to activation of the
1595 Firmware, to verify that the Firmware, at that time, is in the form originally received. On
1596 failure of verification ESME shall be capable of:

- 1597 i. generating an entry to that effect in the *Security Log*(5.7.5.31); and
1598 ii. generating and sending an Alert to that effect via its HAN Interface.

1599 Where ESME comprises more than one Device, each Device other than the Electricity Meter
1600 shall be capable of verifying its Firmware at power-on and prior to activation of the Firmware,
1601 to verify that the Firmware, at that time, is in the form originally received. On failure of
1602 verification ESME shall be capable of:

- 1603 iii. generating an entry to that effect in the *Security Log*(5.7.5.31); and
1604 iv. generating and sending an Alert to that effect via its HAN Interface.

1605 ESME shall be capable of logging in the *Security Log*(5.7.5.31) the occurrence and type of
1606 any Sensitive Event.

1607 **5.5.10.2 Security Credentials**

1608 **5.5.10.2.1 Meter Private Keys**

1609 ESME shall be capable of generating Public-Private Key Pairs to support the Cryptographic
1610 Algorithms set out in *Section 5.5.10.3*.

1611 ESME shall be capable of securely storing such Private Keys and shall be capable of
1612 formatting and sending via its HAN Interface a Certificate Signing Request containing the
1613 corresponding Public Key and the *ESME Identifier*(5.7.1.1).

1614 ESME shall be capable of securely storing Key Agreement values.

1615 **5.5.10.2.2 Public Key Certificates**

1616 ESME shall be capable of securely storing Security Credentials from Certificates including
1617 for use in the Cryptographic Algorithms as set out in *Section 5.5.10.3*.

1618 During the replacement of any *ESME Security Credentials*(5.7.4.18) (as set out in *Section*
1619 *5.6.3.20*), ESME shall be capable of ensuring that the *ESME Security Credentials*(5.7.4.18)
1620 being replaced remain usable until the successful completion of the replacement.

1621 **5.5.10.2.3 Role-based Access Control (RBAC)**

1622 ESME shall be capable of restricting Authorisation to execute Commands and of issuing
1623 Alerts according to Role permissions.

1624 **5.5.10.3 Cryptographic Algorithms**

1625 ESME shall be capable of supporting the following Cryptographic Algorithms:

- 1626 i. Elliptic Curve DSA;
- 1627 ii. Elliptic Curve DH; and
- 1628 iii. SHA-256.

1629 In executing and creating any Command, Response or Alert, ESME shall be capable of
1630 applying Cryptographic Algorithms (alone or in combination) for:

- 1631 iv. Digital Signing;
- 1632 v. Digital Signature verification;
- 1633 vi. Hashing;
- 1634 vii. Message Authentication; and
- 1635 viii. Encryption and Decryption.

1636 **5.5.10.4 Firmware**

1637 ESME shall only be capable of activating Firmware on receipt of an Activate Firmware
1638 Command (as set out in *Section 5.6.3.2*).

1639 **5.5.10.5 Communications**

1640 ESME shall be capable of preventing and detecting, on all of its interfaces, Unauthorised
1641 access that could compromise the Confidentiality and / or Data Integrity of:

- 1642 i. Personal Data whilst being transferred via an interface;
- 1643 ii. Consumption data used for billing whilst being transferred via an interface;
- 1644 iii. Security Credentials whilst being transferred via an interface; and
- 1645 iv. Firmware and data essential for ensuring its integrity whilst being transferred via an
1646 interface,

1647 and any Command that could compromise the Confidentiality and / or Data Integrity of:

- 1648 v. Personal Data;
- 1649 vi. Consumption data used for billing;
- 1650 vii. Security Credentials; and
- 1651 viii. Firmware and data essential for ensuring its integrity,

1652 stored or executing on ESME, and on such detection shall be capable of:

- 1653 ix. generating an entry to that effect in the *Security Log(5.7.5.31)*; and
- 1654 x. generating and sending an Alert to that effect via its HAN Interface.

1655 ESME shall be capable of employing techniques to protect against Replay Attacks relating to
1656 Commands received.

1657 ESME shall not be capable of executing a Command to modify or delete entries from the
1658 *Security Log(5.7.5.31)*.

1659 **5.5.11 Controlling Auxiliary Loads**

1660 ESME shall be capable of supporting up to a maximum combined total of five Auxiliary Load
1661 Control Switches and HAN Connected Auxiliary Load Control Switches.

1662 **5.5.11.1 Calendar-based switching of HAN Connected Auxiliary Loads**

1663 ESME shall be capable of monitoring the *Auxiliary Load Control Switch Calendar(5.7.4.2)*
1664 and at times defined in the calendar:

- 1665 i. where a *Set HAN Connected Auxiliary Load Control Switch [n] State*(5.6.3.33)
 1666 Command has been issued and the time period has not elapsed, taking no further
 1667 action;
 1668 ii. where the *Supply State [INFO]*(5.7.5.32) is Disabled or Armed, taking no further
 1669 action; and
 1670 iii. where the *Supply State [INFO]*(5.7.5.32) is Enabled, applying the *Randomised*
 1671 *Offset*(5.7.5.28) and then issuing a *Control HAN Connected Auxiliary Load Control*
 1672 *Switch*(5.6.4.1) Command containing the time period remaining until the next
 1673 switching event defined in the calendar for HCALCS [n] (taking account of the
 1674 *Randomised Offset*(5.7.5.28)).

1675 On receipt of a *Request Control of HAN Connected Auxiliary Load Control Switch*(5.6.3.21)
 1676 Command and on receipt of a *Reset HAN Connected Auxiliary Load Control Switch [n]*
 1677 *State*(5.6.3.24) Command ESME shall be capable of:

- 1678 iv. where the *Supply State [INFO]*(5.7.5.32) is Disabled or Armed, taking no further
 1679 action; and
 1680 v. where the *Supply State [INFO]*(5.7.5.32) is Enabled, issuing a *Control HAN*
 1681 *Connected Auxiliary Load Control Switch*(5.6.4.1) Command to set the commanded
 1682 state of HCALCS [n] according to the rules defined in the *Auxiliary Load Control*
 1683 *Switch Calendar*(5.7.4.2) containing the time period remaining until the next
 1684 switching event defined in the calendar for HCALCS [n] (taking account of the
 1685 *Randomised Offset*(5.7.5.28)).

1686 When controlling an HCALCS as set out in this *Section 5.5.11*, ESME shall be capable of
 1687 applying the *Randomised Offset*(5.7.5.28).

1688 **5.5.12 Voltage Quality Measurements**

1689 **5.5.12.1 Average RMS voltage**

1690 ESME shall be capable of calculating the average value of RMS voltage over a configurable
 1691 period as defined in the *Average RMS Voltage Measurement Period*(5.7.4.6) and:

- 1692 i. recording the value calculated (including the UTC date and time at the end of the
 1693 period to which the value relates) in the *Average RMS Voltage Profile Data*
 1694 *Log*(5.7.5.9);
 1695 ii. detecting when the value calculated is above the *Average RMS Over Voltage*
 1696 *Threshold*(5.7.4.4), and on detection:
 1697 a) counting the number of such occurrences in the *Average RMS Over Voltage*
 1698 *Counter*(5.7.5.7);
 1699 b) where the value calculated in the prior configurable period was below the
 1700 *Average RMS Over Voltage Threshold*(5.7.4.4):
 1701 ▪ generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 1702 ▪ generating and sending an Alert to that effect via its HAN Interface.
 1703 iii. detecting when the value calculated is below the *Average RMS Over Voltage*
 1704 *Threshold*(5.7.4.4), and where the value calculated in the prior configurable period
 1705 was above the *Average RMS Over Voltage Threshold*(5.7.4.4):
 1706 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 1707 b) generating and sending an Alert to that effect via its HAN Interface.
 1708 iv. detecting when the value calculated is below the *Average RMS Under Voltage*
 1709 *Threshold*(5.7.4.5), and on detection:

- 1710 a) counting the number of such occurrences in the *Average RMS Under Voltage*
 1711 *Counter*(5.7.5.8);
 1712 b) where the value calculated in the prior configurable period was above the
 1713 *Average RMS Under Voltage Threshold*(5.7.4.5):
- 1714 ▪ generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 - 1715 ▪ generating and sending an Alert to that effect via its HAN Interface.
- 1716 v. detecting when the value is above the *Average RMS Under Voltage*
 1717 *Threshold*(5.7.4.5), and where the value calculated in the prior configurable period
 1718 was below the *Average RMS Under Voltage Threshold*(5.7.4.5):
- 1719 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 - 1720 b) generating and sending an Alert to that effect via its HAN Interface.

1721 **5.5.12.2 RMS extreme over voltage detection**

1722 ESME shall be capable of:

- 1723 i. detecting when the RMS voltage rises above the *RMS Extreme Over Voltage*
 1724 *Threshold*(5.7.4.35) for a continuous period longer than the *RMS Extreme Over*
 1725 *Voltage Measurement Period*(5.7.4.34) and on detection:
 - 1726 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 - 1727 b) generating and sending an Alert to that effect via its HAN Interface; and
- 1728 ii. detecting when the RMS voltage returns below the *RMS Extreme Over Voltage*
 1729 *Threshold*(5.7.4.35) for a continuous period longer than the *RMS Extreme Over*
 1730 *Voltage Measurement Period*(5.7.4.34) and on detection:
 - 1731 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 - 1732 b) generating and sending an Alert to that effect via its HAN Interface.

1733 **5.5.12.3 RMS extreme under voltage detection**

1734 ESME shall be capable of:

- 1735 i. detecting when the RMS voltage falls below the *RMS Extreme Under Voltage*
 1736 *Threshold*(5.7.4.37) for a continuous period longer than the *RMS Extreme Under*
 1737 *Voltage Measurement Period*(5.7.4.36) and on detection:
 - 1738 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25);
 - 1739 b) generating and sending an Alert to that effect via its HAN Interface;
- 1740 ii. detecting when the RMS voltage rises back above the *RMS Extreme Under Voltage*
 1741 *Threshold*(5.7.4.37) for a continuous period longer than the *RMS Extreme Under*
 1742 *Voltage Measurement Period*(5.7.4.36) and on detection:
 - 1743 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25);
 - 1744 b) generating and sending an Alert to that effect via its HAN Interface;

1745 **5.5.12.4 RMS voltage sag detection**

1746 ESME shall be capable of:

- 1747 i. detecting when the RMS voltage falls below the *RMS Voltage Sag*
 1748 *Threshold*(5.7.4.40) for a continuous period longer than the *RMS Voltage Sag*
 1749 *Measurement Period*(5.7.4.38) and on detection:
 - 1750 a) generating an entry to that effect in the *Power Event Log*(5.7.5.25); and
 - 1751 b) generating and sending an Alert to that effect via its HAN Interface;

- 1752 ii. detecting when the RMS voltage returns above the *RMS Voltage Sag*
 1753 *Threshold(5.7.4.40)* for longer than the *RMS Voltage Sag Measurement*
 1754 *Period(5.7.4.38)* and on detection:
- 1755 a) generating an entry to that effect in the Power Event Log(5.7.5.25); and
 1756 b) generating and sending an Alert to that effect via its HAN Interface.

1757 **5.5.12.5 RMS voltage swell detection**

1758 ESME shall be capable of:

- 1759 i. detecting when the RMS voltage rises above the *RMS Voltage Swell*
 1760 *Threshold(5.7.4.41)* for a continuous period longer than the *RMS Voltage Swell*
 1761 *Measurement Period(5.7.4.39)* and on detection:
- 1762 a) generating an entry to that effect in the Power Event Log(5.7.5.25); and
 1763 b) generating and sending an Alert to that effect via its HAN Interface;
- 1764 ii. detecting when the RMS voltage returns below the *RMS Voltage Swell*
 1765 *Threshold(5.7.4.41)* for a continuous period longer than the *RMS Voltage Swell*
 1766 *Measurement Period(5.7.4.39)* and on detection:
- 1767 a) generating an entry to that effect in the Power Event Log(5.7.5.25); and
 1768 b) generating and sending an Alert to that effect via its HAN Interface.

1769 **5.5.12.6 Supply outage reporting**

1770 ESME shall be capable of recording the UTC date and time at which the Supply is
 1771 interrupted and the UTC date and time when the Supply is restored and:

- 1772 i. generating entries to that effect in the *Power Event Log(5.7.5.25)*;
 1773 ii. following restoration of the Supply, generating and sending an Alert to that effect via
 1774 its HAN Interface containing details of the UTC dates and times of interruption and
 1775 restoration; and
 1776 iii. following restoration of the Supply, when the time difference between the Supply
 1777 being interrupted and restored is greater than or equal to three minutes, generating
 1778 and sending an Alert to that effect via its HAN Interface containing details of the
 1779 UTC dates and times of interruption and restoration.

1780 **5.5.13 ESME Operational Integrity**

1781 ESME shall be capable of taking all reasonable steps to detect conditions affecting its Smart
 1782 Meter Operational Integrity and on such detection shall be capable of generating an entry to
 1783 that effect in the *Event Log(5.7.5.16)* and generating and sending an Alert to that effect via
 1784 its HAN Interface where reasonably practicable, including in the Alert information relating to
 1785 the nature of the condition detected.

1786 **5.6 Interface Requirements**

1787 This Section describes the minimum required interactions which ESME shall be capable of
 1788 undertaking via its HAN Interface and its User Interface (including with Devices as set out in
 1789 *Sections 5.5.2.2 and 5.5.2.3*).

1790 **5.6.1 Type 1 Devices and Type 2 Device information provision**

1791 ESME shall be capable, immediately upon establishment of a Communications Link with
 1792 Type 1 Devices (as set out in *Section 5.5.2.2*) and Type 2 Devices (as set out in *Section*
 1793 *5.5.2.3*), of providing the data annotated [INFO] set out in *Sections 5.7.1, 5.7.4 and 5.7.5* to
 1794 Type 1 Devices and Type 2 Devices (with timely updates of any changes to all data).

1795 5.6.2 User Interface Commands

1796 ESME shall be capable of executing immediately the Commands set out in this *Section 5.6.2*
1797 following their receipt via its User Interface.

1798 ESME shall be capable of logging all such Commands received and Outcomes in the *Event*
1799 *Log(5.7.5.16)*.

1800 5.6.2.1 Activate Emergency Credit [PIN]

1801 A Command to activate Emergency Credit when ESME is operating in Prepayment Mode
1802 where Emergency Credit is available (as set out in *Section 5.5.7.2*).

1803 In executing the Command, if the Supply is Disabled, ESME shall be capable of Arming the
1804 Supply if the combined credit of the *Meter Balance [INFO](5.7.5.22)* and *Emergency Credit*
1805 *Balance [INFO](5.7.5.15)* rises above the *Disablement Threshold [INFO](5.7.4.15)*,
1806 displaying any such change in the *Supply State [INFO](5.7.5.32)* on its User Interface and
1807 generating and sending an Alert that the Supply has been Armed via its HAN Interface.

1808 5.6.2.2 Add Credit

1809 A Command to accept credit to be applied to ESME when ESME is operating in Prepayment
1810 Mode on input of a UTRN. In executing the Command, ESME shall be capable of:

- 1811 i. comparing the credit value of the UTRN with the *Maximum Credit*
1812 *Threshold(5.7.4.25)* and rejecting the UTRN where the credit value is greater than
1813 that threshold;
- 1814 ii. comparing the projected new *Meter Balance [INFO](5.7.5.22)* (calculated on the
1815 basis of (xii) to (xv) below and the credit value of the UTRN and rejecting the UTRN
1816 where the projected new *Meter Balance [INFO](5.7.5.22)* is greater than the
1817 *Maximum Meter Balance Threshold(5.7.4.27)*;
- 1818 iii. verifying the Authenticity of the UTRN;
- 1819 iv. verifying that ESME is the intended recipient of the UTRN;
- 1820 v. using the UTRN to generate a UTRN Counter, and comparing this against the last
1821 100 verified UTRN Counters and rejecting duplicate presentation of verified UTRNs;
1822 and
- 1823 vi. controlling the number of invalid UTRN entries entered and processed.

1824 ESME shall be capable of generating an entry in the *Security Log(5.7.5.31)*:

- 1825 vii. where the UTRN is rejected as set out in (i) above;
- 1826 viii. where the UTRN is rejected as set out in (ii) above;
- 1827 ix. on failure of (iii) above;
- 1828 x. on failure of (iv) above; and
- 1829 xi. where duplicates are rejected as set out in (v) above.

1830 In executing the Command, ESME shall be capable of applying the credit added in the
1831 following order:

- 1832 xii. recovery of payment-based debt of an amount defined by *Debt Recovery per*
1833 *Payment [INFO](5.7.4.11)* from the *Payment Debt Register [INFO](5.7.5.23)* subject
1834 to the *Debt Recovery Rate Cap [INFO](5.7.4.13)*;
- 1835 xiii. recovery of debt accumulated in the *Accumulated Debt Register [INFO](5.7.5.1)*;
- 1836 xiv. repayment of Emergency Credit activated and used by the Consumer; and
- 1837 xv. adding remaining credit (the credit after deduction of (xii), (xiii) and (xiv) above) to
1838 the *Meter Balance [INFO] (5.7.5.22)*.

1839 In executing the Command, ESME shall be capable of Arming the Supply if the *Meter*
1840 *Balance [INFO](5.7.5.22)* rises above the *Disablement Threshold [INFO](5.7.4.15)* and

1841 displaying any such change in the *Supply State [INFO](5.7.5.32)* on its User Interface and
 1842 generating and sending an Alert that the Supply has been Armed via its HAN Interface.

1843 In executing the Command, ESME shall be capable of:

- 1844 xvi. recording the credit applied to the *Meter Balance [INFO](5.7.5.22)* and the amount of
 1845 payment-based debt recovered (as set out in (xii)) in the *Billing Data Log(5.7.5.10)*;
 1846 and
- 1847 xvii. generating and sending an Alert containing the UTC date and time of the last update
 1848 of the *Meter Balance [INFO](5.7.5.22)* via its HAN Interface.

1849 **5.6.2.3 Allow Access to User Interface**

1850 Where Privacy PIN Protection is enabled, a Command to enable temporary access to the
 1851 restricted display items annotated [PIN] in *Section 5.5.4* and the restricted User Interface
 1852 Commands annotated [PIN] in *Section 5.6.2* on input of a number that matches the *Privacy*
 1853 *PIN(5.7.3.1)*.

1854 **5.6.2.4 Disable Privacy PIN Protection [PIN]**

1855 A Command to disable Privacy PIN Protection.

1856 **5.6.2.5 Enable Supply [PIN]**

1857 A Command to Enable the Supply if the Supply is Armed.

1858 In executing the Command ESME shall be capable of setting the *Supply State*
 1859 *[INFO](5.7.5.32)* accordingly.

1860 **5.6.2.6 Find Smart Metering Home Area Network and Re-establish** 1861 **Communications Links**

1862 A Command to seek the frequency at which a ZigBee SEP Smart Metering Home Area
 1863 Network is operating and then:

- 1864 i. re-establish the Communications Links set out in *Sections 5.5.2.1, 5.5.2.2* and
 1865 *5.5.2.3*;
- 1866 ii. generate an entry to that effect in the *Event Log(5.7.5.16)*; and
- 1867 iii. generate and sending an Alert to that effect via its HAN Interface.

1868 Where the ESME has Communications Links set out in *5.6.2.6(j)* ESME shall be capable of
 1869 not executing the Command.

1870 **5.6.2.7 Set Privacy PIN [PIN]**

1871 A Command to set a new value of the *Privacy PIN(5.7.3.1)*.

1872 In executing the Command where Privacy PIN Protection is disabled ESME shall be capable
 1873 of enabling Privacy PIN Protection.

1874 **5.6.3 HAN Interface Commands**

1875 ESME shall be capable of executing the Commands set out in this Section. ESME shall be
 1876 capable of logging all Commands received and Outcomes in the *Event Log(5.7.5.16)*.

1877 ESME shall be capable of executing Commands immediately on receipt ('immediate
 1878 Commands') and where specified in the Great Britain Companion Specification at a future
 1879 date ('future dated Commands'). A future dated Command shall include the UTC date and
 1880 time at which the Command shall be executed by ESME.

1881 ESME shall be capable of cancelling a future dated Command. A future dated Command
 1882 shall be capable of being cancelled by an Authorised party, subject to RBAC (as set out in

- 1883 Section 5.5.10.2.3). ESME shall be capable of generating and sending a Response
1884 acknowledging that a future dated Command has been successfully cancelled.
- 1885 **5.6.3.1 Activate Emergency Credit**
- 1886 A Command to activate Emergency Credit when ESME is operating in Prepayment Mode
1887 where Emergency Credit is available (as set out in Section 5.5.7.2).
- 1888 In executing the Command where the Supply is Disabled ESME shall be capable of Arming
1889 the Supply if the combined credit of the *Meter Balance [INFO](5.7.5.22)* and *Emergency*
1890 *Credit Balance [INFO](5.7.5.15)* rises above the *Disablement Threshold [INFO](5.7.4.15)*,
1891 displaying any such change in the *Supply State [INFO](5.7.5.32)* on its User Interface and
1892 generating and sending an Alert that the Supply has been Armed via its HAN Interface.
- 1893 When operating in Credit Mode, ESME shall be capable of not executing the Command and
1894 generating and sending a Response to that effect via its HAN Interface.
- 1895 **5.6.3.2 Activate Firmware**
- 1896 A Command to activate Firmware.
- 1897 In executing the Command ESME shall be capable of installing new Firmware using a
1898 mechanism that is robust against failure and loss of data.
- 1899 The new Firmware shall include version information. Where new Firmware is successfully
1900 installed, ESME shall be capable of recording the version information of that new Firmware
1901 in *Firmware Version(5.7.5.17)*.
- 1902 **5.6.3.3 Add Credit**
- 1903 A Command to accept credit to be applied to ESME when ESME is operating in Prepayment
1904 Mode on receipt of: a UTRN from a Type 1 Device or a UTRN from an Authorised party.
- 1905 In executing the Command following receipt of a UTRN from a Type 1 Device ESME shall be
1906 capable of applying credit as set out in Section 5.6.2.2.
- 1907 In executing the Command following receipt of a UTRN from an Authorised party, ESME
1908 shall be capable of:
- 1909 i. comparing the credit value of the UTRN with the *Maximum Credit*
1910 *Threshold(5.7.4.25)* and rejecting the UTRN where the credit value is greater than
1911 that threshold;
 - 1912 ii. comparing the projected new *Meter Balance [INFO](5.7.5.22)* (calculated on the
1913 basis of (xii) to (xv) below and the credit value of the UTRN and rejecting the UTRN
1914 where the projected new *Meter Balance [INFO](5.7.5.22)* is greater than the
1915 *Maximum Meter Balance Threshold(5.7.4.27)*;
 - 1916 iii. verifying the Authenticity of the UTRN;
 - 1917 iv. verifying that ESME is the intended recipient of the UTRN;
 - 1918 v. comparing the UTRN Counter against the last 100 verified UTRN Counters and
1919 rejecting duplicate presentation of verified UTRNs; and
 - 1920 vi. controlling the number of invalid UTRN entries entered and processed.
- 1921 ESME shall be capable of generating an entry in the *Security Log(5.7.5.31)*:
- 1922 vii. where the UTRN is rejected as set out in (i) above;
 - 1923 viii. where the UTRN is rejected as set out in (ii) above;
 - 1924 ix. on failure of (iii) above;
 - 1925 x. on failure of (iv) above; and
 - 1926 xi. where duplicates are rejected as set out in (v) above.

- 1927 In executing the Command, ESME shall be capable of applying the credit added in the
1928 following order:
- 1929 xii. recovery of payment-based debt of an amount defined by *Debt Recovery per*
1930 *Payment [INFO](5.7.4.11)* from the *Payment Debt Register [INFO](5.7.5.23)* subject
1931 to the *Debt Recovery Rate Cap [INFO](5.7.4.13)*;
 - 1932 xiii. recovery of debt accumulated in the *Accumulated Debt Register [INFO](5.7.5.1)*;
 - 1933 xiv. repayment of Emergency Credit activated and used by the Consumer; and
 - 1934 xv. adding remaining credit (the credit after deduction of (xii), (xiii) and (xiv) above) to
1935 the *Meter Balance [INFO](5.7.5.22)*.
- 1936 In executing the Command, ESME shall be capable of Arming the Supply if the *Meter*
1937 *Balance [INFO](5.7.5.22)* rises above the *Disablement Threshold [INFO](5.7.4.15)*,
1938 displaying any such change in the *Supply State [INFO](5.7.5.32)* on its User Interface and
1939 generating and sending an Alert that the Supply has been Armed via its HAN Interface.
- 1940 In executing the Command, ESME shall be capable of recording the credit applied to the
1941 *Meter Balance [INFO](5.7.5.22)* and the amount of payment-based debt recovered (as set
1942 out in (xii)) in the *Billing Data Log(5.7.5.10)*.
- 1943 In executing the Command from a Type 1 Device, ESME shall be capable of generating and
1944 sending an Alert containing the UTC date and time stamp of the last update of the *Meter*
1945 *Balance [INFO](5.7.5.22)* via its HAN Interface.
- 1946 When operating in Credit Mode, ESME shall be capable of not executing the Command and
1947 generating and sending a Response to that effect via its HAN Interface.
- 1948 **5.6.3.4 Add Device Security Credentials**
- 1949 A Command to add Security Credentials for a Type 1 Device or a Type 2 Device to the
1950 *Device Log(5.7.4.14)*.
- 1951 In executing the Command, ESME shall be capable of:
- 1952 i. verifying the Security Credentials; and
 - 1953 ii. recording the Command and Outcome to the *Security Log(5.7.5.31)*.
- 1954 **5.6.3.5 Adjust Debt**
- 1955 A Command to apply positive and negative adjustments to the *Time Debt Registers [1 ... 2]*
1956 *[INFO](5.7.5.36)* and the *Payment Debt Register [INFO](5.7.5.23)* when operating in
1957 Prepayment Mode.
- 1958 When operating in Credit Mode, ESME shall be capable of not executing the Command and
1959 generating and sending a Response to that effect via its HAN Interface.
- 1960 **5.6.3.6 Adjust Meter Balance**
- 1961 A Command to apply positive and negative adjustments to the *Meter Balance*
1962 *[INFO](5.7.5.22)*.
- 1963 In executing the Command where ESME is operating in Prepayment Mode and where,
1964 following any such adjustment, the *Meter Balance [INFO](5.7.5.22)* rises above the
1965 *Disablement Threshold [INFO](5.7.4.15)*, ESME shall be capable of Arming the Supply and
1966 displaying any such change in the *Supply State [INFO](5.7.5.32)* on its User Interface,
1967 generating and sending an Alert that the Supply has been Armed via its HAN Interface.
- 1968 **5.6.3.7 Arm Supply**
- 1969 A Command to return ESME from a Locked state to an Unlocked state.

- 1970 In executing the Command where the state of the Supply is Enabled or Armed, ESME shall
1971 Arm the Supply and shall set the *Supply State [INFO](5.7.5.32)* to Armed.
- 1972 In executing the Command where the state of the Supply is only Disabled as a result of:
- 1973 i. a Disable Supply Command; or
1974 ii. an attempt at Unauthorised Physical Access through its Secure Perimeter and the
1975 *Supply Tamper State(5.7.4.44)*,
- 1976 ESME shall Arm the Supply and shall set the *Supply State [INFO](5.7.5.32)* to Armed;
1977 otherwise ESME shall not Arm the Supply.
- 1978 **5.6.3.8 Clear Auxiliary Load Control Switch Event Log**
- 1979 A Command to clear all entries from the *Auxiliary Load Control Switch Event Log(5.7.5.6)*.
1980 ESME shall be capable of logging that the Command has been executed in the *Security*
1981 *Log(5.7.5.31)*.
- 1982 **5.6.3.9 Clear Event Log**
- 1983 A Command to clear all entries from the *Event Log(5.7.5.16)*. ESME shall be capable of
1984 logging that the Command has been executed in the *Security Log(5.7.5.31)*.
- 1985 **5.6.3.10 Disable Privacy PIN Protection**
- 1986 A Command to disable Privacy PIN Protection.
- 1987 **5.6.3.11 Disable Supply**
- 1988 A Command to establish a Locked state whereby the Supply is Disabled and can only be
1989 Enabled or Armed in response to a Command to Arm the Supply (as described in *Section*
1990 *5.6.3.7*) or Enable the Supply (as described in *Section 5.6.3.12*).
- 1991 In executing the Command ESME shall be capable of setting the *Supply State(5.7.5.32)* to
1992 Disabled.
- 1993 **5.6.3.12 Enable Supply**
- 1994 A Command to return ESME from a Locked state to an Unlocked state.
- 1995 In executing the Command where the state of the Supply is Enabled or Armed, ESME shall
1996 Enable the Supply and shall set the *Supply State [INFO](5.7.5.32)* to Enabled.
- 1997 In executing the Command where the state of the Supply is only Disabled as a result of:
- 1998 i. a Disable Supply Command; or
1999 ii. an attempt at Unauthorised Physical Access through its Secure Perimeter and the
2000 *Supply Tamper State(5.7.4.44)*,
- 2001 ESME shall Enable the Supply and shall set the *Supply State [INFO](5.7.5.32)* to Enabled;
2002 otherwise ESME shall not Enable the Supply.
- 2003 **5.6.3.13 Issue ESME Security Credentials**
- 2004 A Command to generate a Public-Private Key Pair and issue a corresponding Certificate
2005 Signing Request.
- 2006 **5.6.3.14 PPMID Enable Supply**
- 2007 A Command issued by a PPMID to Enable the Supply if the Supply is Armed. In executing
2008 the Command ESME shall be capable of setting the *Supply State [INFO](5.7.5.32)*
2009 accordingly.

- 2010 **5.6.3.15 Read Configuration Data**
- 2011 A Command to read the value of one or more of the configuration data items set out in
2012 *Section 5.7.4*.
- 2013 In executing the Command, ESME shall be capable of sending such value(s) in a Response
2014 via its HAN Interface.
- 2015 **5.6.3.16 Read Constant Data**
- 2016 A Command to read the value of one or more of the constant data items set out in *Section*
2017 *5.7.1*.
- 2018 In executing the Command, ESME shall be capable of sending such value(s) in a Response
2019 via its HAN Interface.
- 2020 **5.6.3.17 Read Operational Data**
- 2021 A Command to read the value of one or more of the operational data items set out in *Section*
2022 *5.7.5*.
- 2023 In executing the Command, ESME shall be capable of sending such value(s) in a Response
2024 via its HAN Interface.
- 2025 **5.6.3.18 Receive Firmware**
- 2026 A Command to receive Firmware.
- 2027 In executing the Command ESME shall be capable of:
- 2028 i. only accepting new Firmware from an Authorised and Authenticated source; and
2029 ii. verifying the Authenticity and integrity of new Firmware before installation.
- 2030 **5.6.3.19 Remove Device Security Credentials**
- 2031 A Command to remove Security Credentials for a Type 1 Device or a Type 2 Device from
2032 the *Device Log(5.7.4.14)*.
- 2033 In executing the Command ESME shall be capable of recording the Command and Outcome
2034 to the *Security Log(5.7.5.31)*.
- 2035 **5.6.3.20 Replace ESME Security Credentials**
- 2036 A Command to replace *ESME Security Credentials(5.7.4.18)*.
- 2037 In executing the Command ESME shall be capable of:
- 2038 i. maintaining the Command's Transactional Atomicity; and
2039 ii. recording the Command and Outcome to the *Security Log(5.7.5.31)*.
- 2040 **5.6.3.21 Request Control of HAN Connected Auxiliary Load Control Switch**
- 2041 A Command issued by an HCALCS requesting that an ESME issues a *Control HAN*
2042 *Connected Auxiliary Load Control Switch(5.6.4.1)* Command according to the rules set out in
2043 *Section 5.5.11*.
- 2044 **5.6.3.22 Reset Average RMS Over Voltage Counter**
- 2045 A Command to reset the *Average RMS Over Voltage Counter(5.7.5.7)* to zero.
- 2046 **5.6.3.23 Reset Average RMS Under Voltage Counter**
- 2047 A Command to reset the *Average RMS Under Voltage Counter(5.7.5.8)* to zero.

- 2048 **5.6.3.24 Reset HAN Connected Auxiliary Load Control Switch [n] State**
- 2049 A Command to revert to the state commanded by the *Auxiliary Load Control Switch*
- 2050 *Calendar*(5.7.4.2). In executing the Command, according to the rules set out in *Section*
- 2051 *5.5.11.1*, ESME shall be capable of issuing a *Control HAN Connected Auxiliary Load Control*
- 2052 *Switch*(5.6.4.1) Command to HCALCS [n].
- 2053 **5.6.3.25 Reset Load Limit Counter**
- 2054 A Command to reset the *Load Limit Counter*(5.7.5.18) to zero.
- 2055 **5.6.3.26 Reset Maximum Demand Active Power Import Value**
- 2056 A Command to reset the *Maximum Demand Active Power Import Value*(5.7.5.19).
- 2057 **5.6.3.27 Reset Maximum Demand Active Power Export Value**
- 2058 A Command to reset the *Maximum Demand Active Power Export Value*(5.7.5.21).
- 2059 **5.6.3.28 Reset Maximum Demand (Configurable Time) Active Power Import Value**
- 2060 A Command to reset the *Maximum Demand (Configurable Time) Active Power Import*
- 2061 *Value*(5.7.5.20).
- 2062 **5.6.3.29 Reset Meter Balance**
- 2063 A Command to reset the *Meter Balance [INFO]*(5.7.5.22) to zero.
- 2064 In executing the Command, ESME shall reset the Accumulated Debt Register
- 2065 *[INFO]*(5.7.5.1), the Emergency Credit activated and used, and the *Emergency Credit*
- 2066 *Balance [INFO]*(5.7.5.15).
- 2067 **5.6.3.30 Reset Tariff Block Counter Matrix**
- 2068 A Command to reset the *Tariff Block Counter Matrix [INFO]*(5.7.5.33) to zero.
- 2069 **5.6.3.31 Restrict Data**
- 2070 A Command to restrict provision to Type 1 Devices and Type 2 Devices of all items of
- 2071 Personal Data stored in ESME which have a UTC date and time stamp prior to the date and
- 2072 time stamp specified in the Restrict Data Command.
- 2073 **5.6.3.32 Set Clock**
- 2074 A Command to set the Clock date and time via its HAN Interface.
- 2075 In executing the Command, ESME shall be capable of comparing the date and time
- 2076 specified in the Command with the Communications Hub Date and Time. Where the
- 2077 difference is:
- 2078 i. within the tolerance specified in the Command ESME shall be capable of adjusting
- 2079 its date and time to the Communications Hub Date and Time and generating an
- 2080 entry to that effect in the *Event Log*(5.7.5.16); and
- 2081 ii. outside the tolerance specified in the Command ESME shall be capable of not
- 2082 adjusting its date and time and:
- 2083 a) generating an entry to that effect in the *Event Log*(5.7.5.16); and
- 2084 b) generating and sending an Alert to that effect via its HAN Interface.
- 2085 ESME shall be capable of ensuring that any adjustments do not cause calendar-based
- 2086 events to be missed or future-dated Commands to be missed or repeated.

2087 **5.6.3.33 Set HAN Connected Auxiliary Load Control Switch [n] State**

2088 A Command to ignore the state defined in *Auxiliary Load Control Switch Calendar*(5.7.4.2)
 2089 and to issue a *Control HAN Connected Auxiliary Load Control Switch* (5.6.4.1) Command to
 2090 HCALCS [n] for a time period specified within the 'Set HAN Connected Auxiliary Load
 2091 Control Switch [n] State Command'.

2092 ESME shall only be capable of issuing a Command to set HCALCS [n] as closed when the
 2093 *Supply State [INFO]*(5.7.5.32) is Enabled.

2094 **5.6.3.34 Set Payment Mode**

2095 A Command to set the payment mode as either Prepayment Mode or Credit Mode and to
 2096 record the mode of operation in *Payment Mode [INFO]*(5.7.4.31).

2097 In executing the Command, ESME shall be capable of taking a UTC date and time stamped
 2098 copy of:

- 2099 i. the *Tariff TOU Register Matrix [INFO]*(5.7.5.34);
- 2100 ii. the *Tariff TOU Block Register Matrix*(5.7.5.35); and
- 2101 iii. the *Active Import Register [INFO]*(5.7.5.3),

2102 and unless in Credit Mode both before and after execution of the Command:

- 2103 iv. the *Meter Balance [INFO]*(5.7.5.22);
- 2104 v. the *Emergency Credit Balance [INFO]*(5.7.5.15);
- 2105 vi. the *Payment Debt Register [INFO]*(5.7.5.23);
- 2106 vii. the *Time Debt Registers [1 ... 2] [INFO]*(5.7.5.36); and
- 2107 viii. the *Accumulated Debt Register [INFO]*(5.7.5.1),

2108 in the *Billing Data Log*(5.7.5.10).

2109 **5.6.3.35 Set Tariff**

2110 A Command to accept new values for *Tariff TOU Price Matrix [INFO]*(5.7.4.50), *Tariff Block*
 2111 *Price Matrix [INFO]*(5.7.4.47), *Tariff Switching Table*(5.7.4.48) and *Tariff Threshold Matrix*
 2112 *[INFO]*(5.7.4.49).

2113 In executing the Command, ESME shall be capable of taking a UTC date and time stamped
 2114 copy of:

- 2115 i. the *Tariff TOU Register Matrix [INFO]*(5.7.5.34);
- 2116 ii. the *Tariff TOU Block Register Matrix*(5.7.5.35); and
- 2117 iii. the *Active Import Register [INFO]*(5.7.5.3),

2118 and where in Prepayment mode:

- 2119 iv. the *Meter Balance [INFO]*(5.7.5.22);
- 2120 v. the *Emergency Credit Balance [INFO]*(5.7.5.15);
- 2121 vi. the *Payment Debt Register [INFO]*(5.7.5.23);
- 2122 vii. the *Time Debt Registers [1 ... 2] [INFO]*(5.7.5.36); and
- 2123 viii. the *Accumulated Debt Register [INFO]*(5.7.5.1),

2124 in the *Billing Data Log*(5.7.5.10).

2125 **5.6.3.36 Write Configuration Data**

2126 A Command to record one or more new values of the configuration data items set out in
 2127 *Section 5.7.4*.

2128 In executing the Command, ESME shall be capable of generating an entry to that effect in
 2129 the *Event Log*(5.7.5.16).

2130 **5.6.4 HAN Interface Commands issued by ESME**

2131 ESME shall be capable of issuing the Commands set out in this Section, receiving
2132 corresponding Responses and, where required by a Response, taking the required actions.

2133 **5.6.4.1 Control HAN Connected Auxiliary Load Control Switch**

2134 A Command requesting that a HAN Connected Auxiliary Load Control Switch either closes
2135 or opens its switch for a time period specified within the Command. The ESME shall be
2136 capable of issuing a *Control HAN Connected Auxiliary Load Control Switch(5.6.4.1)*
2137 Command according to the rules set out in *Section 5.5.11.1*.

2138 In executing the Command, ESME shall be capable of recording the Command and
2139 Outcome to the *Auxiliary Load Control Switch Event Log(5.7.5.6)*.

2140 **5.7 Data Requirements**

2141 This Section describes the minimum information which ESME shall be capable of holding in
2142 its Data Store.

2143 **5.7.1 Constant data**

2144 Describes data that remains constant and unchangeable at all times.

2145 **5.7.1.1 ESME Identifier**

2146 A globally unique identifier used to identify ESME based on the EUI-64 Institute of Electrical
2147 and Electronic Engineers standard.

2148 **5.7.1.2 Manufacturer Identifier**

2149 An identifier used to identify the manufacturer of ESME.

2150 **5.7.1.3 Model Type**

2151 An identifier used to identify the model of ESME.

2152 **5.7.1.4 Meter Variant**

2153 A data item to indicate if ESME is Single Element Electricity Metering Equipment, Twin
2154 Element Electricity Metering Equipment or Polyphase Electricity Metering Equipment.

2155 **5.7.1.5 Randomised Offset Number**

2156 A randomly generated value between 0 and 1.

2157 **5.7.2 This Section is not used**

2158 **5.7.3 Locally Set Configuration Data**

2159 Describes data that is configured by execution of a User Interface Command and that is not
2160 available outside ESME.

2161 **5.7.3.1 Privacy PIN**

2162 A number comprising four digits used by the Consumer to enable temporary access to a
2163 specified set of display items and Commands via the User Interface of ESME.

2164 **5.7.4 Configuration data**

2165 Describes data that configures the operation of various functions of ESME.

2166 **5.7.4.1 Alerts Configuration Settings**

2167 Settings to control whether to generate and send an Alert.

2168 **5.7.4.2 Auxiliary Load Control Switch Calendar**

2169 A Switching Table containing a set of rules for setting the commanded state of up to five
2170 Auxiliary Load Control Switches or HAN Connected Auxiliary Load Control Switches as open
2171 and closed.

2172 The rules stored within the table shall specify which Day Profile should be used to set the
2173 commanded state of each Auxiliary Load Control Switch or HAN Connected Auxiliary Load
2174 Control Switch according to:

- 2175 i. where the day is one of 20 Special Days, the Day Profile specified for that day and
2176 the Day Profile specified for that day of the Week; or
- 2177 ii. where the day is not a Special Day, the Day Profile specified for that day of the
2178 Week.

2179 The Switching Table shall support up to 48 switching rules across all Day Profiles.

2180 All dates and times shall be specified in UTC.

2181 **5.7.4.3 Auxiliary Load Control Switch [n] Description [INFO]**

2182 For each Auxiliary Load Control Switch or HAN Connected Auxiliary Load Control Switch, a
2183 description of the type of controlled load connected, the switch type and, for HAN Connected
2184 Auxiliary Load Control Switches, the *HCALCS Identifier*(8.6.1.1).

2185 **5.7.4.4 Average RMS Over Voltage Threshold**

2186 The average RMS voltage above which an over voltage condition is reported. The threshold
2187 shall be configurable within the specified operating range of ESME.

2188 **5.7.4.5 Average RMS Under Voltage Threshold**

2189 The average RMS voltage below which an under voltage condition is reported. The threshold
2190 shall be configurable within the specified operating range of ESME.

2191 **5.7.4.6 Average RMS Voltage Measurement Period**

2192 The length of time in seconds over which the RMS voltage is averaged.

2193 **5.7.4.7 Billing Calendar**

2194 A calendar defining billing dates for the storage of billing related information in the *Billing*
2195 *Data Log*(5.7.5.10).

2196 **5.7.4.8 Contact Details [INFO]**

2197 The name and contact telephone number of the Supplier.

2198 **5.7.4.9 Currency Units [INFO]**

2199 The Currency Units currently used by ESME, which shall be either GB Pounds or European
2200 Central Bank Euro.

2201 **5.7.4.10 Customer Identification Number [INFO]**

2202 A number issued to ESME for display on the User Interface.

2203 **5.7.4.11 Debt Recovery per Payment [INFO]**

2204 The percentage of a payment to be recovered against debt when ESME is operating
2205 Payment-based Debt Recovery in Prepayment Mode.

2206 **5.7.4.12 Debt Recovery Rates [1 ... 2] [INFO]**

2207 Two debt recovery rates in Currency Units per unit time for when ESME is using Time-based
2208 Debt Recovery in Prepayment Mode.

- 2209 **5.7.4.13 Debt Recovery Rate Cap [INFO]**
- 2210 The maximum amount in Currency Units per unit time that can be recovered through
2211 Payment-based Debt Recovery when ESME is operating in Prepayment Mode.
- 2212 **5.7.4.14 Device Log**
- 2213 The Security Credentials for each of the Type 1 Devices and Type 2 Devices with which
2214 ESME can establish Communications Links.
- 2215 **5.7.4.15 Disablement Threshold [INFO]**
- 2216 The threshold in Currency Units for controlling when to Disable the Supply.
- 2217 **5.7.4.16 Emergency Credit Limit [INFO]**
- 2218 The amount of Emergency Credit in Currency Units to be made available to a Consumer
2219 where Emergency Credit is activated by the Consumer.
- 2220 **5.7.4.17 Emergency Credit Threshold [INFO]**
- 2221 The threshold in Currency Units below which Emergency Credit Balance [INFO](5.7.5.15)
2222 may be activated by the Consumer if so configured when ESME is operating in Prepayment
2223 Mode.
- 2224 **5.7.4.18 ESME Security Credentials**
- 2225 The Security Credentials for ESME and parties Authorised to establish Communications
2226 Links with it.
- 2227 **5.7.4.19 Load Limit Period**
- 2228 The length of time in seconds which the Active Power Import [INFO](5.7.5.4) needs to
2229 continuously exceed the *Load Limit Power Threshold*(5.7.4.20) before a load limiting event is
2230 deemed to have occurred.
- 2231 **5.7.4.20 Load Limit Power Threshold**
- 2232 The Active Power threshold in kW above which the measurement of a *Load Limit*
2233 *Period*(5.7.4.19) is commenced.
- 2234 **5.7.4.21 Load Limit Restoration Period**
- 2235 The length of time in seconds after the Supply has been Armed following a Load Limiting
2236 Event before the Supply is Enabled by ESME.
- 2237 **5.7.4.22 Load Limit Supply State**
- 2238 A setting to control the state of the Supply in the case of a load limiting occurring, being
2239 Disabled or unchanged.
- 2240 **5.7.4.23 Low Credit Threshold [INFO]**
- 2241 The threshold in Currency Units below which a low credit Alert is signalled.
- 2242 **5.7.4.24 Low Medium Power Threshold [INFO]**
- 2243 A value in kW defining the threshold between an indicative low and medium *Active Power*
2244 *Import* [INFO](5.7.5.4) level.
- 2245 **5.7.4.25 Maximum Credit Threshold**
- 2246 The maximum credit which can be applied by any Add Credit Command.

-
- 2247 **5.7.4.26 Maximum Demand Configurable Time Period**
- 2248 A single time period of up to 24 hours comprising a number of half-hour periods
2249 (commencing at the start of minutes 00 and 30 in each hour) during which recording to the
2250 *Maximum Demand (Configurable Time) Active Power Import Value*(5.7.5.20) is active.
- 2251 **5.7.4.27 Maximum Meter Balance Threshold**
- 2252 The *Meter Balance [INFO]*(5.7.5.22) threshold in Currency Units above which an Add Credit
2253 Command is rejected.
- 2254 **5.7.4.28 Meter Point Administration Numbers (MPAN) [INFO]**
- 2255 The reference numbers identifying an electricity metering point for Import and Export.
- 2256 **5.7.4.29 Medium High Power Threshold [INFO]**
- 2257 A value in kW defining the threshold between an indicative medium and high *Active Power*
2258 *Import [INFO]*(5.7.5.4) level.
- 2259 **5.7.4.30 Non-Disablement Calendar [INFO]**
- 2260 A Switching Table comprising a set of rules specifying periods during which the Supply will
2261 not be Disabled due to the combined credit of the *Meter Balance [INFO]*(5.7.5.22) and
2262 *Emergency Credit Balance [INFO]*(5.7.5.15) falling below the *Disablement Threshold*
2263 *[INFO]*(5.7.4.15), when ESME is operating in Prepayment Mode.
- 2264 The rules stored within the table shall specify which of five Day Profiles should be used to
2265 specify Non-disablement Periods for each day according to:
- 2266 i. where the day is one of 20 Special Days, the Day Profile specified for that day; or
2267 ii. where the day is not a Special Day, the Day Profile specified by the active Season
2268 Profile and Week Profile.
- 2269 A Day Profile shall contain up to one contiguous time period during which the Supply may be
2270 Disabled due to the combined credit of the *Meter Balance [INFO]*(5.7.5.22) and *Emergency*
2271 *Credit Balance [INFO]*(5.7.5.15) falling below the *Disablement Threshold [INFO]*(5.7.4.15),
2272 when ESME is operating in Prepayment Mode.
- 2273 The rules shall support three Season Profiles and two Week Profiles. Each Week Profile
2274 shall support two Day Profiles.
- 2275 All dates and times shall be specified as UTC.
- 2276 **5.7.4.31 Payment Mode [INFO]**
- 2277 The current mode of operation, being Prepayment Mode or Credit Mode.
- 2278 **5.7.4.32 Public Key Security Credentials Store**
- 2279 A store for Security Credentials relating to Public Keys.
- 2280 **5.7.4.33 Randomised Offset Limit**
- 2281 A value in seconds in the range 0 to 1799.
- 2282 **5.7.4.34 RMS Extreme Over Voltage Measurement Period**
- 2283 The duration in seconds used to measure an extreme over voltage condition.
- 2284 **5.7.4.35 RMS Extreme Over Voltage Threshold**
- 2285 The RMS voltage above which an extreme over voltage condition is reported. The threshold
2286 shall be configurable within the specified operating range of ESME.

- 2287 **5.7.4.36 RMS Extreme Under Voltage Measurement Period**
- 2288 The duration in seconds used to measure an extreme under voltage condition.
- 2289 **5.7.4.37 RMS Extreme Under Voltage Threshold**
- 2290 The RMS voltage below which an extreme under voltage condition is reported. The threshold
- 2291 shall be configurable within the specified operating range of ESME.
- 2292 **5.7.4.38 RMS Voltage Sag Measurement Period**
- 2293 The duration in seconds used to measure a voltage sag condition.
- 2294 **5.7.4.39 RMS Voltage Swell Measurement Period**
- 2295 The duration in seconds used to measure a voltage swell condition.
- 2296 **5.7.4.40 RMS Voltage Sag Threshold**
- 2297 The RMS voltage below which a sag condition is reported. The threshold shall be
- 2298 configurable within the specified operating range of ESME.
- 2299 **5.7.4.41 RMS Voltage Swell Threshold**
- 2300 The RMS voltage above which a swell condition is reported. The threshold shall be
- 2301 configurable within the specified operating range of ESME.
- 2302 **5.7.4.42 Standing Charge [INFO]**
- 2303 A charge to be levied in Currency Units per unit time when operating in Credit Mode and
- 2304 Prepayment Mode.
- 2305 **5.7.4.43 Supplier Message [INFO]**
- 2306 A message issued to, and held on, ESME for provision to the Consumer.
- 2307 **5.7.4.44 Supply Tamper State**
- 2308 A setting to control the state of the Supply in the case of Unauthorised Physical Access
- 2309 being detected, being Locked or unchanged.
- 2310 **5.7.4.45 Suspend Debt Disabled**
- 2311 A setting controlling whether debt should be collected when ESME is operating in
- 2312 Prepayment Mode and Supply is Disabled.
- 2313 **5.7.4.46 Suspend Debt Emergency**
- 2314 A setting controlling whether standing charge and debt should be deducted from the
- 2315 *Emergency Credit Balance [INFO](5.7.5.15)* when ESME is operating in Prepayment Mode
- 2316 and Emergency Credit is in use.
- 2317 **5.7.4.47 Tariff Block Price Matrix [INFO]**
- 2318 A 4 x 8 matrix containing Prices for Block Pricing.
- 2319 **5.7.4.48 Tariff Switching Table [INFO]**
- 2320 A set of rules for allocating half-hourly Consumption to a Tariff Register for Time-of-use
- 2321 Pricing and Time-of-use with Block Pricing. The rules stored within the table shall specify
- 2322 which of 16 Day Profiles should be used to allocate Consumption to Tariff Registers
- 2323 according to:
- 2324 i. where the day is one of 50 Special Days, the Day Profile specified for that day; or
- 2325 ii. where the day is not a Special Day, the Day Profile specified by the active Season
- 2326 Profile and Week Profile.

- 2327 The Switching Table shall support four Season Profiles and four Week Profiles. The
2328 Switching Table shall support up to 200 switching rules across all Day Profiles.
- 2329 All dates and times shall be specified as UTC.
- 2330 **5.7.4.49 Tariff Threshold Matrix [INFO]**
- 2331 A 3 x 8 matrix capable of holding thresholds in kWh for controlling Block Tariffs.
- 2332 **5.7.4.50 Tariff TOU Price Matrix [INFO]**
- 2333 A 1 x 48 matrix containing prices for Time-of-use Pricing.
- 2334 **5.7.4.51 Events Configuration Settings**
- 2335 Settings to control, for each Alert described in this *Section 5* and for each event which this
2336 *Section 5* requires the ESME to be capable of logging in the *Event Log(5.7.5.16)* or *Power*
2337 *Event Log(5.7.5.25)* which is not a Critical Event, whether an Alarm is sounded and whether
2338 an Event Log entry or Power event log entry is created.
- 2339 **5.7.5 Operational data**
- 2340 Describes data used by the functions of ESME for output of information.
- 2341 **5.7.5.1 Accumulated Debt Register [INFO]**
- 2342 The debt resulting from the collection of *Standing Charge [INFO](5.7.4.42)* and / or time-
2343 based debt when Emergency Credit is in use as configured by *Suspend Debt*
2344 *Emergency(5.7.4.46)*, when operating in Prepayment Mode.
- 2345 **5.7.5.2 Active Export Register [INFO]**
- 2346 The register recording the cumulative Active Energy Exported.
- 2347 **5.7.5.3 Active Import Register [INFO]**
- 2348 The register recording the cumulative Active Energy Imported.
- 2349 **5.7.5.4 Active Power Import [INFO]**
- 2350 The import of Active Power measured by ESME.
- 2351 **5.7.5.5 Active Tariff Price [INFO]**
- 2352 The Price currently active.
- 2353 **5.7.5.6 Auxiliary Load Control Switch Event Log**
- 2354 A log capable of storing one hundred UTC date and time stamped entries of events related
2355 to Auxiliary Load Control Switch(es) or HAN Connected Auxiliary Load Control Switch(es)
2356 arranged as a circular buffer such that when full, further writes shall cause the oldest entry to
2357 be overwritten.
- 2358 **5.7.5.7 Average RMS Over Voltage Counter**
- 2359 The number of times the average RMS voltage, as calculated in *Section 5.5.12.1*, has been
2360 above the *Average RMS Over Voltage Threshold(5.7.4.4)* since last reset.
- 2361 **5.7.5.8 Average RMS Under Voltage Counter**
- 2362 The number of times the average RMS voltage, as calculated in *Section 5.5.12.1*, has been
2363 below the *Average RMS Under Voltage Threshold(5.7.4.5)* since last reset.
- 2364 **5.7.5.9 Average RMS Voltage Profile Data Log**
- 2365 A log capable of storing 4320 entries (including the UTC date and time at the end of the
2366 period to which the value relates) comprising the averaged RMS voltage for each *Average*

2367 *RMS Voltage Measurement Period*(5.7.4.6) arranged as a circular buffer such that when full,
2368 further writes shall cause the oldest entry to be overwritten.

2369 **5.7.5.10 Billing Data Log**

2370 A log capable of storing the following UTC date and time stamped entries:

2371 i. twelve entries comprising *Tariff TOU Register Matrix [INFO]*(5.7.5.34), *Tariff TOU*
2372 *Block Register Matrix*(5.7.5.35), the *Active Import Register [INFO]*(5.7.5.3);

2373 and where in Prepayment mode:

2374 ii. five entries comprising the value of prepayment credits;

2375 iii. ten entries comprising the value of payment-based debt payments [INFO]; and

2376 iv. twelve entries comprising *Meter Balance [INFO]*(5.7.5.22), *Emergency Credit*
2377 *Balance [INFO]*(5.7.5.15), *Accumulated Debt Register [INFO]*(5.7.5.1), *Payment*
2378 *Debt Register [INFO]*(5.7.5.23) and *Time Debt Registers [1 ... 2] [INFO]*(5.7.5.36),

2379 each of (i) to (iv) arranged as a circular buffer such that when full, further writes shall cause
2380 the oldest entry to be overwritten.

2381 **5.7.5.11 Cost of Instantaneous Active Power Import**

2382 The indicative cost in Currency Units of maintaining the Active Power Import for an hour at
2383 the Price(s) currently active.

2384 **5.7.5.12 Cumulative and Historical Value Store [INFO]**

2385 A store capable of holding the following values:

2386 i. nine Days of Consumption comprising the current Day and the prior eight Days, in
2387 kWh and Currency Units;

2388 ii. six Weeks of Consumption comprising the current Week and the prior five Weeks, in
2389 kWh and Currency Units; and

2390 iii. fourteen months of Consumption comprising the current month and the prior thirteen
2391 months, in kWh and Currency Units.

2392 **5.7.5.13 Daily Read Log**

2393 A log capable of storing thirty one UTC date and time stamped entries of the *Tariff TOU*
2394 *Register Matrix [INFO]*(5.7.5.34), the *Tariff TOU Block Register Matrix*(5.7.5.35), the *Active*
2395 *Import Register [INFO]*(5.7.5.3) and the *Active Export Register [INFO]*(5.7.5.2) arranged as a
2396 circular buffer such that when full, further writes shall cause the oldest entry to be
2397 overwritten.

2398 **5.7.5.14 Daily Consumption Log [INFO]**

2399 A log capable of storing 731 date stamped entries of Consumption arranged as a circular
2400 buffer such that when full, further writes shall cause the oldest entry to be overwritten.

2401 **5.7.5.15 Emergency Credit Balance [INFO]**

2402 The amount of Emergency Credit available to the Consumer after it has been activated by
2403 the Consumer.

2404 **5.7.5.16 Event Log**

2405 A log capable of storing one hundred UTC date and time stamped entries of non-security
2406 related information for diagnosis and auditing arranged as a circular buffer such that when
2407 full, further writes shall cause the oldest entry to be overwritten.

2408 **5.7.5.17 Firmware Version**

2409 The active version of Firmware of ESME.

2410 **5.7.5.18 Load Limit Counter**

2411 The number of times the *Active Power Import [INFO]*(5.7.5.4) has exceeded, for the *Load*
2412 *Limit Period*(5.7.4.19), the *Load Limit Power Threshold*(5.7.4.20) since last cleared.

2413 **5.7.5.19 Maximum Demand Active Power Import Value**

2414 A store capable of holding the largest average value of *Active Power Import [INFO]*(5.7.5.4)
2415 recorded in any 30 minute period (commencing at the start of minutes 00 and 30 in each
2416 hour and including the UTC date and time at the end of the 30 minute period to which the
2417 data relates) since the value was last reset (as set out in *Section 5.6.3.26*), together with the
2418 UTC date and time when the value was last reset, arranged such that the recording of a
2419 larger value shall cause the previous entry to be overwritten.

2420 **5.7.5.20 Maximum Demand (Configurable Time) Active Power Import Value**

2421 A store capable of holding the largest average value of *Active Power Import [INFO]*(5.7.5.4)
2422 recorded in any 30 minute period (commencing at the start of minutes 00 and 30 in each
2423 hour) within the time period specified in *Maximum Demand Configurable Time*
2424 *Period*(5.7.4.26) (including the UTC date and time at the end of the 30 minute period to
2425 which the data relates) since the value was last reset (as set out in *Section 5.6.3.28*),
2426 together with the UTC date and time when the value was last reset, arranged such that the
2427 recording of a larger value shall cause the previous entry to be overwritten.

2428 **5.7.5.21 Maximum Demand Active Power Export Value**

2429 A store capable of holding the largest average value of the Active Power Export recorded in
2430 any 30 minute period (commencing at the start of minutes 00 and 30 in each hour and
2431 including the UTC date and time at the end of the 30 minute period to which the data relates)
2432 since the value was last reset (as set out in *Section 5.6.3.27*), together with the UTC date
2433 and time when the value was last reset, arranged such that the recording of a larger value
2434 shall cause the previous entry to be overwritten.

2435 **5.7.5.22 Meter Balance [INFO]**

2436 The amount of money in Currency Units as determined by ESME. If operating in Prepayment
2437 Mode, the Meter Balance represents ESME's determination of the amount of credit available
2438 to the Consumer (excluding any *Emergency Credit Balance [INFO]*(5.7.5.15)). If operating in
2439 Credit Mode, it represents ESME's determination of the amount of money due from the
2440 Consumer since the Meter Balance was last reset.

2441 **5.7.5.23 Payment Debt Register [INFO]**

2442 A Debt Register recording debt to be recovered as a percentage of payment when using
2443 Payment-based Debt Recovery in Prepayment Mode.

2444 **5.7.5.24 Power Threshold Status [INFO]**

2445 An indication of the Active Power level, being low, medium or high.

2446 **5.7.5.25 Power Event Log**

2447 A log capable of storing one hundred UTC date and time stamped entries of non-security
2448 related information for diagnosis and auditing arranged as a circular buffer such that when
2449 full, further writes shall cause the oldest entry to be overwritten.

2450 **5.7.5.26 Prepayment Daily Read Log**

2451 A log capable of storing thirty one UTC date and time stamped entries of *Meter Balance*
2452 *[INFO]*(5.7.5.22), *Emergency Credit Balance [INFO]*(5.7.5.15), *Accumulated Debt Register*
2453 *[INFO]*(5.7.5.1), *Payment Debt Register [INFO]*(5.7.5.23) and *Time Debt Registers [1 ... 2]*

- 2454 *[INFO]*(5.7.5.36) arranged as a circular buffer such that when full, further writes shall cause
2455 the oldest entry to be overwritten.
- 2456 **5.7.5.27 Profile Data Log *[INFO]***
- 2457 A log capable of storing UTC date and time-stamped half hourly data (the amount of energy
2458 Imported or Exported in a half hour period) arranged as a circular buffer such that when full,
2459 further writes shall cause the oldest entry to be overwritten. The log shall be capable of
2460 storing:
- 2461 i. 13 months of Consumption;
 - 2462 ii. 3 months of Active Energy Exported;
 - 2463 iii. 3 months of Reactive Energy Imported; and
 - 2464 iv. 3 months of Reactive Energy Exported.
- 2465 **5.7.5.28 Randomised Offset**
- 2466 The product of the *Randomised Offset Limit*(5.7.4.33) and the *Randomised Offset*
2467 *Number*(5.7.1.5) rounded to the nearest second. This value is used to delay the Tariff
2468 Switching Table times, the Auxiliary Load Control Switch switching times, and HAN
2469 Connected Auxiliary Load Control Switch switching times.
- 2470 **5.7.5.29 Reactive Export Register**
- 2471 The register recording the cumulative Reactive Energy Exported.
- 2472 **5.7.5.30 Reactive Import Register**
- 2473 The register recording the cumulative Reactive Energy Imported.
- 2474 **5.7.5.31 Security Log**
- 2475 A log capable of storing one hundred UTC date and time stamped entries of security related
2476 information for diagnosis and auditing arranged as a circular buffer such that when full,
2477 further writes shall cause the oldest entry to be overwritten.
- 2478 **5.7.5.32 Supply State *[INFO]***
- 2479 The state of the Supply being Enabled, Disabled or Armed.
- 2480 **5.7.5.33 Tariff Block Counter Matrix *[INFO]***
- 2481 A 4 x 8 matrix for storing Block Counters for Block Pricing.
- 2482 **5.7.5.34 Tariff TOU Register Matrix *[INFO]***
- 2483 A 1 x 48 matrix for storing Tariff Registers for Time-of-use Pricing.
- 2484 **5.7.5.35 Tariff TOU Block Register Matrix**
- 2485 A 4 x 8 matrix for storing Tariff Registers for Time-of-use with Block Pricing.
- 2486 **5.7.5.36 Time Debt Registers [1 ... 2] *[INFO]***
- 2487 Two Debt Registers recording independent debts to be recovered over time when operating
2488 Time-based Debt Recovery in Prepayment Mode.

2489 **Part B - Twin Element Electricity Metering** 2490 **Equipment**

2491 **5.8 Overview**

2492 In this Part B ESME shall mean Twin Element Electricity Metering Equipment.

2493 ESME shall comply with the requirements of Part A save as set out in the remainder of this
2494 Part B. Requirements in a Part A Section that are disapplied by this Part B are identified in
2495 the Part B Section of the same name. Additional or amended requirements applied by this
2496 Part B are a continuation of the Part A Section of the same name and hence must also be
2497 met by ESME.

2498 **5.9 SMETS Testing and Certification Requirements**

2499 **5.9.1 Conformance with the SMETS**

2500 ESME shall have been tested to ensure that it meets the requirements described in this
2501 *Section 5 Part B*, and evidence must be available to confirm such testing and conformance.

2502 **5.9.2 Conformance with the Great Britain Companion Specification**

2503 ESME shall meet the requirements described in the Great Britain Companion Specification.

2504 ESME shall have been certified:

- 2505 i. by the ZigBee Alliance as being compliant with those ZigBee SEP requirements that
2506 are identified as being required in the Great Britain Companion Specification and
2507 that were certifiable under the ZigBee SEP certification scheme on 31 August 2017;
2508 and
- 2509 ii. by the DLMS User Association as being compliant with those DLMS COSEM
2510 requirements that are identified as being required in the Great Britain Companion
2511 Specification and that were certifiable under the DLMS COSEM certification scheme
2512 on 31 August 2017.

2513 **5.9.3 Conformance with the Commercial Product Assurance** 2514 **Security Characteristics for GB Smart Metering**

2515 ESME shall meet the requirements described in the Commercial Product Assurance Security
2516 Characteristic for Electricity Smart Metering Equipment.

2517 ESME shall be certified by NCSC as compliant with the Commercial Product Assurance
2518 Security Characteristic for Electricity Smart Metering Equipment.

2519 **5.10 Physical Requirements**

2520 *Physical Requirements(5.4)* in Part A shall not apply to ESME.

2521 ESME shall as a minimum include the following components:

- 2522 i. a Clock;
- 2523 ii. a Data Store;
- 2524 iii. an Electricity Meter containing two measuring elements;
- 2525 iv. a HAN Interface;
- 2526 v. a Load Switch;
- 2527 vi. a Random Number Generator;
- 2528 vii. a User Interface; and

2529 viii. where installed with a Communications Hub provided by the Data and
2530 Communications Company, a Communications Hub Physical Interface (this may
2531 comprise a Communications Hub Physical Interface forming part of GSME where
2532 present at the time of installation in the Premises).

2533 The Communications Hub Physical Interface shall as a minimum include a physical interface
2534 that meets the requirements defined by the Data and Communications Company at the time
2535 of installation (available on the Data and Communications Company's website) and includes
2536 provision for a DC power supply to the Communications Hub.

2537 ESME shall be mains powered and be capable of performing the minimum functional,
2538 interface and data requirements set out in *Sections 5.11, 5.12 and 5.13* respectively
2539 operating at a nominal voltage of 230VAC without consuming more than an average of 4
2540 watts of electricity under normal operating conditions.

2541 ESME shall be capable of automatically resuming operation after a power failure in its
2542 operating state prior to such failure.

2543 ESME shall:

- 2544 ix. permanently display the *ESME Identifier(5.7.1.1)* on the ESME; and
- 2545 x. have a Secure Perimeter.

2546 The HAN Interface of ESME shall be capable of joining a ZigBee SEP Smart Metering Home
2547 Area Network which:

- 2548 xi. operates within the 2400 – 2483.5 MHz harmonised frequency band; and
- 2549 xii. supports the Communications Links described in *Sections 5.6.3, 5.6.4., 5.12.1 and*
2550 *5.12.2.*

2551 On joining a ZigBee SEP Smart Metering Home Area Network ESME shall be capable of
2552 generating and sending an Alert to that effect via its HAN Interface.

2553 ESME shall be designed taking all reasonable steps so as to prevent Unauthorised Physical
2554 Access and Unauthorised communications through its Secure Perimeter that could
2555 compromise the Confidentiality and / or Data Integrity of:

- 2556 xiii. Personal Data;
- 2557 xiv. Consumption data used for billing;
- 2558 xv. Security Credentials;
- 2559 xvi. Random Number Generator;
- 2560 xvii. Cryptographic Algorithms;
- 2561 xviii. the Electricity Meter; and
- 2562 xix. Firmware and data essential for ensuring its integrity,

2563 stored or executing on ESME.

2564 ESME shall be capable of detecting any attempt at Unauthorised Physical Access through
2565 its Secure Perimeter that could compromise such Confidentiality and / or Data Integrity and
2566 on such detection shall be capable of:

- 2567 xx. providing evidence of such an attempt through the use of tamper evident coatings or
2568 seals,

2569 and where reasonably practicable:

- 2570 xxi. generating an entry to that effect in the *Security Log(5.7.5.31)*;
- 2571 xxii. generating and sending an Alert to that effect via its HAN Interface; and
- 2572 xxiii. where the *Supply Tamper State(5.7.4.44)* is configured to require Locking, sending
2573 an Alert that the Supply is being disabled for this reason via its HAN Interface, and
2574 establishing a Locked state whereby the Supply is Disabled and can only be

2575 Enabled or Armed in response to a Command to Arm the Supply (as described in
 2576 *Section 5.6.3.7*) or Enable the Supply (as described in *Section 5.6.3.12*), and setting
 2577 the *Supply State [INFO](5.7.5.32)* to Locked.

2578 **5.11 Functional Requirements**

2579 **5.11.1 Display of information**

2580 *Display of information(5.5.4)* in Part A shall not apply to ESME.

2581 ESME shall be capable of displaying the following up to date information on its User
 2582 Interface:

- 2583 i. the *Payment Mode [INFO](5.7.4.31)* currently in operation, being Prepayment Mode
- 2584 or Credit Mode [PIN];
- 2585 ii. the *Tariff TOU Register Matrix [INFO](5.7.5.34)* with appropriate precision, the
- 2586 *Secondary Tariff TOU Register Matrix [INFO](5.13.2.10)* with appropriate precision,
- 2587 *Tariff TOU Block Register Matrix(5.7.5.35)* with appropriate precision and the *Tariff*
- 2588 *Block Counter Matrix [INFO](5.7.5.33)* with appropriate precision;
- 2589 iii. the *Active Import Register [INFO](5.7.5.3)* with appropriate precision;
- 2590 iv. the *Secondary Active Import Register [INFO](5.13.2.11)* with appropriate precision;
- 2591 v. the *Meter Balance [INFO](5.7.5.22)* [PIN];
- 2592 vi. the Debt to Clear (calculated as set out in *Section 5.11.2.2*) [PIN];
- 2593 vii. the *Customer Identification Number [INFO](5.7.4.10)* [PIN];
- 2594 viii. whether Emergency Credit is available for activation [PIN];
- 2595 ix. whether ESME has suspended the Disablement of Supply during a period defined in
- 2596 the *Non-Disablement Calendar [INFO](5.7.4.30)* (as set out in *Section 5.11.2.2*)
- 2597 [PIN];
- 2598 x. the *Emergency Credit Balance [INFO](5.7.5.15)* where Emergency Credit is
- 2599 activated [PIN];
- 2600 xi. any low credit condition [PIN];
- 2601 xii. the *Supply State [INFO](5.7.5.32)*;
- 2602 xiii. any time-based debts and Time-based Debt Recovery rates [PIN];
- 2603 xiv. any payment-based debt [PIN];
- 2604 xv. any accumulated debt recorded in the *Accumulated Debt Register [INFO](5.7.5.1)*
- 2605 [PIN];
- 2606 xvi. any *Standing Charge [INFO](5.7.4.42)* [PIN];
- 2607 xvii. the *Meter Point Administration Numbers (MPAN) [INFO](5.7.4.28)* [PIN];
- 2608 xviii. the Local Time;
- 2609 xix. the *Contact Details [INFO](5.7.4.8)*;
- 2610 xx. the *Primary Active Tariff Price [INFO](5.13.2.6)* [PIN];
- 2611 xxi. the *Secondary Active Tariff Price [INFO](5.13.2.9)* [PIN];
- 2612 xxii. the *Event Log(5.7.5.16)* and the *Power Event Log(5.7.5.25)* (with the exception of
- 2613 any Personal Data)and
- 2614 xxiii. the *Active Export Register [INFO](5.7.5.2)*.

2615 ESME shall be capable of displaying the *Security Log(5.7.5.31)* on its User Interface
 2616 following physical access through the Secure Perimeter of ESME.

2617 ESME shall be capable of displaying Currency Units in GB Pounds and European Central
 2618 Bank Euro.

2619 **5.11.1.1 Presentation of information on the User Interface**

2620 For each of the values currently stored in the *Active Import Register [INFO](5.7.5.3)* , the
 2621 *Active Export Register [INFO](5.7.5.2)*, the *Secondary Active Import Register*
 2622 *[INFO](5.13.2.11)*, the *Tariff ToU Register Matrix [INFO](5.7.5.34)*, the *Tariff ToU Block*

2623 *Register Matrix*(5.7.5.35) and the *Secondary Active Tariff Price [INFO]*(5.13.2.9), ESME shall
2624 be capable of displaying a value calculated from the stored value by:

- 2625 i. converting the stored value in to a decimal, integer number of kilowatt hours,
2626 rounding the stored value down to the nearest kilowatt hour;
- 2627 ii. discarding all except the five least significant decimal digits so produced; and
- 2628 iii. adding leading zeros (if necessary) so that there are exactly five decimal digits.

2629 **5.11.2 Payment Mode**

2630 *Payment Mode*(5.5.7) in Part A shall not apply to ESME.

2631 ESME shall be capable of operating in Credit Mode and Prepayment Mode and of being
2632 remotely switched from one mode to the other.

2633 **5.11.2.1 Credit Mode**

2634 ESME, when operating in Credit Mode, shall be capable of maintaining a calculation of the
2635 *Meter Balance [INFO]*(5.7.5.22) based on:

- 2636 i. the Consumption in the *Tariff TOU Register Matrix [INFO]*(5.7.5.34) and the Prices
2637 in the *Tariff TOU Price Matrix [INFO]*(5.7.4.50) and if operating Time-of-use with
2638 Block Pricing, the Consumption in the *Tariff TOU Block Register Matrix*(5.7.5.35)
2639 and the Prices in the *Tariff Block Price Matrix [INFO]*(5.7.4.47);
- 2640 ii. the Consumption in the *Secondary Tariff TOU Register Matrix [INFO]*(5.13.2.10) and
2641 the Prices in *Secondary Tariff TOU Price Matrix [INFO]*(5.13.1.1); and
- 2642 iii. the *Standing Charge [INFO]*(5.7.4.42).

2643 **5.11.2.2 Prepayment Mode**

2644 ESME shall be capable of operating in Prepayment Mode, including during periods of loss of
2645 its Communications Link via its HAN Interface, and maintaining a balance of credit and
2646 reflecting any reduction in credit based on Consumption, standing charge and Time-based
2647 Debt Recovery.

2648 ESME shall be capable of adding credit to the *Meter Balance [INFO]*(5.7.5.22) (as set out in
2649 *Sections 5.6.2.2 and 5.6.3.3*) and reducing the amount of credit in the *Meter Balance*
2650 *[INFO]*(5.7.5.22).

2651 ESME shall be capable of making Emergency Credit available to the Consumer (by means
2652 of the *Emergency Credit Balance [INFO]*(5.7.5.15) if the *Meter Balance [INFO]*(5.7.5.22) is
2653 below the *Emergency Credit Threshold [INFO]*(5.7.4.17)). ESME shall be capable of
2654 displaying the availability of Emergency Credit on its User Interface and of generating and
2655 sending an Alert indicating the availability of Emergency Credit via its HAN Interface. The
2656 amount of Emergency Credit made available to the Consumer shall be equal to the
2657 *Emergency Credit Limit [INFO]*(5.7.4.16). ESME shall be capable of reducing the amount of
2658 credit in the *Emergency Credit Balance [INFO]*(5.7.5.15) where Emergency Credit is
2659 activated by the Consumer (as set out in *Sections 5.6.2.1 and 5.6.3.1*) and the *Meter*
2660 *Balance [INFO]*(5.7.5.22) is exhausted. Any Emergency Credit used shall be repaid when
2661 credit is added to ESME (as set out in *Sections 5.6.2.2 and 5.6.3.3*).

2662 ESME shall be capable of reducing the *Meter Balance [INFO]*(5.7.5.22) until it reaches the
2663 *Disablement Threshold [INFO]*(5.7.4.15) followed by reducing the *Emergency Credit Balance*
2664 *[INFO]*(5.7.5.15), where activated, until exhausted on the basis of:

- 2665 i. the Consumption in the *Tariff TOU Register Matrix [INFO]*(5.7.5.34) and the Prices
2666 in the *Tariff TOU Price Matrix [INFO]*(5.7.4.50), and if operating Time-of-use with

- 2667 Block Pricing the Consumption in the *Tariff TOU Block Register Matrix*(5.7.5.35) and
 2668 the Prices in the *Tariff Block Price Matrix [INFO]*(5.7.4.47);
 2669 ii. the Consumption in the *Secondary Tariff TOU Register Matrix [INFO]*(5.13.2.10) and
 2670 the Prices in the *Secondary Tariff TOU Price Matrix [INFO]*(5.13.1.1);
 2671 iii. the *Standing Charge [INFO]*(5.7.4.42); and
 2672 iv. the recovery of debt hourly and daily through each of the *Time Debt Registers [1 ...*
 2673 *2] [INFO]*(5.7.5.36) at rates defined by the *Debt Recovery Rates [1 ... 2]*
 2674 *[INFO]*(5.7.4.12).
- 2675 Where configured by *Suspend Debt Emergency*(5.7.4.46) to do so and when Emergency
 2676 Credit is in use, ESME shall be capable suspending the application of (iii) and (iv) to the
 2677 *Emergency Credit Balance [INFO]*(5.7.5.15), and of accumulating (iii) and (iv) in the
 2678 *Accumulated Debt Register [INFO]*(5.7.5.1).
- 2679 ESME shall be capable of recording debt recovered, or accumulated in the *Accumulated*
 2680 *Debt Register [INFO]*(5.7.5.1), in the *Billing Data Log*(5.13.2.3).
- 2681 ESME shall be capable of monitoring the *Meter Balance [INFO]*(5.7.5.22) and where
 2682 activated the *Emergency Credit Balance [INFO]*(5.7.5.15) and:
- 2683 v. if the combined credit of the *Meter Balance [INFO]*(5.7.5.22) and *Emergency Credit*
 2684 *Balance [INFO]*(5.7.5.15) falls below the *Low Credit Threshold [INFO]*(5.7.4.23),
 2685 displaying an Alert to that effect on its User Interface and generating and sending an
 2686 Alert to that effect via its HAN Interface;
- 2687 vi. if the combined credit of the *Meter Balance [INFO]*(5.7.5.22) and *Emergency Credit*
 2688 *Balance [INFO]*(5.7.5.15) falls below the *Disablement Threshold [INFO]*(5.7.4.15),
 2689 Disabling the Supply, displaying an Alert to that effect on its User Interface and
 2690 generating and sending an Alert to that effect via its HAN Interface;
- 2691 vii. where the Supply is Disabled (as set out in (vi) above):
- 2692 a) where configured by *Suspend Debt Disabled*(5.7.4.45) not to suspend Time-
 2693 based Debt Recovery, continuing to apply (iii) and (iv) above to reduce the
 2694 *Meter Balance [INFO]*(5.7.5.22);
- 2695 b) where configured by *Suspend Debt Disabled*(5.7.4.45) to suspend Time-based
 2696 Debt Recovery, suspending the application of (iv) above to the *Meter Balance*
 2697 *[INFO]*(5.7.5.22), and continuing to apply (iii) above to reduce the *Meter*
 2698 *Balance [INFO]*(5.7.5.22); and
- 2699 viii. if the Supply is Enabled, suspending the Disablement of Supply (as set out in (vi)
 2700 above) during periods defined in the *Non-Disablement Calendar [INFO]*(5.7.4.30),
 2701 continuing to reduce the *Meter Balance [INFO]*(5.7.5.22) on the basis of (i) to (iv)
 2702 above, displaying on its User Interface an indication that the combined *Meter*
 2703 *Balance [INFO]*(5.7.5.22) and *Emergency Credit Balance [INFO]*(5.7.5.15) is below
 2704 the *Disablement Threshold [INFO]*(5.7.4.15) and that Disablement of Supply due to
 2705 insufficient credit has been suspended, and generating and sending an Alert that
 2706 Disablement of Supply due to insufficient credit has been suspended via its HAN
 2707 Interface.
- 2708 If the *Meter Balance [INFO]*(5.7.5.22) is equal to or below the *Disablement Threshold*
 2709 *[INFO]*(5.7.4.15) ESME shall be capable of maintaining a calculation of the Debt to Clear
 2710 based on:
- 2711 ix. the difference between the *Meter Balance [INFO]*(5.7.5.22) and the *Disablement*
 2712 *Threshold [INFO]*(5.7.4.15);
- 2713 x. the amount of debt accumulated in the *Accumulated Debt Register [INFO]*(5.7.5.1)
- 2714 xi. the amount of Emergency Credit activated and used by the Consumer; and

2715 xii. the payment-based debt to be collected based on (ix), (x) and (xi) (as defined by
 2716 *Debt Recovery per Payment [INFO](5.7.4.11)* taking account of the amount
 2717 remaining in the *Payment Debt Register [INFO](5.7.5.23)*, the payment-based debt
 2718 payments in the *Billing Data Log(5.13.2.3)* and the *Debt Recovery Rate Cap*
 2719 *[INFO](5.7.4.13)*.

2720 For Time-based Debt Recovery, the ESME shall be capable of recovering the lesser of:

2721 xiii. the amount in the relevant *Time Debt Registers [1 ... 2] [INFO](5.7.5.36)*; and
 2722 xiv. the corresponding amount determined by the *Debt Recovery Rates [1 ... 2]*
 2723 *[INFO](5.7.4.12)*.

2724 For Payment-based Debt Recovery, the ESME shall be capable of recovering the lesser of:

2725 xv. the amount defined by *Debt Recovery per Payment [INFO](5.7.4.11)* subject to the
 2726 *Debt Recovery Rate Cap [INFO](5.7.4.13)*; and
 2727 xvi. the amount in the *Payment Debt Register [INFO](5.7.5.23)*.

2728 Where an Adjust Debt Command is to reduce the amount in a Debt Register and the amount
 2729 in the Command is greater than the amount in the Debt Register, ESME shall be capable of
 2730 setting the amount in the Debt Register to zero then applying the difference in the amounts
 2731 in the following order:

2732 xvii. recovering debt accumulated in the *Accumulated Debt Register [INFO](5.7.5.1)*;
 2733 xviii. repaying Emergency Credit activated and used by the Consumer; and
 2734 xix. increasing the *Meter Balance [INFO](5.7.5.22)*.

2735 ESME shall be capable of monitoring the *Meter Balance [INFO](5.7.5.22)* and, where the
 2736 Supply is Disabled, ESME shall be capable of Arming the Supply if the *Meter Balance*
 2737 *[INFO](5.7.5.22)* rises above the *Disablement Threshold [INFO](5.7.4.15)*, displaying any
 2738 such change in the *Supply State [INFO](5.7.5.32)* on its User Interface and generating and
 2739 sending an Alert that the Supply has been Armed via its HAN Interface.

2740 **5.11.3 Pricing**

2741 *Pricing(5.5.8)* in Part A shall not apply to ESME.

2742 ESME shall be capable of applying Time-of-use Pricing and Time-of-use with Block Pricing.

2743 When switching between Time-of-use Bands and Tariff Registers as set out in this Section
 2744 ESME shall be capable of applying the *Randomised Offset(5.7.5.28)*.

2745 ESME shall be capable of maintaining the *Primary Active Tariff Price [INFO](5.13.2.6)* and
 2746 the *Secondary Active Tariff Price [INFO](5.13.2.9)*.

2747 **5.11.3.1 Time-of-use Pricing**

2748 ESME shall be capable of recording Consumption via the primary measuring element of its
 2749 Electricity Meter according to Time-of-use Bands in one of forty-eight Tariff Registers in the
 2750 *Tariff TOU Register Matrix [INFO](5.7.5.34)*.

2751 ESME shall be capable of recording Consumption via the secondary measuring element of
 2752 its Electricity Meter according to Time-of-use Bands in one of four Tariff Registers in the
 2753 *Secondary Tariff TOU Register Matrix [INFO](5.13.2.10)*.

2754 ESME shall be capable of switching between different Tariff Registers once every 30
 2755 minutes. The switching between Time-of-use Bands and thus Tariff Registers shall be based
 2756 on the switching rules defined in the *Tariff Switching Table(5.13.1.2)*.

2757 **5.11.3.2 Time-of-use with Block Pricing**

2758 ESME shall be capable of recording Consumption via the primary measuring element of its
2759 Electricity Meter in one of four Block Registers for each of eight Time-of-use Bands in the
2760 *Tariff TOU Block Register Matrix*(5.7.5.35).

2761 The switching between Time-of-use Bands and sets of Block Registers shall be based on
2762 the switching rules set out in the *Tariff Switching Table [INFO]*(5.13.1.2). ESME shall be
2763 capable of switching between Time-of-use Bands once every 30 minutes.

2764 Switching between the Block Registers within each Time-of-use Band shall be based on
2765 Consumption via the primary measuring element of its Electricity Meter accumulated in the
2766 *Tariff Block Counter Matrix [INFO]*(5.7.5.33) and Consumption thresholds in the *Tariff*
2767 *Threshold Matrix [INFO]*(5.7.4.49).

2768 ESME shall also be capable of accumulating Consumption via the primary measuring
2769 element of its Electricity Meter in one of four Block Counters in the *Tariff Block Counter*
2770 *Matrix [INFO]*(5.7.5.33) for each of the eight Time-of-use Bands. ESME shall be capable of
2771 switching between Block Counters according to the Consumption thresholds in the *Tariff*
2772 *Threshold Matrix [INFO]*(5.7.4.49).

2773 ESME shall be capable of resetting the counters in the *Tariff Block Counter Matrix*
2774 *[INFO]*(5.7.5.33) once per Day and in accordance with the timetable set out in the *Billing*
2775 *Calendar*(5.7.4.7).

2776 **5.11.4 Recording**

2777 *Recording*(5.5.9) in Part A shall not apply to ESME.

2778 **5.11.4.1 Active Energy Imported**

2779 ESME shall be capable of recording:

- 2780 i. cumulative Active Energy Imported via the primary measuring element of its
- 2781 Electricity Meter in the *Active Import Register [INFO]*(5.7.5.3); and
- 2782 ii. cumulative Active Energy Imported via the secondary measuring element of its
- 2783 Electricity Meter in the *Secondary Active Import Register [INFO]*(5.13.2.11).

2784 **5.11.4.2 Active Energy Exported**

2785 ESME shall be capable of recording cumulative Active Energy Exported via the primary
2786 measuring element of its Electricity Meter in the *Active Export Register [INFO]*(5.7.5.2).

2787 **5.11.4.3 Billing data**

2788 In accordance with the timetable set out in the *Billing Calendar*(5.7.4.7) ESME shall be
2789 capable of taking a UTC date and time stamped copy of:

- 2790 i. the *Tariff TOU Register Matrix [INFO]*(5.7.5.34);
- 2791 ii. the *Secondary Tariff TOU Register Matrix [INFO]*(5.13.2.10);
- 2792 iii. the *Tariff TOU Block Register Matrix*(5.7.5.35);
- 2793 iv. the *Active Import Register [INFO]*(5.7.5.3); and
- 2794 v. the *Secondary Active Import Register [INFO]*(5.13.2.11),

2795 and where in Prepayment mode:

- 2796 vi. the *Meter Balance [INFO]*(5.7.5.22);
- 2797 vii. the *Emergency Credit Balance [INFO]*(5.7.5.15);
- 2798 viii. the *Payment Debt Register [INFO]*(5.7.5.23);
- 2799 ix. the *Time Debt Registers [1 ... 2] [INFO]*(5.7.5.36); and
- 2800 x. the *Accumulated Debt Register [INFO]*(5.7.5.1),

2801 in the *Billing Data Log*(5.13.2.3), and:

- 2802 xi. generating and sending an Alert via its HAN Interface containing the most recent
- 2803 entries in the *Billing Data Log*(5.13.2.3) of (i) to (v) above; and
- 2804 xii. if operating in Credit Mode immediately resetting the *Meter Balance*
- 2805 *[INFO]*(5.7.5.22).

2806 **5.11.4.4 Consumption Data**

2807 ESME shall be capable of calculating Consumption via the primary and secondary

2808 measuring elements of its Electricity Meter and recording:

- 2809 i. to the *Cumulative and Historical Value Store [INFO]*(5.7.5.12) in kWh:
 - 2810 a) Consumption on the Day up to the Local Time;
 - 2811 b) Consumption on each of the eight Days prior to such Day;
 - 2812 c) Consumption in the Week in which the calculation is performed;
 - 2813 d) Consumption in each of the five Weeks prior to such Week;
 - 2814 e) Consumption in the month in which the calculation is performed; and
 - 2815 f) Consumption in the thirteen months prior to such month.
- 2816 ii. the *Daily Consumption Log [INFO]*(5.7.5.14) in kWh the Consumption on each of the
- 2817 731 Days prior to the current Day.

2818 **5.11.4.5 Cost of Consumption Data**

2819 ESME shall be capable of calculating and recording to the *Cumulative and Historical Value*

2820 *Store [INFO]*(5.7.5.12) the cost of:

- 2821 i. Consumption on the Day up to the Local Time;
- 2822 ii. Consumption on each of the eight Days prior to such Day;
- 2823 iii. Consumption in the Week in which the calculation is performed;
- 2824 iv. Consumption in each of the five Weeks prior to such Week;
- 2825 v. Consumption in the month in which the calculation is performed; and
- 2826 vi. Consumption in the thirteen months prior to such month.

2827 ESME shall be capable of calculating cost of Consumption as above on the basis of:

- 2828 vii. the Consumption in the *Tariff TOU Register Matrix [INFO]*(5.7.5.34) and the Prices
- 2829 in the *Tariff TOU Price Matrix [INFO]*(5.7.4.50), and if operating Time-of-use with
- 2830 Block Pricing the Consumption in the *Tariff TOU Block Register Matrix*(5.7.5.35) and
- 2831 the Prices in the *Tariff Block Price Matrix [INFO]*(5.7.4.47);
- 2832 viii. the Consumption in the *Secondary Tariff TOU Register Matrix [INFO]*(5.13.2.10) and
- 2833 the Prices in the *Secondary Tariff TOU Price Matrix [INFO]*(5.13.1.1); and
- 2834 ix. the *Standing Charge [INFO]*(5.7.4.42).

2835 **5.11.4.6 Cost of Instantaneous Consumption**

2836 ESME shall be capable of calculating and recording the *Cost of Instantaneous Active Power*

2837 *Import*(5.7.5.11) on the basis of:

- 2838 i. the *Primary Active Power Import [INFO]*(5.13.2.5);
- 2839 ii. the *Primary Active Tariff Price [INFO]*(5.13.2.6);
- 2840 iii. the *Secondary Active Power Import [INFO]*(5.13.2.8); and
- 2841 iv. the *Secondary Active Tariff Price [INFO]*(5.13.2.9).

2842 **5.11.4.7 Daily read data**

2843 ESME shall be capable of taking a copy of and storing the *Tariff TOU Register Matrix*

2844 *[INFO]*(5.7.5.34), the *Secondary Tariff TOU Register Matrix [INFO]*(5.13.2.10), the *Tariff*

2845 *TOU Block Register Matrix*(5.7.5.35), the *Active Import Register [INFO]*(5.7.5.3), the

2846 *Secondary Active Import Register [INFO](5.13.2.11)* and the *Active Export Register*
 2847 *[INFO](5.7.5.2)*, together with a UTC date and time stamp in the *Daily Read Log(5.13.2.4)*
 2848 every day at midnight UTC.

2849 If operating in Prepayment Mode ESME shall be capable of recording the *Meter Balance*
 2850 *[INFO](5.7.5.22)*, *Emergency Credit Balance [INFO](5.7.5.15)*, *Accumulated Debt Register*
 2851 *[INFO](5.7.5.1)*, *Payment Debt Register [INFO](5.7.5.23)* and *Time Debt Registers [1 ... 2]*
 2852 *[INFO](5.7.5.36)* in the *Prepayment Daily Read Log(5.7.5.26)* every day at midnight UTC.

2853 **5.11.4.8 Half hour profile data**

2854 ESME shall be capable of recording in each 30 minute period (commencing at the start of
 2855 minutes 00 and 30 in each hour), the following information (including the UTC date and time
 2856 at the end of the 30 minute period to which the data relates) in the *Profile Data Log*
 2857 *[INFO](5.13.2.7)*:

- 2858 i. Active Energy Imported via the primary measuring element of its Electricity Meter;
- 2859 ii. Active Energy Exported via the primary measuring element of its Electricity Meter;
- 2860 iii. Reactive Energy Imported via the primary and secondary measuring elements of its
 2861 Electricity Meter;
- 2862 iv. Reactive Energy Exported via the primary measuring element of its Electricity Meter;
 2863 and
- 2864 v. Active Energy Imported via the secondary measuring element of its Electricity Meter.

2865 **5.11.4.9 Maximum Demand Import data**

2866 ESME shall be capable of calculating the average value of *Active Power Import*
 2867 *[INFO](5.13.2.1)* over each 30 minute period (commencing at the start of minutes 00 and 30
 2868 in each hour) and recording:

- 2869 i. to the *Maximum Demand Active Power Import Value(5.7.5.19)*, the maximum value
 2870 so calculated since the *Maximum Demand Active Power Import Value(5.7.5.19)* was
 2871 last reset (as set out in *Section 5.6.3.26*) including the UTC date and time at the end
 2872 of the 30 minute period to which the data relates; and
- 2873 ii. to the *Maximum Demand (Configurable Time) Active Power Import Value(5.7.5.20)*
 2874 the maximum value so calculated in any 30 minute period (commencing at the start
 2875 of minutes 00 and 30 in each hour) within the time period specified in *Maximum*
 2876 *Demand Configurable Time Period(5.7.4.26)* (including the UTC date and time at the
 2877 end of the 30 minute period to which the data relates) since the *Maximum Demand*
 2878 *(Configurable Time) Active Power Import Value(5.7.5.20)* was last reset (as set out
 2879 in *Section 5.6.3.28*).

2880 **5.11.4.10 Maximum Demand Export data**

2881 ESME shall be capable of calculating the average value of Active Power Export over each
 2882 30 minute period (commencing at the start of minutes 00 and 30 in each hour) and recording
 2883 to the *Maximum Demand Active Power Export Value(5.7.5.21)* the maximum value so
 2884 calculated since the *Maximum Demand Active Power Export Value(5.7.5.21)* was last reset
 2885 (as set out in *Section 5.6.3.27*) including the UTC date and time at the end of the 30 minute
 2886 period to which the data relates.

2887 **5.11.4.11 Power Threshold Status**

2888 ESME shall be capable of comparing the *Active Power Import [INFO](5.13.2.1)* against
 2889 thresholds and:

- 2890 i. if the *Active Power Import [INFO](5.13.2.1)* is equal to or lower than the *Low Medium*
 2891 *Power Threshold [INFO](5.7.4.24)*, setting *Power Threshold Status(5.7.5.24)* to low;

- 2892 ii. if the *Active Power Import [INFO](5.13.2.1)* is higher than the *Low Medium Power*
 2893 *Threshold [INFO](5.7.4.24)* and equal to or lower than the *Medium High Power*
 2894 *Threshold [INFO](5.7.4.29)*, setting *Power Threshold Status(5.7.5.24)* to medium;
 2895 and
 2896 iii. otherwise, setting the *Power Threshold Status(5.7.5.24)* to high.

2897 **5.11.4.12 Reactive Energy Imported**

2898 ESME shall be capable of recording cumulative Reactive Energy Imported via the primary
 2899 and secondary measuring elements of its Electricity Meter in the *Reactive Import*
 2900 *Register(5.7.5.30)*.

2901 **5.11.4.13 Reactive Energy Exported**

2902 ESME shall be capable of recording cumulative Reactive Energy Exported via the primary
 2903 measuring element of its Electricity Meter in the *Reactive Export Register(5.7.5.29)*.

2904 **5.12 Interface Requirements**

2905 **5.12.1 HAN Interface information provision**

2906 *Type 1 Devices and Type 2 Device information provision(5.6.1)* in Part A shall not apply to
 2907 ESME.

2908 ESME shall be capable, immediately upon establishment of a Communications Link with
 2909 Type 1 Devices (as set out in *Section 5.5.2.2*) and Type 2 Devices (as set out in *Section*
 2910 *5.5.2.3*), of providing the Data annotated [INFO] in *Sections 5.7.1, 5.7.4, 5.7.5, 5.13.1* and
 2911 *5.13.2* to Type 1 Devices and Type 2 Devices (with timely updates of any changes to all
 2912 data).

2913 **5.12.2 HAN Interface Commands**

2914 **5.12.2.1 Set Payment Mode**

2915 *Set Payment Mode(5.6.3.34)* in Part A shall not apply to ESME.

2916 A Command to set the payment mode as either Prepayment Mode or Credit Mode and to
 2917 record the mode of operation in *Payment Mode [INFO](5.7.4.31)*.

2918 In executing the Command, ESME shall be capable of taking a UTC date and time stamped
 2919 copy of:

- 2920 i. the *Tariff TOU Register Matrix [INFO](5.7.5.34)*;
 2921 ii. the *Secondary Tariff TOU Register Matrix [INFO](5.13.2.10)*;
 2922 iii. the *Tariff TOU Block Register Matrix(5.7.5.35)*;
 2923 iv. the *Active Import Register [INFO](5.7.5.3)*; and
 2924 v. the *Secondary Active Import Register [INFO](5.13.2.11)*,

2925 and unless in Credit Mode both before and after execution of the Command:

- 2926 vi. the *Meter Balance [INFO](5.7.5.22)*;
 2927 vii. the *Emergency Credit Balance [INFO](5.7.5.15)*;
 2928 viii. the *Payment Debt Register [INFO](5.7.5.23)*;
 2929 ix. the *Time Debt Registers [1 ... 2] [INFO](5.7.5.36)*; and
 2930 x. the *Accumulated Debt Register [INFO](5.7.5.1)*,

2931 in the *Billing Data Log(5.13.2.3)*.

2932 **5.12.2.2 Set Tariff**

2933 *Set Tariff(5.6.3.35)* in Part A shall not apply to ESME.

2934 A Command to accept new values for the *Tariff TOU Price Matrix [INFO](5.7.4.50)*, the
 2935 *Secondary Tariff TOU Price Matrix [INFO](5.13.1.1)*, the *Tariff Block Price Matrix*
 2936 *[INFO](5.7.4.47)*, the *Tariff Switching Table [INFO](5.13.1.2)* and the *Tariff Threshold Matrix*
 2937 *[INFO](5.7.4.49)*.

2938 In executing the Command, ESME shall be capable of taking a UTC date and time stamped
 2939 copy of:

- 2940 i. the *Tariff TOU Register Matrix [INFO](5.7.5.34)*;
- 2941 ii. the *Secondary Tariff TOU Register Matrix [INFO](5.13.2.10)*;
- 2942 iii. the *Tariff TOU Block Register Matrix(5.7.5.35)*;
- 2943 iv. the *Active Import Register [INFO](5.7.5.3)*; and
- 2944 v. the *Secondary Active Import Register [INFO](5.13.2.11)*,

2945 and where in Prepayment mode:

- 2946 vi. the *Meter Balance [INFO](5.7.5.22)*;
- 2947 vii. the *Emergency Credit Balance [INFO](5.7.5.15)*;
- 2948 viii. the *Payment Debt Register [INFO](5.7.5.23)*;
- 2949 ix. the *Time Debt Registers [1 ... 2] [INFO](5.7.5.36)*; and
- 2950 x. the *Accumulated Debt Register [INFO](5.7.5.1)*,

2951 in the *Billing Data Log(5.13.2.3)*.

2952 **5.13 Data Requirements**

2953 This Section describes the minimum information which ESME shall be capable of holding in
 2954 its Data Store.

2955 **5.13.1 Configuration Data**

2956 **5.13.1.1 Secondary Tariff TOU Price Matrix [INFO]**

2957 A 1 x 4 matrix containing Prices for Time-of-use Pricing Tariffs relating to Supply via the
 2958 secondary measuring element of the Electricity Meter.

2959 **5.13.1.2 Tariff Switching Table [INFO]**

2960 *Tariff Switching Table(5.7.4.48)* in Part A shall not apply to ESME.

2961 A set of rules for allocating:

- 2962 i. half-hourly Consumption via the primary measuring element of the Electricity Meter
 2963 to a Tariff Register in the *Tariff TOU Register Matrix [INFO](5.7.5.34)* if applying
 2964 Time-of-use Pricing, and in the *Tariff TOU Block Register Matrix(5.7.5.35)* if applying
 2965 Time-of-use with Block Pricing; and
- 2966 ii. half-hourly Consumption via the secondary measuring element of the Electricity
 2967 Meter to a Tariff Register in the *Secondary Tariff TOU Register Matrix*
 2968 *[INFO](5.13.2.10)*.

2969 The rules stored within the table shall specify which of 16 Day Profiles should be used to
 2970 allocate Consumption to Tariff Registers for Consumption via each of the primary and
 2971 secondary measuring elements of the Electricity Meter according to:

- 2972 iii. where the day is one of 50 Special Days, the Day Profile(s) specified for that
 2973 measuring element for that day; or
- 2974 iv. where the day is not a Special Day, the Day Profile(s) specified by the active
 2975 Season Profile and Week Profile for that measuring element for that day.

2976 The Switching Table shall support four Season Profiles and four Week Profiles. The
 2977 Switching Table shall support up to 200 switching rules across all Day Profiles.

2978 All dates and times shall be specified as UTC.

2979 **5.13.2 Operational Data**

2980 **5.13.2.1 Active Power Import [INFO]**

2981 *Active Power Import [INFO](5.7.5.4)* in Part A shall not apply to ESME.

2982 The sum of:

- 2983 i. the *Primary Active Power Import [INFO](5.13.2.5)* on the primary measuring element
- 2984 of the Electricity Meter; and
- 2985 ii. the *Secondary Active Power Import [INFO](5.13.2.8)* on the secondary measuring
- 2986 element of the Electricity Meter.

2987 **5.13.2.2 Active Tariff Price [INFO]**

2988 *Active Tariff Price [INFO](5.7.5.5)* in Part A shall not apply to ESME.

2989 **5.13.2.3 Billing Data Log**

2990 *Billing Data Log(5.7.5.10)* in Part A shall not apply to ESME.

2991 A log capable of storing the following UTC date and time stamped entries:

- 2992 i. twelve entries comprising the *Tariff TOU Register Matrix [INFO](5.7.5.34)*, the
- 2993 *Secondary Tariff TOU Register Matrix [INFO](5.13.2.10)*, the *Tariff TOU Block*
- 2994 *Register Matrix(5.7.5.35)*, the *Active Import Register [INFO](5.7.5.3)*, the *Secondary*
- 2995 *Active Import Register [INFO](5.13.2.11)*;

2996 and where in Prepayment mode:

- 2997 ii. five entries comprising the value of prepayment credits;
- 2998 iii. ten entries comprising the value of payment-based debt payments; and
- 2999 iv. twelve entries comprising *Meter Balance [INFO](5.7.5.22)*, *Emergency Credit*
- 3000 *Balance [INFO](5.7.5.15)*, *Accumulated Debt Register [INFO](5.7.5.1)*, *Payment*
- 3001 *Debt Register [INFO](5.7.5.23)* and *Time Debt Registers [1 ... 2] [INFO](5.7.5.36)*,

3002 each of (i) to (iv) arranged as a circular buffer such that when full, further writes shall cause

3003 the oldest entry to be overwritten.

3004 **5.13.2.4 Daily Read Log**

3005 *Daily Read Log(5.7.5.13)* in Part A shall not apply to ESME.

3006 A log capable of storing thirty one UTC date and time stamped entries of the *Tariff TOU*

3007 *Register Matrix [INFO](5.7.5.34)*, the *Secondary Tariff TOU Register Matrix*

3008 *[INFO](5.13.2.10)*, the *Tariff TOU Block Register Matrix(5.7.5.35)*, the *Active Import Register*

3009 *[INFO](5.7.5.3)*, the *Secondary Active Import Register [INFO](5.13.2.11)* and the *Active*

3010 *Export Register [INFO](5.7.5.2)* arranged as a circular buffer such that when full, further

3011 writes shall cause the oldest entry to be overwritten.

3012 **5.13.2.5 Primary Active Power Import [INFO]**

3013 The import of Active Power measured via the primary measuring element of the Electricity

3014 Meter.

3015 **5.13.2.6 Primary Active Tariff Price [INFO]**

3016 The Price currently active for Consumption via the primary measuring element of the

3017 Electricity Meter.

3018 **5.13.2.7 Profile Data Log [INFO]**

3019 *Profile Data Log [INFO](5.7.5.27)* in Part A shall not apply to ESME.

3020 A log capable of storing UTC date and time-stamped half hourly data (the amount of energy
3021 Imported or Exported in a half hour period) arranged as a circular buffer such that when full,
3022 further writes shall cause the oldest entry to be overwritten. The log shall be capable of
3023 storing a minimum of:

- 3024 i. 13 months of Active Energy Imported via the primary measuring element of the
3025 Electricity Meter;
- 3026 ii. 13 months of Active Energy Imported via the secondary measuring element of the
3027 Electricity Meter;
- 3028 iii. 3 months of Active Energy Exported via the primary measuring element of the
3029 Electricity Meter;
- 3030 iv. 3 months of Reactive Energy Imported via the primary and secondary measuring
3031 elements of the Electricity Meter; and
- 3032 v. 3 months of Reactive Energy Exported via the primary measuring element of the
3033 Electricity Meter.

3034 **5.13.2.8 Secondary Active Power Import [INFO]**

3035 The import of Active Power measured via the secondary measuring element of the Electricity
3036 Meter.

3037 **5.13.2.9 Secondary Active Tariff Price [INFO]**

3038 The Price currently active for Consumption via the secondary measuring element of the
3039 Electricity Meter.

3040 **5.13.2.10 Secondary Tariff TOU Register Matrix [INFO]**

3041 A 1 x 4 matrix for storing Tariff Registers for Time-of-use Pricing relating to Supply via the
3042 secondary measuring element of the Electricity Meter.

3043 **5.13.2.11 Secondary Active Import Register [INFO]**

3044 The register recording the cumulative Active Energy Imported via the secondary measuring
3045 element of the Electricity Meter.

3046 **Part C - Polyphase Electricity Metering** 3047 **Equipment**

3048 **5.14 Overview**

3049 In this Part C ESME shall mean Polyphase Electricity Metering Equipment.

3050 ESME shall meet the requirements of Part A save as set out in the remainder of this Part C.
3051 Requirements in a Part A Section that are disapplied by this Part C are identified in the Part
3052 C Section of the same name. Additional or amended requirements applied by this Part C
3053 are a continuation of the Part A Section of the same name and hence must also be met by
3054 ESME.

3055 **5.15 SMETS Testing and Certification Requirements**

3056 **5.15.1 Conformance with the SMETS**

3057 ESME shall have been tested to ensure that it meets the requirements described in this
3058 *Section 5 Part C*, and evidence must be available to confirm such testing and conformance.

3059 **5.15.2 Conformance with the Great Britain Companion** 3060 **Specification**

3061 ESME shall meet the requirements described in the Great Britain Companion Specification.

3062 ESME shall have been certified:

- 3063 i. by the ZigBee Alliance as being compliant with those ZigBee SEP requirements that
3064 are identified as being required in the Great Britain Companion Specification and
3065 that were certifiable under the ZigBee SEP certification scheme on 31 August 2017;
3066 and
- 3067 ii. by the DLMS User Association as being compliant with those DLMS COSEM
3068 requirements that are identified as being required described in the Great Britain
3069 Companion Specification and that were certifiable under the DLMS COSEM
3070 certification scheme on 31 August 2017.

3071 **5.15.3 Conformance with the Commercial Product Assurance** 3072 **Security Characteristics for GB Smart Metering**

3073 ESME shall meet the requirements described in the Commercial Product Assurance Security
3074 Characteristic Electricity Smart Metering Equipment.

3075 ESME shall be certified by NCSC as compliant with the Commercial Product Assurance
3076 Security Characteristic Electricity Smart Metering Equipment.

3077 **5.16 Physical Requirements**

3078 *Physical Requirements(5.4)* in Part A shall not apply to ESME.

3079 ESME shall as a minimum include the following components:

- 3080 i. a Clock;
- 3081 ii. a Data Store;
- 3082 iii. an Electricity Meter containing three measuring elements;
- 3083 iv. a HAN Interface;
- 3084 v. a Load Switch;
- 3085 vi. a Random Number Generator;

- 3086 vii. a User Interface; and
 3087 viii. where installed with a Communications Hub provided by the Data and
 3088 Communications Company, a Communications Hub Physical Interface (this may
 3089 comprise a Communications Hub Physical Interface forming part of GSME where
 3090 present at the time of installation in the Premises).

3091 The Communications Hub Physical Interface shall as a minimum include a physical interface
 3092 that meets the requirements defined by the Data and Communications Company at the time
 3093 of installation (available on the Data and Communications Company's website) and includes
 3094 provision for a DC power supply to the Communications Hub.

3095 ESME shall be mains powered and be capable of performing the minimum functional,
 3096 interface and data requirements set out in *Sections 5.17, 0* and *5.23* respectively operating
 3097 at a nominal voltage of 230VAC without consuming more than an average of 7 watts of
 3098 electricity under normal operating conditions.

3099 ESME shall be capable of automatically resuming operation after a power failure in its
 3100 operating state prior to such failure.

3101 ESME shall:

- 3102 ix. permanently display the *ESME Identifier(5.7.1.1)* on the ESME; and
 3103 x. have a Secure Perimeter.

3104 The HAN Interface of ESME shall be capable of joining a ZigBee SEP Smart Metering Home
 3105 Area Network which:

- 3106 xi. operates within the 2400 – 2483.5 MHz harmonised frequency band; and
 3107 xii. supports the Communications Links described in *Sections 5.6.1, 5.6.3, 5.6.4* and
 3108 *5.18.1*.

3109 On joining a ZigBee SEP Smart Metering Home Area Network ESME shall be capable of
 3110 generating and sending an Alert to that effect via its HAN Interface.

3111 ESME shall be designed taking all reasonable steps so as to prevent Unauthorised Physical
 3112 Access and Unauthorised communications through its Secure Perimeter that could
 3113 compromise the Confidentiality and / or Data Integrity of:

- 3114 xiii. Personal Data;
 3115 xiv. Consumption data used for billing;
 3116 xv. Security Credentials;
 3117 xvi. Random Number Generator;
 3118 xvii. Cryptographic Algorithms;
 3119 xviii. the Electricity Meter; and
 3120 xix. Firmware and data essential for ensuring its integrity,

3121 stored or executing on ESME.

3122 ESME shall be capable of detecting any attempt at Unauthorised Physical Access through
 3123 its Secure Perimeter that could compromise such Confidentiality and / or Data Integrity and
 3124 on such detection shall be capable of:

- 3125 xx. providing evidence of such an attempt through the use of tamper evident coatings or
 3126 seals,

3127 and where reasonably practicable:

- 3128 xxi. generating an entry to that effect in the *Security Log(5.7.5.31)*;
 3129 xxii. generating and sending an Alert to that effect via its HAN Interface; and
 3130 xxiii. where the *Supply Tamper State(5.7.4.44)* is configured to require Locking, sending
 3131 an Alert that the Supply is being disabled for this reason via its HAN Interface, and

3132 establishing a Locked state whereby the Supply is Disabled and can only be
 3133 Enabled or Armed in response to a Command to Arm the Supply (as described in
 3134 *Section 5.6.3.7*) or Enable the Supply (as described in *Section 5.6.3.12*).

3135 5.17 Functional Requirements

3136 ESME shall be capable of calculating Active Power Import, Consumption, Reactive Energy
 3137 Import, Active Energy Export and Reactive Energy Export values as follows:

- 3138 i. Active Power Import shall be the sum of the Active Power Import on the importing
 3139 measuring element(s) of its Electricity Meter less the sum of the Active Power Export
 3140 on the exporting measuring element(s) of its Electricity Meter;
- 3141 ii. Consumption shall be the sum of the cumulative Active Energy Imported on the
 3142 importing measuring element(s) of its Electricity Meter less the sum of the
 3143 cumulative Active Energy Exported on the exporting measuring element(s) of its
 3144 Electricity Meter;
- 3145 iii. Reactive Energy Import shall be the sum of the cumulative Reactive Energy Import
 3146 on the importing measuring element(s) of its Electricity Meter less the sum of the
 3147 cumulative Reactive Energy Export on the exporting measuring element(s) of its
 3148 Electricity Meter;
- 3149 iv. Active Energy Export shall be the sum of the cumulative Active Energy Export on the
 3150 exporting measuring element(s) of its Electricity Meter less the sum of the
 3151 cumulative Active Energy Import on the importing measuring element(s) of its
 3152 Electricity Meter; and
- 3153 v. Reactive Energy Export shall be the sum of the cumulative Reactive Energy Export
 3154 on the exporting measuring element(s) of its Electricity Meter less the sum of the
 3155 cumulative Reactive Energy Import on the importing measuring element(s) of its
 3156 Electricity Meter.

3157 If the result of any of the calculations (i) to (v) is negative then it shall be deemed to be zero.

3158 5.17.1 Phase Measurements

3159 ESME shall be capable of measuring:

- 3160 i. three phase four wire unbalanced supplies operating at a nominal voltage of
 3161 230VAC phase-to-neutral (400VAC phase-to-phase);
- 3162 ii. two phases of a three phase four wire system;
- 3163 iii. two phases of a three wire system 230-0-230VAC phase-to-neutral-to-phase
 3164 (460VAC phase-to-phase); and
- 3165 iv. the sum of two distinct one phase two wire 230VAC services with a common neutral.

3166 5.17.2 Voltage Quality Measurements

3167 *Voltage Quality Measurements(5.5.12)* in Part A shall not apply to ESME.

3168 5.17.2.1 Average RMS voltage phase [n]

3169 ESME shall be capable of calculating the average value of RMS voltage for phase [n] over a
 3170 configurable period as defined in the *Phase [n] Average RMS Voltage Measurement*
 3171 *Period(5.19.1.3)* and:

- 3172 i. recording the values calculated (including the UTC date and time at the end of the
 3173 period to which the values relate) in the *Phase [n] Average RMS Voltage Profile*
 3174 *Data Log(5.19.2.3)*;
- 3175 ii. detecting when the value calculated for phase [n] is above the *Phase [n] Average*
 3176 *RMS Over Voltage Threshold(5.19.1.1)* and on detection:

- 3177 a) counting the number of such occurrences in the *Phase [n] Average RMS Over*
3178 *Voltage Counter(5.19.2.1)*;
- 3179 b) where the value calculated in the prior configurable period was below the
3180 *Phase [n] Average RMS Over Voltage Threshold(5.19.1.1)*:
- 3181 ▪ generating an entry to that effect (including identification of the relevant
3182 phase) in the *Power Event Log(5.7.5.25)*; and
 - 3183 ▪ generating and sending an Alert to that effect (including identification of the
3184 relevant phase) via its HAN Interface.
- 3185 iii. detecting when the value calculated for phase [n] is below the *Phase [n] Average*
3186 *RMS Over Voltage Threshold(5.19.1.1)* and where the value calculated in the prior
3187 configurable period was above the *Phase [n] Average RMS Over Voltage*
3188 *Threshold(5.19.1.1)*:
- 3189 a) generating an entry to that effect (including identification of the relevant phase)
3190 in the *Power Event Log(5.7.5.25)*; and
 - 3191 b) generating and sending an Alert to that effect (including identification of the
3192 relevant phase) via its HAN Interface.
- 3193 iv. detecting when the value calculated for phase [n] is below the *Phase [n] Average*
3194 *RMS Under Voltage Threshold(5.19.1.2)* and on detection:
- 3195 a) counting the number of such occurrences in the *Phase [n] Average RMS Under*
3196 *Voltage Counter(5.19.2.2)*;
 - 3197 b) where the value calculated for phase [n] in the prior configurable period was
3198 above the *Phase [n] Average RMS Under Voltage Counter(5.19.2.2)*:
 - 3199 ▪ generating an entry to that effect (including identification of the relevant
3200 phase) in the *Power Event Log(5.7.5.25)*; and
 - 3201 ▪ generating and sending an Alert to that effect (including identification of the
3202 relevant phase) via its HAN Interface.
- 3203 v. detecting when the value calculated for phase [n] is above the *Phase [n] Average*
3204 *RMS Under Voltage Threshold(5.19.1.2)* and where the value calculated in the prior
3205 configurable period was below the *Phase [n] Average RMS Under Voltage*
3206 *Threshold(5.19.1.2)*:
- 3207 a) generating an entry to that effect (including identification of the relevant phase)
3208 in the *Power Event Log(5.7.5.25)*; and
 - 3209 b) generating and sending an Alert to that effect (including identification of the
3210 relevant phase) via its HAN Interface.

3211 **5.17.2.2 RMS extreme over voltage detection**

3212 ESME shall be capable of:

- 3213 i. detecting when the RMS voltage for phase [n] rises above the *RMS Extreme Over*
3214 *Voltage Threshold(5.7.4.35)* for a continuous period longer than the *RMS Extreme*
3215 *Over Voltage Measurement Period(5.7.4.34)* and on detection:
 - 3216 a) generating an entry to that effect (including identification of the relevant phase)
3217 in the *Power Event Log(5.7.5.25)*; and
 - 3218 b) generating and sending an Alert to that effect (including identification of the
3219 relevant phase) via its HAN Interface.
- 3220 ii. detecting when the RMS voltage for phase [n] returns below the *RMS Extreme Over*
3221 *Voltage Threshold(5.7.4.35)* for a continuous period longer than the *RMS Extreme*
3222 *Over Voltage Measurement Period(5.7.4.34)* and on detection:

- 3223 a) generating an entry to that effect (including identification of the relevant phase)
3224 in the *Power Event Log(5.7.5.25)*; and
3225 b) generating and sending an Alert to that effect (including identification of the
3226 relevant phase) via its HAN Interface.

3227 **5.17.2.3 RMS extreme under voltage detection**

3228 ESME shall be capable of:

- 3229 i. detecting when the RMS voltage for phase [n] falls below the *RMS Extreme Under*
3230 *Voltage Threshold(5.7.4.37)* for longer than the *RMS Extreme Under Voltage*
3231 *Measurement Period(5.7.4.36)* and on detection:
- 3232 a) generating an entry to that effect (including identification of the relevant phase)
3233 in the *Power Event Log(5.7.5.25)*; and
3234 b) generating and sending an Alert to that effect (including identification of the
3235 relevant phase) via its HAN Interface.
- 3236 ii. detecting when the RMS voltage for phase [n] returns above the *RMS Extreme*
3237 *Under Voltage Threshold(5.7.4.37)* for longer than the *RMS Extreme Under Voltage*
3238 *Measurement Period(5.7.4.36)* and on detection:
- 3239 a) generating an entry to that effect (including identification of the relevant phase)
3240 in the *Power Event Log(5.7.5.25)*; and
3241 b) generating and sending an Alert to that effect (including identification of the
3242 relevant phase) via its HAN Interface.

3243 **5.17.2.4 RMS voltage sag detection**

3244 ESME shall be capable of:

- 3245 i. detecting when the RMS voltage for phase [n] falls below the *RMS Voltage Sag*
3246 *Threshold(5.7.4.40)* for a continuous period longer than the *RMS Voltage Sag*
3247 *Measurement Period(5.7.4.38)* and on detection:
- 3248 a) generating an entry to that effect (including identification of the relevant phase)
3249 in the *Power Event Log(5.7.5.25)*; and
3250 b) generating and sending an Alert to that effect (including identification of the
3251 relevant phase) via its HAN Interface.
- 3252 ii. detecting when the RMS voltage for phase [n] returns above the *RMS Voltage Sag*
3253 *Threshold(5.7.4.40)* for a continuous period longer than the *RMS Voltage Sag*
3254 *Measurement Period(5.7.4.38)* and on detection:
- 3255 a) generating an entry to that effect (including identification of the relevant phase)
3256 in the *Power Event Log(5.7.5.25)*; and
3257 b) generating and sending an Alert to that effect (including identification of the
3258 relevant phase) via its HAN Interface.

3259 **5.17.2.5 RMS voltage swell detection**

3260 ESME shall be capable of:

- 3261 i. detecting when the RMS voltage for phase [n] rises above the *RMS Voltage Swell*
3262 *Threshold(5.7.4.41)* for a continuous period longer than the *RMS Voltage Swell*
3263 *Measurement Period(5.7.4.39)* and on detection:
- 3264 a) generating an entry to that effect (including identification of the relevant phase)
3265 in the *Power Event Log(5.7.5.25)*; and
3266 b) generating and sending an Alert to that effect (including identification of the
3267 relevant phase) via its HAN Interface.

- 3268 ii. detecting when the RMS voltage for phase [n] returns below the *RMS Voltage Swell*
 3269 *Threshold*(5.7.4.41) for a continuous period longer than the *RMS Voltage Swell*
 3270 *Measurement Period*(5.7.4.39) and on detection:
- 3271 a) generating an entry to that effect (including identification of the relevant phase)
 3272 in the *Power Event Log*(5.7.5.25); and
- 3273 b) generating and sending an Alert to that effect (including identification of the
 3274 relevant phase) via its HAN Interface.

3275 5.17.2.6 Supply outage reporting phase [n]

3276 ESME shall be capable of recording the UTC date and time at which the Supply via phase
 3277 [n] is interrupted and:

- 3278 i. generating entries to that effect in the *Power Event Log*(5.7.5.25); and
- 3279 ii. where Supply via phase [n] has not been restored 3 minutes after interruption, and
 3280 ESME still has a power Supply, generating and sending an Alert to that effect via its
 3281 HAN Interface.

3282 ESME shall be capable of recording the UTC date and time at which the Supply via phase
 3283 [n] is restored and:

- 3284 iii. generating entries to that effect in the *Power Event Log*(5.7.5.25);
- 3285 iv. following restoration of the Supply via phase [n], generating and sending an Alert to
 3286 that effect via its HAN Interface containing details of the UTC dates and times of
 3287 interruption and restoration; and
- 3288 v. following restoration of the Supply via phase [n], when the time difference between
 3289 the Supply being interrupted and restored is greater than or equal to three minutes,
 3290 generating and sending an Alert to that effect via its HAN Interface containing details
 3291 of the UTC date and time of interruption and restoration.

3292 5.17.3 Presentation of information on the User Interface

3293 *Presentation of information on the User Interface* (5.5.4.1) in Part A shall not apply to ESME.

3294 For each of the values currently stored in the *Active Import Register [INFO]*(5.7.5.3), the *Active*
 3295 *Export Register [INFO]*(5.7.5.2), the *Tariff ToU Register Matrix [INFO]*(5.7.5.34), and the *Tariff*
 3296 *ToU Block Register Matrix*(5.7.5.35), ESME shall be capable of displaying a value calculated
 3297 from the stored value by:

- 3298 i. converting the stored value in to a decimal, integer number of kilowatt hours,
 3299 rounding the stored value down to the nearest kilowatt hour;
- 3300 ii. discarding all except the six least significant decimal digits so produced; and
- 3301 iii. adding leading zeros (if necessary) so that there are exactly six decimal digits.

3302 5.18 Interface Requirements

3303 5.18.1 HAN Interface Commands

3304 5.18.1.1 Reset Phase [n] Average RMS Over Voltage Counter

3305 A Command to reset the *Phase [n] Average RMS Over Voltage Counter*(5.19.2.1) to zero.

3306 5.18.1.2 Reset Phase [n] Average RMS Under Voltage Counter

3307 A Command to reset the *Phase [n] Average RMS Under Voltage Counter*(5.19.2.2) to zero.

3308 5.19 Data Requirements

3309 This Section describes the minimum information which ESME shall be capable of holding in
 3310 its Data Store.

3311 **5.19.1 Configuration Data**

3312 **5.19.1.1 Phase [n] Average RMS Over Voltage Threshold**

3313 The average RMS voltage for phase [n] above which an over voltage condition is reported.
3314 The threshold shall be configurable within the specified operating range of ESME.

3315 **5.19.1.2 Phase [n] Average RMS Under Voltage Threshold**

3316 The average RMS voltage for phase [n] below which an under voltage condition is reported.
3317 The threshold shall be configurable within the specified operating range of ESME.

3318 **5.19.1.3 Phase [n] Average RMS Voltage Measurement Period**

3319 The length of time in seconds over which the RMS voltage is averaged for phase [n].

3320 **5.19.2 Operational Data**

3321 **5.19.2.1 Phase [n] Average RMS Over Voltage Counter**

3322 The number of times the average RMS voltage for phase [n], as calculated in *Section*
3323 *5.17.2.1*, has been above the *Phase [n] Average RMS Over Voltage Threshold(5.19.1.1)*
3324 since this counter was last reset.

3325 **5.19.2.2 Phase [n] Average RMS Under Voltage Counter**

3326 The number of times the average RMS voltage for phase [n], as calculated in accordance
3327 with *Section 5.17.2.1*, has been below the *Phase [n] Average RMS Under Voltage*
3328 *Threshold(5.19.1.2)* since this counter was last reset.

3329 **5.19.2.3 Phase [n] Average RMS Voltage Profile Data Log**

3330 A log capable of storing 4320 entries (including the UTC date and time at the end of the
3331 period to which the values relate) comprising the averaged RMS voltage for phase [n] for
3332 each *Phase [n] Average RMS Voltage Measurement Period(5.19.1.3)* arranged as a circular
3333 buffer such that when full, further writes shall cause the oldest entry to be overwritten.

3334 Part D - Auxiliary Load Control Switch

3335 5.20 Overview

3336 This Part D describes the minimum additional functional, interface and data requirements of
 3337 ESME where one or more Auxiliary Load Control Switches are installed within ESME.
 3338 Additional requirements applied by this Part D are a continuation of the Part A Section of the
 3339 same name (where relevant as modified by Part B or Part C) and hence must also be met by
 3340 ESME within which one or more Auxiliary Load Control Switches are installed.

3341 5.21 Functional Requirements

3342 5.21.1 Switching Auxiliary Loads

3343 ESME shall be capable of monitoring the *Auxiliary Load Control Switch Calendar*(5.7.4.2)
 3344 and opening or closing Auxiliary Load Control Switch [n] at times defined in the calendar.

3345 ESME shall only be capable of closing Auxiliary Load Control Switch [n] if the Supply is
 3346 Enabled. If the Supply is Disabled, then on Enablement ESME shall be capable of causing
 3347 the Auxiliary Load Control Switch [n] to open, close or maintain its state as defined in the
 3348 *Auxiliary Load Control Switch Calendar*(5.7.4.2).

3349 When switching Auxiliary Loads as set out in this *Section 5.21.1*, ESME shall be capable of:

- 3350 i. applying the *Randomised Offset*(5.7.5.28); and
- 3351 ii. setting the *Auxiliary Load Control Switch [n] - Status*(5.23.1.1) to open and closed.

3352 5.22 Interface Requirements

3353 5.22.1 User Interface Commands

3354 5.22.1.1 Test Auxiliary Load Control Switch [n]

3355 A Command to cause an Auxiliary Load Control Switch [n] to change its state for 5 minutes
 3356 and then to revert to normal operation in accordance with the *Auxiliary Load Control Switch*
 3357 *Calendar*(5.7.4.2).

3358 In executing the Command ESME shall be capable of recording the Command and Outcome
 3359 to the *Event Log*(5.7.5.16).

3360 5.22.2 HAN Interface Commands

3361 5.22.2.1 Close Auxiliary Load Control Switch [n]

3362 A Command to cause Auxiliary Load Control Switch [n] to close immediately. The
 3363 Command shall include a time period. When this time period has elapsed, ESME shall be
 3364 capable of causing the switch to open or remain closed as defined in the *Auxiliary Load*
 3365 *Control Switch Calendar*(5.7.4.2).

3366 A Command to close an Auxiliary Load Control Switch [n] shall be executed only if the
 3367 Supply is Enabled. If the Supply is Armed or Disabled, the Command shall be executed
 3368 when the Supply is Enabled if, on Enablement, the time period included in the Command
 3369 has not elapsed.

3370 In executing the Command, ESME shall be capable of:

- 3371 i. recording the Command and Outcome to the *Auxiliary Load Control Switch Event*
 3372 *Log*(5.7.5.6); and
- 3373 ii. updating the corresponding *Auxiliary Load Control Switch [n] - Status*(5.23.1.1) to
 3374 indicate whether the switch is now open or closed.

3375 **5.22.2.2 Open Auxiliary Load Control Switch [n]**

3376 A Command to cause Auxiliary Load Control Switch [n] to open immediately. The Command
3377 shall include a time period. When this time period has elapsed, ESME shall be capable of
3378 causing the switch to close or remain open as defined in the *Auxiliary Load Control Switch*
3379 *Calendar*(5.7.4.2).

3380 In executing the Command, ESME shall be capable of:

- 3381 i. recording the Command and Outcome to the *Auxiliary Load Control Switch Event*
3382 *Log*(5.7.5.6); and
- 3383 ii. updating the corresponding *Auxiliary Load Control Switch [n] - Status*(5.23.1.1) to
3384 indicate whether the switch is now open or closed.

3385 **5.22.2.3 Reset Auxiliary Load Control Switch [n]**

3386 A Command to cause the Auxiliary Load Control Switch [n] to open, close or maintain its
3387 state, as defined in the *Auxiliary Load Control Switch Calendar*(5.7.4.2).

3388 A Command to close an Auxiliary Load Control Switch [n] shall be executed only if the
3389 Supply is Enabled. If the Supply is Armed or Disabled, the Command shall be executed
3390 when the Supply is Enabled.

3391 In executing the Command, ESME shall be capable of:

- 3392 i. recording the Command and Outcome to the *Auxiliary Load Control Switch Event*
3393 *Log*(5.7.5.6); and
- 3394 ii. updating the corresponding *Auxiliary Load Control Switch [n] - Status*(5.23.1.1) to
3395 indicate whether the switch is now open or closed.

3396 **5.23 Data Requirements**

3397 **5.23.1 Operational Data**

3398 **5.23.1.1 Auxiliary Load Control Switch [n] - Status**

3399 The current status (being 'open' or 'closed') of Auxiliary Load Control Switch [n] as
3400 commanded by ESME.

3401 Part E - Boost Function

3402 5.24 Overview

3403 This Part E describes the minimum additional functional and data requirements of ESME
3404 where a Boost Function is installed within ESME. Additional requirements applied by this
3405 Part E are a continuation of the Part A Section of the same name (where relevant as
3406 modified by Part B or Part C and / or Part D) and hence must also be met by ESME within
3407 which a Boost Function is installed.

3408 5.25 Functional Requirements

3409 5.25.1 User Interface Commands

3410 In executing the Commands in this *Section 5.25.1* ESME shall be capable of recording UTC
3411 date and time at the beginning and end of any Boost Period in the *Boost Function Event*
3412 *Log(5.26.3.1)*.

3413 5.25.1.1 Activate Boost Period

3414 A Command to cause the Auxiliary Load Control Switch(es) specified in *Boost Function*
3415 *Control [n](5.26.2.1)* to close for 15, 30, 45 or 60 minutes and then to revert to normal
3416 operation in accordance with the *Auxiliary Load Control Switch Calendar(5.7.4.2)*.

3417 ESME shall only be capable of executing this Command if no Boost Period is currently
3418 active.

3419 5.25.1.2 Cancel Boost Period

3420 A Command to cause the Auxiliary Load Control Switch(es) specified in *Boost Function*
3421 *Control [n](5.26.2.1)* to revert to normal operation in accordance with the *Auxiliary Load*
3422 *Control Switch Calendar(5.7.4.2)*.

3423 ESME shall only be capable of executing this Command if a Boost Period is active.

3424 In executing the Command ESME shall be capable of generating an entry in the *Boost*
3425 *Function Event Log(5.26.3.1)* to the effect that the active Boost Period has been cancelled.

3426 5.25.1.3 Extend Boost Period

3427 A Command to cause the Auxiliary Load Control Switch(es) specified in *Boost Function*
3428 *Control [n](5.26.2.1)* to remain closed for an additional 15, 30, 45 minutes, and then to revert
3429 to normal operation in accordance with the *Auxiliary Load Control Switch Calendar(5.7.4.2)*.

3430 ESME shall only be capable of executing this Command if a Boost Period is active. In
3431 executing the Command ESME shall be capable of limiting any active Boost Period to a
3432 maximum of 60 minutes.

3433 5.26 Data Requirements

3434 5.26.1 Constant Data

3435 5.26.1.1 Boost Function Availability

3436 A data item to identify if ESME has a configured Boost Function.

3437 **5.26.2 Configuration Data**

3438 **5.26.2.1 Boost Function Control [n]**

3439 A data item to identify whether Auxiliary Load Control Switch [n] is to be controlled by the
3440 Boost Function.

3441 **5.26.3 Operational Data**

3442 **5.26.3.1 Boost Function Event Log**

3443 A single log capable of storing entries for the most recent 25 Boost Periods including the
3444 UTC date and time of the beginning and end of the Boost Period.

3445 6 In Home Display Technical 3446 Specifications

3447 6.1 Overview

3448 *Section 6* of this document describes the minimum physical, minimum functional, minimum
3449 interface, minimum data and minimum testing and certification requirements of an In-home
3450 Display maintained to comply with the smart metering licence conditions (standard condition
3451 34 of gas supply licences and / or standard condition 40 of electricity supply licences).

3452 6.2 SMETS Testing and Certification Requirements

3453 6.2.1 Conformance with the SMETS

3454 The IHD shall have been tested to ensure that it meets the requirements described in this
3455 *Section 6*, and evidence must be available to confirm such testing and conformance.

3456 6.2.2 ZigBee Alliance Certification

3457 The IHD shall have been certified by the ZigBee Alliance as being compliant with those
3458 ZigBee SEP requirements that are identified as being required in the Great Britain
3459 Companion Specification and that were certifiable under the ZigBee SEP certification
3460 scheme on 31 August 2017.

3461 6.3 Physical requirements

3462 The IHD shall as a minimum include the following components:

- 3463 i. a Data Store;
- 3464 ii. a HAN Interface;
- 3465 iii. a User Interface; and
- 3466 xi. when capable of operating within Sub GHz Bands, a Timer.

3467 The IHD shall be mains powered and shall be capable of performing the minimum functional,
3468 interface and data requirements set out in *Sections 6.4, 6.5 and 6.6* respectively operating at
3469 a nominal voltage of 230VAC without consuming more than an average of 0.6 watts of
3470 electricity under normal operating conditions.

3471 The IHD shall:

- 3472 iv. permanently display the *IHD Identifier(6.6.1.1)* on the IHD;

3473 The HAN Interface of the IHD shall be capable of joining a ZigBee SEP Smart Metering
3474 Home Area Network which:

- 3475 v. operates within the 2400 – 2483.5 MHz harmonised frequency band or Sub GHz
3476 Bands; and
- 3477 vi. supports the Communications Links described in *Section 6.5*.

3478 The IHD shall be designed to enable the information displayed on it to be easily accessed
3479 and presented in a form that is clear and easy to understand including by Consumers with
3480 impaired:

- 3481 vii. sight;
- 3482 viii. memory and learning ability;
- 3483 ix. perception and attention; or
- 3484 x. dexterity.

3485 When operating within Sub GHz Bands, the IHD shall:

- 3486 xii. be capable of supporting Frequency Agility;
- 3487 xiii. not exceed a transmit power of 25 mW; and
- 3488 xiv. not exceed a duty cycle of 0.35%.

3489 **6.4 Functional requirements**

3490 This Section describes the minimum functions that the IHD shall be capable of performing.

3491 **6.4.1 Communications**

3492 The IHD shall be capable of establishing Communications Links via its HAN Interface.

3493 The IHD shall be capable of ensuring that the security characteristics of all Communications
3494 Links it establishes meet the requirements described in *Section 6.4.5.2*.

3495 **6.4.1.1 Communications Links with ESME and the Gas Proxy Function via the HAN** 3496 **Interface**

3497 The IHD shall be capable of establishing and maintaining Communications Links via its HAN
3498 Interface with one ESME and one Gas Proxy Function.

3499 In establishing the Communications Link, the IHD shall be capable of using its Security
3500 Credentials to enable it to be Authenticated.

3501 The IHD shall be capable of supporting the following types of Communications Links:

- 3502 i. receiving Pricing and Consumption information from ESME; and
- 3503 ii. receiving Pricing and Consumption information from a Gas Proxy Function.

3504 The IHD shall be capable of detecting a failure of a Communications Link and on detection
3505 of a failure, shall be capable of clearing or suitably annotating the information displayed on
3506 its User Interface (set out in *Sections 6.4.2, 6.4.3 and 6.4.4*) to indicate that the information
3507 may be out of date.

3508 **6.4.2 General Information**

3509 The IHD shall be capable immediately upon establishment of a Communications Link with
3510 ESME and a Gas Proxy Function (as set out in *Section 6.4.1.1*), of providing the following
3511 information on its User Interface and providing updates of any changes to the information
3512 every 10 seconds thereafter.

3513 **6.4.2.1 Connection Link Quality**

3514 The signal strength of its HAN Interface.

3515 **6.4.2.2 Local Time**

3516 Time as UTC with adjustment for British Summer Time.

3517 **6.4.3 Information pertaining to the Supply of gas to the Premises**

3518 The IHD shall be capable immediately upon establishment of a Communications Link with a
3519 Gas Proxy Function (as set out in *Section 6.4.1.1*), of providing the following information⁴ on
3520 its User Interface and providing timely updates of any changes to the information thereafter.

3521 The IHD shall be capable of displaying Currency Units in GB Pounds and European Central
3522 Bank Euro.

⁴ Information that shall be capable of being provided in numerical form is annotated [NUM]. Information that shall be capable of being provided in Ambient form is annotated [AMB]. Where information is not annotated the information may be provided in any visual format.

3523 **6.4.3.1 Active Tariff Price [NUM]**

3524 The active Tariff Price for Energy Consumption in Currency Units per kWh.

3525 **6.4.3.2 Cumulative Consumption [NUM]**

- 3526 i. Current Day cumulative Energy Consumption;
- 3527 ii. Current Day cost to the Consumer of cumulative Energy Consumption in Currency
- 3528 Units;
- 3529 iii. Current Week cumulative Energy Consumption;
- 3530 iv. Current Week cost to the Consumer of cumulative Energy Consumption in Currency
- 3531 Units;
- 3532 v. Current month cumulative Energy Consumption; and
- 3533 vi. Current month cost to the Consumer of cumulative Energy Consumption in Currency
- 3534 Units.

3535 **6.4.3.3 Customer Identification Number [NUM]**

3536 A number issued to the IHD for display on the User Interface.

3537 **6.4.3.4 Debt [NUM]**3538 Either Aggregate Debt or time-based and payment-based debt when GSME is operating in
3539 Prepayment Mode.3540 **6.4.3.5 Debt Recovery Rate [NUM]**3541 Either Aggregate Debt Recovery Rate or each Time-based Debt Recovery rate when GSME
3542 is operating in Prepayment Mode.3543 **6.4.3.6 Emergency Credit Balance [NUM]**3544 The Emergency Credit balance where Emergency Credit is activated (including a clear
3545 indication that Emergency Credit has been activated).3546 **6.4.3.7 Historic Consumption**

- 3547 i. D-1 to D-8 historic Energy Consumption;
- 3548 ii. D-1 to D-8 cost to the Consumer of historic Energy Consumption in Currency Units;
- 3549 iii. W-1 to W-5 historic Energy Consumption;
- 3550 iv. W-1 to W-5 cost to the Consumer of historic Energy Consumption in Currency Units;
- 3551 v. M-1 to M-13 historic Energy Consumption; and
- 3552 vi. M-1 to M-13 cost to the Consumer of historic Energy Consumption in Currency
- 3553 Units.

3554 where: D-1 = current Day minus 1, D-2 = current Day minus 2, W-1 = current Week minus 1,
3555 M-1 = current month minus 1, etc.3556 **6.4.3.8 Low Credit Alert**3557 An indication that the combined *Meter Balance [NUM]*(6.4.3.9) and *Emergency Credit*
3558 *Balance [NUM]*(6.4.3.6) has fallen below a low credit threshold.3559 **6.4.3.9 Meter Balance [NUM]**3560 The amount of money in Currency Units as determined by GSME. If operating in
3561 Prepayment Mode, the Meter Balance represents GSME's determination of the amount of
3562 credit available to the Consumer (excluding any *Emergency Credit Balance [NUM]*(6.4.3.6)).
3563 If operating in Credit Mode, it represents GSME's determination of the amount of money due
3564 from the Consumer since the Meter Balance was last reset.

3565 **6.4.3.10 Payment Mode**

3566 The current mode of operation of GSME, being Prepayment Mode or Credit Mode.

3567 **6.4.4 Information pertaining to the Supply of electricity to the**
3568 **Premises**3569 The IHD shall be capable, upon establishment of a Communications Link with ESME (as set
3570 out in *Section 6.4.1.1*), of providing the following information⁵ on its User Interface and
3571 providing updates of any changes to the information every 10 seconds thereafter.3572 The IHD shall be capable of displaying Currency Units in GB Pounds and European Central
3573 Bank Euro.3574 **6.4.4.1 Active Tariff Price [NUM]**

3575 The active Tariff Price for Consumption in Currency Units per kWh.

3576 **6.4.4.2 Cumulative Consumption [NUM]**

- 3577 i. Current Day cumulative Consumption;
- 3578 ii. Current Day cost to the Consumer of cumulative Consumption in Currency Units;
- 3579 iii. Current Week cumulative Consumption;
- 3580 iv. Current Week cost to the Consumer of cumulative Consumption in Currency Units;
- 3581 v. Current month cumulative Consumption; and
- 3582 vi. Current month cost to the Consumer of cumulative Consumption in Currency Units.

3583 **6.4.4.3 Customer Identification Number [NUM]**

3584 A number issued to the IHD for display on the User Interface.

3585 **6.4.4.4 Debt [NUM]**3586 Either Aggregate Debt or time-based and payment-based debt when ESME is operating in
3587 Prepayment Mode.3588 **6.4.4.5 Debt Recovery Rate [NUM]**3589 Either Aggregate Debt Recovery Rate or each Time-based Debt Recovery rate when ESME
3590 is operating in Prepayment Mode.3591 **6.4.4.6 Emergency Credit Balance [NUM]**3592 The Emergency Credit balance where Emergency Credit is activated in ESME (including a
3593 clear indication that the Emergency credit has been activated).3594 **6.4.4.7 Historic Consumption**

- 3595 i. D-1 to D-8 historic Consumption;
- 3596 ii. D-1 to D-8 cost to the Consumer of historic Consumption in Currency Units;
- 3597 iii. W-1 to W-5 historic Consumption;
- 3598 iv. W-1 to W-5 cost to the Consumer of historic Consumption in Currency Units;
- 3599 v. M-1 to M-13 historic Consumption; and
- 3600 vi. M-1 to M-13 cost to the Consumer of historic Consumption in Currency Units.

3601 where: D-1 = current Day minus 1, D-2 = current Day minus 2, W-1 = current Week minus 1,
3602 M-1 = current month minus 1 etc.

⁵ Information that shall be capable of being provided in numerical form is annotated [NUM]. Information that shall be capable of being provided in Ambient form is annotated [AMB]. Where information is not annotated the information may be provided in any visual format.

3603 **6.4.4.8 Instantaneous Active Power Import [NUM]**

3604 A near real-time indication of the Active Power Import in kW and the cost to the Consumer of
3605 maintaining that Instantaneous Active Power Import for one hour.

3606 **6.4.4.9 Low Credit Alert**

3607 An indication that the combined *Meter Balance [NUM]*(6.4.4.10) and *Emergency Credit*
3608 *Balance*(6.4.4.6) has fallen below a low credit threshold.

3609 **6.4.4.10 Meter Balance [NUM]**

3610 The amount of money in Currency Units as determined by ESME. If operating in
3611 Prepayment Mode, the Meter Balance represents ESME's determination of the amount of
3612 credit available to the Consumer (excluding any *Emergency Credit Balance*(6.4.4.6)). If
3613 operating in Credit Mode, it represents ESME's determination of the amount of money due
3614 from the Consumer since the Meter Balance was last reset.

3615 **6.4.4.11 Payment Mode**

3616 The current mode of operation of ESME, being Prepayment Mode or Credit Mode.

3617 **6.4.4.12 Power Threshold Status [AMB]**

3618 An indication of the level of Active Power Import as high, medium or low.

3619 **6.4.5 Security**

3620 **6.4.5.1 General**

3621 The IHD shall be designed taking all reasonable steps so as to ensure that any failure or
3622 compromise of its integrity shall not compromise the Security Credentials or Personal Data
3623 stored on it or compromise the integrity of any other Device to which it is connected by
3624 means of a Communications Link.

3625 **6.4.5.2 Communications**

3626 The IHD shall be capable of preventing and detecting, on all of its interfaces, Unauthorised
3627 access that could compromise the Confidentiality and / or Data Integrity of:

- 3628 i. Personal Data whilst being transferred via an interface;
3629 ii. Consumption data used for billing whilst being transferred via an Interface; and
3630 iii. Security Credentials whilst being transferred via an interface.

3631 **6.5 Interface Requirements**

3632 This Section describes the minimum required interactions which the IHD shall be capable of
3633 undertaking with ESME and / or a Gas Proxy Function as appropriate via its HAN Interface.

3634 **6.5.1 Receipt of information via the HAN Interface**

3635 The IHD shall be capable, immediately upon establishment of a Communications Link with
3636 ESME and / or a Gas Proxy Function (as set out in *Section 6.4.1.1*) of (as relevant):

- 3637 i. receiving information (and updates of any changes of this information every 10
3638 seconds thereafter) required to meet the display requirements described in *Section*
3639 *6.4.2*;
3640 ii. receiving information (and timely updates of any changes to the information
3641 thereafter) required to meet the display requirements described in *Section 6.4.3*; and
3642 iii. receiving information (and updates of any changes of this information every 10
3643 seconds thereafter) required to meet the display requirements described in *Section*
3644 *6.4.4*.

3645 **6.6 Data requirements**

3646 This Section describes the minimum information which the IHD shall be capable of holding in
3647 its Data Store.

3648 **6.6.1 Constant data**

3649 Describes data that remains constant and unchangeable at all times.

3650 **6.6.1.1 IHD Identifier**

3651 A globally unique identifier used to identify the IHD based on the EUI-64 Institute of Electrical
3652 and Electronic Engineers standard.

7 Prepayment Interface Device Technical Specifications

7.1 Overview

Section 7 of this document describes the minimum physical, minimum functional, minimum interface, minimum data and minimum testing and certification requirements of a Prepayment Interface Device (PPMID), where it is maintained by a Supplier in accordance with standard condition 46 of the gas supply licence and / or standard condition 52 of the electricity supply licence.

7.2 SMETS Testing and Certification Requirements

7.2.1 Conformance with the SMETS

A PPMID shall have been tested to ensure that it meets the requirements described in this Section 7, and evidence must be available to confirm such testing and conformance.

7.2.2 Conformance with the Great Britain Companion Specification

A PPMID shall meet the requirements described in the Great Britain Companion Specification.

A PPMID shall have been certified by the ZigBee Alliance as being compliant with those ZigBee SEP requirements that are identified as being required in the Great Britain Companion Specification and that were certifiable under the ZigBee SEP certification scheme on 31 August 2017.

7.3 Physical Requirements

A PPMID shall as a minimum include the following components:

- i. a Data Store;
- ii. a HAN Interface;
- iii. a User Interface; and
- xiv. when capable of operating within Sub GHz Bands, a Timer.

A PPMID shall:

- iv. permanently display the *PPMID Identifier*(7.6.1.1) on the PPMID; and
- v. have a Secure Perimeter.

The HAN Interface of a PPMID shall be capable of joining a ZigBee SEP Smart Metering Home Area Network which:

- vi. operates within the 2400 – 2483.5 MHz harmonised frequency band or Sub GHz Bands; and
- vii. supports the Communications Links described in Sections 7.5.1, 7.5.2, 7.5.4 and 7.5.5.

The PPMID shall be designed taking all reasonable steps so as to prevent Unauthorised Physical Access and Unauthorised communications through its Secure Perimeter that could compromise the Confidentiality and / or Data Integrity of:

- viii. Personal Data;
- ix. Security Credentials;
- x. Cryptographic Algorithms; and

- 3693 xi. Firmware and data essential for ensuring its integrity,
 3694 stored or executing on the PPMID.
- 3695 The PPMID shall be capable of detecting any attempt at Unauthorised Physical Access
 3696 through its Secure Perimeter that could compromise such Confidentiality and / or Data
 3697 Integrity and on such detection shall be capable of:
- 3698 xii. providing evidence of such an attempt through the use of tamper evident coatings or
 3699 seals;
- 3700 and where reasonably practicable:
- 3701 xiii. generating and sending an Alert to that effect via its HAN Interface.
- 3702 When operating within Sub GHz Bands, the PPMID shall:
- 3703 xv. be capable of supporting Frequency Agility;
 3704 xvi. not exceed a transmit power of 25 mW; and
 3705 xvii. not exceed a duty cycle of 0.35%.

3706 7.4 Functional Requirements

3707 This Section describes the minimum functions that a PPMID shall be capable of performing.

3708 7.4.1 Communications

3709 A PPMID shall be capable of establishing Communications Links via its HAN Interface.

3710 A PPMID shall be capable of ensuring that the security characteristics of all Communications
 3711 Links it establishes meet the requirements described in *Section 7.4.7.4*.

3712 When any Command addressed to the PPMID is received via any Communications Link the
 3713 PPMID shall be capable of:

- 3714 i. using the Security Credentials the PPMID holds, Authenticating to a Trusted Source
 3715 the Command;
- 3716 ii. verifying in accordance with *Section 7.4.7.2.3* that the sender of the Command is
 3717 Authorised to execute the Command; and
- 3718 iii. verifying the integrity of the Command.

3719 On failure of any of (i) to (iii) above, the PPMID shall be capable of discarding the Command
 3720 without execution and without either generating or sending a Response, and generating and
 3721 sending an Alert to that effect via its HAN Interface.

3722 Where the Command is not due to be executed immediately, the PPMID shall be capable of
 3723 generating and sending a Response via its HAN Interface to confirm its successful receipt.

3724 A PPMID shall only be capable of addressing a Response to the sender of the relevant
 3725 Command.

3726 7.4.1.1 Communications Links with ESME, GSME and Gas Proxy Function via the 3727 HAN interface

3728 A PPMID shall be capable of establishing Communications Links via its HAN Interface with a
 3729 minimum of one ESME, one GSME and one Gas Proxy Function.

3730 A PPMID shall only be capable of establishing Communications Links via its HAN Interface
 3731 with GSME and ESME with Security Credentials in the *Device Log(7.6.3.1)*.

3732 In establishing any Communications Link via its HAN Interface, the PPMID shall be capable
 3733 of using its Security Credentials to enable it to be Authenticated.

3734 A PPMID shall be capable of supporting the following types of Communications Links:

- 3735 i. receiving Price and Consumption information from ESME;
 3736 ii. receiving Price and Consumption information from a Gas Proxy Function;
 3737 iii. generating and sending the Commands (set out in *Section 7.5.4*) to GSME; and
 3738 iv. generating and sending the Commands (set out in *Section 7.5.5*) to ESME.

3739 A PPMID shall be capable of detecting a failure of a Communications Link and on detection
 3740 of a failure, shall be capable of clearing or suitably annotating the information displayed on
 3741 its User Interface (set out in *Sections 7.4.5* and *7.4.6*) to indicate that the information may be
 3742 out of date.

3743 7.4.2 Data storage

3744 A PPMID shall be capable of retaining all information held in its Data Store at all times,
 3745 including on loss of power.

3746 7.4.3 Debt to Clear Calculations

3747 7.4.3.1 Debt to Clear GSME

3748 If the *Meter Balance*(4.6.5.11) is equal to or below the *Disablement Threshold*(4.6.4.12) a
 3749 PPMID shall be capable of maintaining a calculation of the Debt to Clear based on:

- 3750 i. the difference between the *Meter Balance*(4.6.5.11) and the *Disablement*
 3751 *Threshold*(4.6.4.12);
 3752 ii. amount of debt accumulated in the *Accumulated Debt Register*(4.6.5.1);
 3753 iii. amount of Emergency Credit activated and used by the Consumer; and
 3754 iv. the payment-based debt to be collected based on (i), (ii) and (iii) (as defined by *Debt*
 3755 *Recovery per Payment*(4.6.4.8) taking account of the amount remaining in the
 3756 *Payment Debt Register*(4.6.5.13), the payment-based debt payments in the *Billing*
 3757 *Data Log*(4.6.5.3) and the *Debt Recovery Rate Cap*(4.6.4.10)).

3758 7.4.3.2 Debt to Clear ESME

3759 If the *Meter Balance [INFO]*(5.7.5.22) is equal to or below the *Disablement Threshold*
 3760 *[INFO]*(5.7.4.15) a PPMID shall be capable of maintaining a calculation of the Debt to Clear
 3761 based on:

- 3762 i. the difference between the *Meter Balance [INFO]*(5.7.5.22) and the *Disablement*
 3763 *Threshold [INFO]*(5.7.4.15);
 3764 ii. amount of debt accumulated in the *Accumulated Debt Register [INFO]*(5.7.5.1);
 3765 iii. amount of Emergency Credit activated and used by the Consumer; and
 3766 iv. the payment-based debt to be collected based on (i), (ii) and (iii) (as defined by *Debt*
 3767 *Recovery per Payment [INFO]*(5.7.4.11) taking account of the amount remaining in
 3768 the *Payment Debt Register [INFO]*(5.7.5.23), the payment-based debt payments in
 3769 the *Billing Data Log*(5.7.5.10) and the *Debt Recovery Rate Cap [INFO]*(5.7.4.13)).

3770 7.4.4 General Information

3771 A PPMID shall be capable immediately upon establishment of a Communications Link with
 3772 an ESME and a Gas Proxy Function (as set out in *Section 7.4.1.1*), of displaying the
 3773 following up to date information on its User Interface, and displaying updates of any changes
 3774 to the information every 10 seconds thereafter.

3775 The PPMID shall be capable of displaying Currency Units in GB Pounds and European
 3776 Central Bank Euro.

3777 7.4.4.1 Connection Link Quality

3778 The signal strength of its HAN Interface.

3779 **7.4.4.2 Local Time**

3780 The UTC date and time adjusted for British Summer Time.

3781 **7.4.5 Information Pertaining to the Supply of Gas to the Premises**

3782 A PPMID shall be capable immediately upon establishment of a Communications Link with a
 3783 Gas Proxy Function (as set out in *Section 7.4.1.1*), of displaying the following up to date
 3784 information on its User Interface, and displaying timely updates of any changes to the
 3785 information thereafter:

- 3786 i. the *Active Tariff Price*(4.6.5.2);
- 3787 ii. the *Emergency Credit Balance*(4.6.5.8) where Emergency Credit is activated
 3788 (including a clear indication that Emergency Credit has been activated);
- 3789 iii. whether Emergency Credit is available for activation on GSME;
- 3790 iv. any low credit condition;
- 3791 v. the *Meter Balance*(4.6.5.11);
- 3792 vi. the Debt to Clear;
- 3793 vii. whether GSME has suspended the Disablement of Supply during a period defined in
 3794 the *Non-Disablement Calendar*(4.6.4.20) (as set out in *Section 4.4.7.2*);
- 3795 viii. either Aggregate Debt or time-based and payment-based debts when GSME is
 3796 operating in Prepayment Mode;
- 3797 ix. either Aggregate Debt Recovery Rate or each Time-based Debt Recovery rate when
 3798 GSME is operating in Prepayment Mode;
- 3799 x. any *Standing Charge*(4.6.4.23);
- 3800 xi. the *Contact Details*(4.6.4.4); and
- 3801 xii. the *Supply State*(4.6.5.18).

3802 **7.4.6 Information Pertaining to the Supply of Electricity to the**
3803 **Premises**

3804 A PPMID shall be capable, upon establishment of a Communications Link with ESME (as
 3805 set out in *Section 7.4.1.1*), of displaying the following information on its User Interface, and
 3806 displaying updates of any changes to the information every 10 seconds thereafter:

- 3807 i. the *Active Tariff Price [INFO]*(5.7.5.5);
- 3808 ii. the *Emergency Credit Balance [INFO]*(5.7.5.15) where Emergency Credit is
 3809 activated (including a clear indication that Emergency Credit has been activated);
- 3810 iii. whether Emergency Credit is available for activation on ESME;
- 3811 iv. any low credit condition;
- 3812 v. the *Meter Balance [INFO]*(5.7.5.22);
- 3813 vi. the Debt to Clear when ESME is operating in Prepayment Mode;
- 3814 vii. whether ESME has suspended the Disablement of Supply during a period defined in
 3815 the *Non-Disablement Calendar [INFO]*(5.7.4.30) (as set out in *Section 5.5.7.2*);
- 3816 viii. either Aggregate Debt or time-based and payment-based debts when ESME is
 3817 operating in Prepayment Mode;
- 3818 ix. either Aggregate Debt Recovery Rate or each Time-based Debt Recovery rate when
 3819 ESME is operating in Prepayment Mode;
- 3820 x. any *Standing Charge [INFO]*(5.7.4.42);
- 3821 xi. *Contact Details [INFO]*(5.7.4.8); and
- 3822 xii. the *Supply State [INFO]*(5.7.5.32).

3823 7.4.7 Security

3824 7.4.7.1 General

3825 A PPMID shall be designed taking all reasonable steps to ensure that any failure or
3826 compromise of its integrity shall not compromise the Security Credentials or Personal Data
3827 stored on it or compromise the integrity of any other Device to which it is connected by
3828 means of a Communications Link.

3829 7.4.7.2 Security Credentials

3830 7.4.7.2.1 PPMID Private Keys

3831 The PPMID shall be capable of securely storing Private Keys.

3832 The PPMID shall be capable of securely storing Key Agreement values.

3833 7.4.7.2.2 Public Key Certificates

3834 The PPMID shall be capable of securely storing Security Credentials from Certificates
3835 including for use in the Cryptographic Algorithms as set out in *Section 7.5.2.4*.

3836 During the replacement of any *PPMID Security Credentials(7.6.3.2)* (as set out in *Section*
3837 *7.5.2.4*), the PPMID shall be capable of ensuring that the *PPMID Security*
3838 *Credentials(7.6.3.2)* being replaced remain usable until the successful completion of the
3839 replacement.

3840 7.4.7.2.3 Role Based Access Control (RBAC)

3841 The PPMID shall be capable of restricting Authorisation to execute Commands according to
3842 Role permissions.

3843 7.4.7.3 Cryptographic Algorithms

3844 The PPMID shall be capable of supporting the following Cryptographic Algorithms:

- 3845 i. Elliptic Curve DSA;
- 3846 ii. Elliptic Curve DH; and
- 3847 iii. SHA-256.

3848 In executing and generating any Command or Response or Alert, the PPMID shall be
3849 capable of applying Cryptographic Algorithms (alone or in combination) for:

- 3850 iv. Digital Signing;
- 3851 v. Digital Signature verification;
- 3852 vi. Hashing; and
- 3853 vii. Message Authentication.

3854 7.4.7.4 Communications

3855 A PPMID shall be capable of preventing and detecting, on all of its interfaces, Unauthorised
3856 access that could compromise the Confidentiality and / or Data Integrity of:

- 3857 i. Personal Data whilst being transferred via an interface;
- 3858 ii. Consumption data used for billing whilst being transferred via an interface;
- 3859 iii. Security Credentials whilst being transferred via an interface; and
- 3860 iv. Firmware and data essential for ensuring its integrity whilst being transferred via an
3861 interface.

3862 7.5 Interface Requirements

3863 This Section describes the minimum required interactions which a PPMID shall be capable
3864 of undertaking with ESME, GSME and a Gas Proxy Function as appropriate via its HAN
3865 Interface.

3866 7.5.1 Receipt of Information via the HAN Interface

3867 A PPMID shall be capable, immediately upon establishment of a Communications Link with
3868 ESME and a Gas Proxy Function (as set out in *Section 7.4.1.1*) of:

- 3869 i. receiving information required to meet the display requirements set out in *Section*
3870 *7.4.3*;
- 3871 ii. receiving information (and timely updates of any changes to the information
3872 thereafter) required to meet the display requirements set out in *Section 7.4.5*; and
- 3873 iii. receiving information (and updates of any changes of this information every 10
3874 seconds thereafter) required to meet the display requirements set out in *Section*
3875 *7.4.6*.

3876 7.5.2 HAN Interface Commands

3877 A PPMID shall be capable of executing immediately the Commands set out in this *Section*
3878 *7.5.2* following their receipt via its HAN Interface.

3879 7.5.2.1 Add Device Security Credentials

3880 A Command to add Security Credentials for ESME or GSME to the *Device Log(7.6.3.1)*.

3881 In executing the Command, a PPMID shall be capable of verifying the Security Credentials.

3882 7.5.2.2 Read Configuration Data

3883 A Command to read the value of one or more of the configuration data items set out in
3884 *Section 7.6.3*.

3885 In executing the Command, a PPMID shall be capable of sending such value(s) in a
3886 Response via its HAN Interface.

3887 7.5.2.3 Remove Device Security Credentials

3888 A Command to remove Security Credentials for ESME or GSME from the *Device*
3889 *Log(7.6.3.1)*.

3890 7.5.2.4 Replace PPMID Security Credentials

3891 A Command to replace *PPMID Security Credentials(7.6.3.2)* held within the PPMID.

3892 In executing the Command the PPMID shall be capable of maintaining the Command's
3893 Transactional Atomicity.

3894 7.5.3 User Interface Commands

3895 A PPMID shall be capable of executing immediately the Commands set out in this *Section*
3896 *7.5.3* following their receipt via its User Interface.

3897 7.5.3.1 Activate ESME Emergency credit

3898 A Command to issue a *Request Emergency Credit Activation(7.5.5.1)* to ESME.

3899 7.5.3.2 Activate GSME Emergency credit

3900 A Command to issue a *Request Emergency Credit Activation(7.5.4.1)* to GSME.

3901 **7.5.3.3 Add Credit to ESME**

3902 A Command to generate and issue a *Request to Add Credit*(7.5.5.2) when ESME is
3903 operating in Prepayment Mode on input of a UTRN.

3904 **7.5.3.4 Add Credit to GSME**

3905 A Command to generate and issue a *Request to Add Credit*(7.5.4.2) when GSME is
3906 operating in Prepayment Mode on input of a UTRN.

3907 **7.5.3.5 Enable ESME Supply**

3908 A Command to issue a *Request to Enable ESME Supply*(7.5.5.3) to ESME.

3909 **7.5.4 HAN Interface Commands issued by PPMID to GSME**

3910 A PPMID shall be capable of generating and issuing to GSME the Commands set out in this
3911 *Section 7.5.4*.

3912 **7.5.4.1 Request Emergency Credit Activation**

3913 A Command requesting that GSME Activates Emergency Credit.

3914 **7.5.4.2 Request to Add Credit**

3915 A Command including a UTRN requesting that GSME accepts Credit.

3916 **7.5.5 HAN Interface Commands issued by PPMID to ESME**

3917 A PPMID shall be capable of generating and issuing to ESME the Commands set out in this
3918 *Section 7.5.5*.

3919 **7.5.5.1 Request Emergency Credit Activation**

3920 A Command requesting that ESME Activates Emergency Credit.

3921 **7.5.5.2 Request to Add Credit**

3922 A Command including a UTRN requesting that ESME accepts credit.

3923 **7.5.5.3 Request to Enable ESME Supply**

3924 A Command requesting that ESME Enables Supply.

3925 **7.6 Data Requirements**

3926 This Section describes the minimum information which a PPMID shall be capable of holding
3927 in its Data Store.

3928 **7.6.1 Constant data**

3929 Data that shall remain constant and unchangeable at all times.

3930 **7.6.1.1 PPMID Identifier**

3931 A globally unique identifier used to identify the PPMID based on the EUI-64 Institute of
3932 Electrical and Electronic Engineers standard.

3933 **7.6.2 This Section is not used**

3934 **7.6.3 Configuration data**

3935 Data that configures the operation of various functions of the PPMID.

3936 **7.6.3.1 Device Log**

3937 The Security Credentials and Device identity details for each of the Devices with which the
3938 PPMID can communicate.

3939 **7.6.3.2 PPMID Security Credentials**

3940 The Security Credentials for the PPMID and parties Authorised to interact with it.

8 HAN Connected Auxiliary Load Control Switch Technical Specifications

8.1 Overview

Section 8 of this document describes the minimum physical, minimum functional, minimum interface, minimum data and minimum testing and certification requirements of a HAN Connected Auxiliary Load Control Switch (HCALCS), where it is maintained by a Supplier in accordance with standard condition 52 of the electricity supply licence.

8.2 SMETS Testing and Certification Requirements

8.2.1 Conformance with the SMETS

An HCALCS shall have been tested to ensure that it meets the requirements described in this Section 8, and evidence must be available to confirm such testing and conformance.

8.2.2 Conformance with the Great Britain Companion Specification

An HCALCS shall meet the requirements described in the Great Britain Companion Specification.

An HCALCS shall have been certified by the ZigBee Alliance as being compliant with those ZigBee SEP requirements that are identified as being required in the Great Britain Companion Specification and that were certifiable under the ZigBee SEP certification scheme on 31 August 2017.

8.2.3 Conformance with the Commercial Product Assurance Security Characteristics for GB Smart Metering

An HCALCS shall meet the requirements described in the Commercial Product Assurance Security Characteristic Smart Metering - HAN Connected Auxiliary Load Control Switch.

An HCALCS shall be certified by NCSC as compliant with the Commercial Product Assurance Security Characteristic Smart Metering - HAN Connected Auxiliary Load Control Switch.

8.3 Physical Requirements

An HCALCS shall as a minimum include the following components:

- i. a HAN Interface;
- ii. a Data Store;
- iii. an Auxiliary Load Control Switch; and
- iv. a Timer.

An HCALCS shall:

- v. permanently display the *HCALCS Identifier(8.6.1.1)* on the HCALCS.

The HAN Interface of an HCALCS shall be capable of joining a ZigBee SEP Smart Metering Home Area Network which:

- vi. operates within the 2400 – 2483.5 MHz harmonised frequency band or Sub GHz Bands; and

3979 vii. supports the Communications Links described in *Sections 8.5.1 and 8.5.2*.
 3980 An HCALCS shall be designed taking all reasonable steps so as to prevent Unauthorised
 3981 Physical Access and Unauthorised communications that could compromise the
 3982 Confidentiality and / or Data Integrity of:

3983 viii. Security Credentials;
 3984 ix. Cryptographic Algorithms; and
 3985 x. Firmware and data essential for ensuring its integrity,
 3986 stored or executing on the HCALCS.

3987 When operating within Sub GHz Bands, the HCALCS shall:

3988 xi. be capable of supporting Frequency Agility; and
 3989 xii. not exceed a transmit power of 25 mW.

3990 **8.4 Functional Requirements**

3991 This Section defines the minimum functions that an HCALCS shall be capable of performing.

3992 **8.4.1 Timer**

3993 The Timer shall be capable of measuring a configurable period of up to 24 hours with a
 3994 minimum resolution of 1 minute.

3995 **8.4.2 Communications**

3996 An HCALCS shall be capable of establishing Communications Links via its HAN Interface.

3997 An HCALCS shall be capable of ensuring that the security characteristics of all
 3998 Communications Links it establishes meet the requirements described in *Section 8.4.4.4*.

3999 When any Command addressed to the HCALCS is received via any Communications Link
 4000 the HCALCS shall be capable of:

4001 i. using the Security Credentials the HCALCS holds, Authenticating to a Trusted
 4002 Source the Command;
 4003 ii. verifying in accordance with *Section 8.4.4.2.3* that the sender of the Command is
 4004 Authorised to execute the Command; and
 4005 iii. verifying the integrity of the Command.

4006 On failure of any of *(i)* to *(iii)* above, the HCALCS shall be capable of discarding the
 4007 Command without execution and without either generating or sending a Response, and
 4008 generating and sending an Alert to that effect via its HAN Interface.

4009 An HCALCS shall only be capable of addressing a Response to the sender of the relevant
 4010 Command.

4011 **8.4.2.1 Communications Links with ESME via the HAN interface**

4012 An HCALCS shall be capable of establishing Communications Links via its HAN Interface
 4013 with one ESME.

4014 An HCALCS shall only be capable of establishing Communications Links via its HAN
 4015 Interface with one ESME with Security Credentials in the *Device Log(8.6.2.1)*.

4016 In establishing the Communications Link, the HCALCS shall be capable of using its own,
 4017 unique Security Credentials to enable it to be Authenticated by the ESME.

4018 The HCALCS shall be capable of supporting the following types of Communications Links:

4019 i. receiving HAN Interface Commands (set out in *Section 8.5.1*) from ESME; and
 4020 ii. sending the Commands (set out in *Section 8.5.1.6*) to ESME.

4021 8.4.3 Data storage

4022 An HCALCS shall be capable of retaining all information held in its Data Store at all times,
4023 including on loss of power.

4024 8.4.4 Security

4025 8.4.4.1 General

4026 An HCALCS shall be designed taking all reasonable steps to ensure that any failure or
4027 compromise of its integrity shall not compromise the Security Credentials stored on it or
4028 compromise the integrity of any other Device to which it is connected by means of a
4029 Communications Link.

4030 An HCALCS shall be capable of securely disabling Critical Commands other than those
4031 Commands set out in *Section 8.5* that are Critical Commands.

4032 8.4.4.2 Security Credentials

4033 8.4.4.2.1 HCALCS Private Keys

4034 The HCALCS shall be capable of securely storing Private Keys.

4035 The HCALCS shall be capable of securely storing Key Agreement values.

4036 8.4.4.2.2 Public Key Certificates

4037 The HCALCS shall be capable of securely storing Security Credentials from Public Key
4038 Certificates including for use in the Cryptographic Algorithms as set out in *Section 8.4.4.3*.

4039 During any replacement of *HCALCS Security Credentials(8.6.2.2)* (as set out in *Section*
4040 *8.5.1.3*) the HCALCS shall be capable of ensuring that the *HCALCS Security*
4041 *Credentials(8.6.2.2)* being replaced remain usable until the successful completion of the
4042 replacement.

4043 8.4.4.2.3 Role Based Access Control (RBAC)

4044 The HCALCS shall be capable of restricting Authorisation to execute Commands according
4045 to Role permissions.

4046 8.4.4.3 Cryptographic Algorithms

4047 The HCALCS shall be capable of supporting the following Cryptographic Algorithms:

- 4048 i. Elliptic Curve DSA;
- 4049 ii. Elliptic Curve DH; and
- 4050 iii. SHA-256.

4051 In creating any Command, the HCALCS shall be capable of applying Cryptographic
4052 Algorithms (alone or in combination) for:

- 4053 iv. Digital Signature verification;
- 4054 v. Hashing; and
- 4055 vi. Message Authentication.

4056 8.4.4.4 Communications

4057 An HCALCS shall be capable of preventing and detecting, on all of its interfaces,
4058 Unauthorised access that could compromise the Confidentiality and / or Data Integrity of:

- 4059 i. Security Credentials whilst being transferred via an interface; and
- 4060 ii. Firmware and data essential for ensuring its integrity whilst being transferred via an
4061 interface.

4062 8.5 Interface Requirements

4063 This Section sets out the minimum required interactions which an HCALCS shall be capable
4064 of undertaking with ESME via its HAN Interface.

4065 8.5.1 HAN Interface Commands

4066 An HCALCS shall be capable of executing immediately the Commands set out in this
4067 Section following their receipt via its HAN Interface.

4068 8.5.1.1 Add Device Security Credentials

4069 A Command to add Security Credentials for ESME to the *Device Log*(8.6.2.1).

4070 In executing the Command, the HCALCS shall be capable of verifying the Security
4071 Credentials.

4072 8.5.1.2 Control HAN Connected Auxiliary Load Control Switch

4073 A Command to control the HCALCS, for the time period specified within the Command.

4074 In executing the Command, the HCALCS shall be capable of:

- 4075 i. performing the specified control operation for the specified time period;
- 4076 ii. send a Response detailing the Outcome via its HAN Interface; and
- 4077 iii. at the end of the control time period, issuing a *Request Control of HAN Connected*
4078 *Auxiliary Load Control Switch*(8.5.2.1) to the ESME.

4079 When not subject to control through this Command, the HCALCS shall default its state to
4080 open.

4081 8.5.1.3 Read Configuration Data

4082 A Command to read the value of one or more of the configuration data items set out in
4083 *Section 8.6.2*.

4084 In executing the Command, the HCALCS shall be capable of sending such value(s) in a
4085 Response via its HAN Interface.

4086 8.5.1.4 Remove Device Security Credentials

4087 A Command to remove Security Credentials for an ESME from the *Device Log*(8.6.2.1).

4088 8.5.1.5 Replace HCALCS Security Credentials

4089 A Command to replace *HCALCS Security Credentials*(8.6.2.2) held within the HCALCS.

4090 In executing the Command the HCALCS shall be capable of maintaining the Command's
4091 Transactional Atomicity.

4092 8.5.1.6 Write Configuration Data

4093 A Command to record one or more new values of the configuration data items set out in
4094 *Section 8.6.2*.

4095 8.5.2 HAN Interface Commands issued by an HCALCS to ESME

4096 An HCALCS shall be capable of issuing the Commands set out in this Section, receiving
4097 corresponding Responses and, where required by a Response, taking the required actions.

4098 8.5.2.1 Request Control of HAN Connected Auxiliary Load Control Switch

4099 A Command requesting that the ESME issues an updated *Control HAN Connected Auxiliary*
4100 *Load Control Switch*(5.6.4.1) Command.

4101 An HCALCS shall be capable of issuing this Command after completing the execution of a
4102 *Control HAN Connected Auxiliary Load Control Switch*(8.5.1.2).

4103 **8.6 Data Requirements**

4104 This Section describes the minimum information which an HCALCS is to be capable of
4105 holding in its Data Store.

4106 **8.6.1 Constant Data**

4107 Describes data that remains constant and unchangeable at all times.

4108 **8.6.1.1 HCALCS Identifier**

4109 A globally unique identifier used to identify the HCALCS based on the EUI-64 Institute of
4110 Electrical and Electronic Engineers standard.

4111 **8.6.2 Configuration Data**

4112 Data that configures the operation of functions of the HCALCS.

4113 **8.6.2.1 Device Log**

4114 The Security Credentials and Device identity details for the ESME with which HCALCS can
4115 communicate.

4116 **8.6.2.2 HCALCS Security Credentials**

4117 The Security Credentials for the HCALCS and parties Authorised to interact with it.

9 Glossary

4118

Active Energy

4119

4120 The integral with respect to time of the Active Power in units of watt-hours (Wh) or standard
4121 multiples thereof (for example, kWh).

Active Power

4122

4123 The product of voltage and the in-phase component of alternating current measured in units
4124 of watts (W) or standard multiples thereof (for example, kW).

Aggregate Debt

4125

4126 The sum of all time-based and payment-based debt registers on ESME or GSME operating
4127 in Prepayment Mode.

Aggregate Debt Recovery Rate

4128

4129 The sum of the Time-based Debt Recovery rates on ESME or GSME operating in
4130 Prepayment Mode.

Alarm

4131

4132 A short-lived audible signal.

Alert

4133

4134 A message generated by a Device including in response to a problem or the risk of a
4135 potential problem.

Ambient

4136

4137 The representation of information in a form that can be understood at a glance.

Arm

4138

4139 To establish a state whereby Supply will be Enabled in response to a Command to Enable
4140 Supply; 'Armed' and 'Arming' shall be construed accordingly.

Authentication

4141

4142 The method used to confirm the identity of entities or Devices wishing to communicate and
4143 'Authenticated' and 'Authenticity' shall be construed accordingly.

Authorisation

4144

4145 The process of granting access to a resource and 'Authorised' shall be construed
4146 accordingly.

Auxiliary Load Control Switch (ALCS)

4147

4148 A switch or other means of controlling a load on the Supply.

Battery

4149

4150 A component that produces electricity from a chemical reaction.

Block Counter

4151

4152 Storage for recording Consumption for the purposes of combined Time-of-use and Block
4153 Pricing.

- 4154 [Block Pricing](#)
- 4155 A pricing scheme used in conjunction with Time-of-use Pricing where Price varies based on
4156 Consumption over a given time period.
- 4157 [Block Register](#)
- 4158 A Tariff Register for recording Consumption for the purposes of combined Time-of-use and
4159 Block Pricing.
- 4160 [Block Tariff](#)
- 4161 A Tariff for Block Pricing.
- 4162 [Certificate](#)
- 4163 An electronic document that binds an identity, and possibly other information, to a Public
4164 Key.
- 4165 [Certificate Signing Request](#)
- 4166 A message requesting the issue of a Certificate by a Certification Authority.
- 4167 [Certification Authority \(CA\)](#)
- 4168 A trusted entity which issues Certificates.
- 4169 [Clock](#)
- 4170 A timing mechanism that has a minimum resolution of 1 second.
- 4171 [Command](#)
- 4172 An instruction to perform a function received or sent via any interface.
- 4173 [Commercial Product Assurance \(CPA\) Security Characteristic Electricity Smart Metering
4174 Equipment](#)
- 4175 A version of the document entitled 'Commercial Product Assurance Security Characteristic
4176 Smart Metering – Electricity Smart Metering Equipment' that is identified in the Smart Energy
4177 Code as being relevant to the GBCS.
- 4178 [Commercial Product Assurance \(CPA\) Security Characteristic Gas Smart Metering
4179 Equipment](#)
- 4180 A version of the document entitled 'Commercial Product Assurance Security Characteristic
4181 Smart Metering – Gas Smart Metering Equipment' that is identified in the Smart Energy
4182 Code as being relevant to the GBCS.
- 4183 [Commercial Product Assurance \(CPA\) Security Characteristic Smart Metering – HAN
4184 Connected Auxiliary Load Control Switch](#)
- 4185 A version of the document entitled 'Commercial Product Assurance Security Characteristic
4186 Smart Metering – HAN Connected Auxiliary Load Control Switch' that is identified in the
4187 Smart Energy Code as being relevant to the GBCS.
- 4188 [Communications Hub Date and Time](#)
- 4189 The CHF Date and Time as described at section 4 in the Communications Hub Technical
4190 Specifications.
- 4191 [Communications Hub Physical Interface](#)
- 4192 A physical interface to connect to the Communications Hub.

4193 [Communications Hub Technical Specifications \(CHTS\)](#)

4194 A version of the document entitled 'Communications Hub Technical Specifications' set out in
4195 Schedule 10 of the Smart Energy Code.

4196 [Communications Link](#)

4197 The means of effecting an exchange of Commands, Responses, Alerts and other
4198 information between a system or Device and another system or Device which is independent
4199 of the transport mechanism used.

4200 [Confidentiality](#)

4201 The state of information, in transit or at rest, where there is assurance that it is not
4202 accessible by Unauthorised parties through either unintentional means or otherwise.

4203 [Consumer](#)

4204 A person who lawfully resides at the Premises that is being Supplied.

4205 [Consumption](#)

4206 In the context of GSME Gas Consumption and in the context of ESME Electricity
4207 Consumption.

4208 [Contact Details](#)

4209 The name and contact telephone number of the current gas or electricity Supplier (as
4210 appropriate).

4211 [Credit Mode](#)

4212 A mode of operation of GSME or ESME whereby Consumers are billed for some or all of
4213 their Consumption retrospectively.

4214 [Critical Commands](#)

4215 Those Commands which relate to Supply being affected, financial fraud or the compromise
4216 of the security of Devices in Consumer Premises.

4217 [Critical Event](#)

4218 An event which relates to Supply being affected, financial fraud or the compromise of the
4219 security of Devices in Consumer Premises.

4220 [Cryptographic Algorithm](#)

4221 An algorithm for performing one or more cryptographic functions which may include:
4222 Encryption, Decryption, Digital Signing or Hashing of information, data, or messages; or
4223 exchange of Security Credentials.

4224 [Currency Units](#)

4225 The units of monetary value in major and minor units.

4226 [Customer Identification Number](#)

4227 A number used to verify that an individual requesting a service is present in the Consumer
4228 Premises.

4229 [Data Integrity](#)

4230 The state of data where there is assurance that it has not been altered by Unauthorised
4231 parties.

4232 [Data Store](#)

4233 An area of a Device capable of storing information for future retrieval.

4234 [Day](#)

4235 The period commencing 00:00:00 Local Time and ending at the next 00:00:00.

4236 [Day Profile](#)

4237 For the purposes of Time-of-use Pricing and Time-of-use with Block Pricing, the rules
4238 defined in a Switching Table specifying the Tariff Register to which Consumption is allocated
4239 for the day (in the context of GSME Time-of-use Pricing and Time-of-use with Block Pricing)
4240 and for each half-hour period within the day (in the context of the ESME Time-of-use Pricing
4241 and Time-of-use with Block Pricing).

4242 For the purposes of setting the commanded state of Auxiliary Load Control Switches or HAN
4243 Connected Auxiliary Load Control Switches, the rules defined in a Switching Table
4244 specifying the commanded state of each Auxiliary Load Control Switch or HAN Connected
4245 Auxiliary Load Control Switch, for all times within the day.

4246 For the purposes of Non-Disablement Periods the rules defined in a Switching Table
4247 specifying the times during the day when a Non-Disablement Period is active.

4248 [Debt Register](#)

4249 Storage for recording an amount of debt to be recovered.

4250 [Debt to Clear](#)

4251 The amount of credit the consumer needs to add to ESME or GSME to cause the Meter
4252 Balance to rise to the disablement threshold when operating in Prepayment Mode.

4253 [Decryption](#)

4254 The process of converting Encrypted information by an Authorised party to recover the
4255 original information and like terms shall be construed accordingly.

4256 [Device](#)

4257 GSME, ESME, a GPF, a CHF, a Type 1 Device or a Type 2 Device.

4258 [Device Language Message Specification \(DLMS\) Companion Specification for Energy
4259 Metering \(COSEM\)](#)

4260 The version of the document of that name identified in the GBCS.

4261 [Digital Signature](#)

4262 The information appended to a Message which is created using the sender's Private Key,
4263 that can be verified using the Public Key contained in the sender's Certificate, and provides
4264 the receiver with assurance that the sender is who they claim to be, the message has not
4265 been altered in transit and that the holder of the sender's Private Key created the Message.

4266 [Digital Signing](#)

4267 The creation of a Digital Signature.

4268 [Disable](#)

4269 In the context of GSME the act of interrupting the flow of gas by closing the Valve and in the
4270 context of ESME the act of interrupting the flow of electricity by opening the Load Switch(es)
4271 and like terms shall be construed accordingly.

4272 Domestic Premises

4273 Shall in the context of GSME have the meaning given to that term in standard condition 1 of
4274 gas supply licences, and in the context of ESME shall have the meaning given to that term in
4275 standard condition 1 of electricity supply licences.

4276 Electricity Consumption

4277 The Active Energy Imported into the Premises and 'Consumed' shall be construed
4278 accordingly.

4279 Electricity Meter

4280 An instrument used to measure, store and display the amount of electrical energy passing
4281 through an electrical circuit or circuits.

4282 Elliptic Curve DH

4283 The Elliptic Curve Diffie–Hellman Algorithm (see
4284 <http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-56Ar2.pdf>).

4285 Elliptic Curve DSA

4286 The Elliptic Curve Digital Signature Algorithm forming part of the NSA Suite B standard (see
4287 <http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.186-4.pdf>).

4288 Emergency Credit

4289 Credit that can be made available to ensure that the Supply is not interrupted in
4290 circumstances (including situations of emergency) defined by the Supplier to the Premises.

4291 Enable

4292 In the context of GSME the act of restoring the flow of gas to the Premises by opening the
4293 Valve and in the context of ESME the act of restoring the flow of electricity to the Premises
4294 by closing the Load Switch and like terms shall be construed accordingly.

4295 Encryption

4296 The process of converting information in order to make it unintelligible other than to
4297 Authorised parties and like terms shall be construed accordingly.

4298 Energy Consumption

4299 The amount of gas in kWh or electricity in kWh Supplied to the Premises.

4300 ESME

4301 Electricity Smart Metering Equipment, being Single Element Electricity Metering Equipment,
4302 Twin Element Electricity Metering Equipment or Polyphase Electricity Metering Equipment
4303 as the context requires.

4304 Export

4305 The flow of electricity out of the Premises, and like terms shall be construed accordingly.

4306 Firmware

4307 The embedded software programmes and / or data structures that control Devices.

4308 Frequency Agility

4309 The ability to change the frequency of operation in Sub GHz Bands.

- 4310 [Gas Consumption](#)
- 4311 The volume of gas in cubic metres (m³) Supplied to the Premises and ‘Consumed’ shall be
4312 construed accordingly.
- 4313 [Gas Meter](#)
- 4314 An instrument designed to measure, memorise and display the quantity of gas (volume or
4315 mass) that has passed through it.
- 4316 [Gas Proxy Function](#)
- 4317 Gas Proxy Function as defined in the Communications Hub Technical Specifications.
- 4318 [Great Britain Companion Specification](#)
- 4319 A version of the document entitled ‘Great Britain Companion Specification’ that is identified
4320 in the Smart Energy Code as being relevant to this version of SMETS.
- 4321 [GSME](#)
- 4322 Gas Smart Metering Equipment.
- 4323 [Hashing](#)
- 4324 A repeatable process to create a fixed size and condensed representation of a message of
4325 any arbitrary data. Hash and like terms shall be construed accordingly.
- 4326 [HCALCS](#)
- 4327 HAN Connected ALCS, which is a Type 1 Device.
- 4328 [HCALCS Technical Specifications](#)
- 4329 HCALCS Technical Specifications as described in SMETS.
- 4330 [Home Area Network Interface \(HAN Interface\)](#)
- 4331 A component of GSME, ESME, IHD or other Device that is capable of sending and receiving
4332 information to and from other Devices.
- 4333 [Key](#)
- 4334 Data used to determine the output of a cryptographic operation.
- 4335 [Key Agreement](#)
- 4336 A means to calculate a shared Key between two parties.
- 4337 [IHD](#)
- 4338 In-home Display.
- 4339 [IHD Source Device](#)
- 4340 ESME or the Gas Proxy Function.
- 4341 [IHD Technical Specifications](#)
- 4342 IHD Technical Specifications as described in SMETS.
- 4343 [Import](#)
- 4344 The flow of electricity into the Premises, and like terms shall be construed accordingly.
- 4345 [Large Gas Meter](#)

- 4346 Means a Gas Meter designed to operate with a maximum flow rate of greater than 11 cubic
4347 metres per hour⁶.
- 4348 [Load Switch](#)
- 4349 A component or combination of components that can close or open (including on receipt of a
4350 Command to that effect) to Enable or Disable the flow of electricity to and from the Premises.
- 4351 [Local Time](#)
- 4352 The UTC date and time adjusted for British Summer Time.
- 4353 [Lock](#)
- 4354 To establish a state whereby the Supply is Disabled and the GSME or ESME cannot
4355 determine the Supply state; 'Locked' and 'Locking' shall be construed accordingly.
- 4356 [Message Authentication](#)
- 4357 The process by which the receiver of a message is provided with assurance that the sender
4358 is who they claim to be and that the message is in the form originally sent.
- 4359 [MPAN](#)
- 4360 Meter Point Administration Number.
- 4361 [MPRN](#)
- 4362 Meter Point Reference Number.
- 4363 [NCSC](#)
- 4364 The National Cyber Security Centre, the UK Government's national technical authority for
4365 information assurance.
- 4366 [Non-Disablement Period](#)
- 4367 A period of time during which the combined credit of the meter balance and Emergency
4368 Credit balance falling below the disablement threshold will not be cause the Supply to be
4369 Disabled when ESME or GSME is operating in Prepayment Mode.
- 4370 [Outcome](#)
- 4371 The result of executing a Command, expressed as success or failure.
- 4372 [Payment-based Debt Recovery](#)
- 4373 A means of recovering debt based on a percentage of a payment.
- 4374 [Personal Data](#)
- 4375 Any information comprising Personal Data as such term is defined in the Data Protection Act
4376 1998 at the date the SMETS is brought into force.
- 4377 [Polyphase Electricity Metering Equipment](#)
- 4378 Electricity metering equipment containing three measuring elements suitable for a polyphase
4379 Supply with up to three phases and neutral.
- 4380 [PPMID Technical Specifications](#)
- 4381 PPMID Technical Specifications as described in SMETS.

⁶ GAS ACT 1986 Standard conditions of gas supply licence page 26.

- 4382 **Prepayment Interface Device (PPMID)**
- 4383 A Type 1 Device that provides a User Interface for Prepayment Mode related information
4384 and Commands.
- 4385 **Premises**
- 4386 The premises which is Supplied.
- 4387 **Prepayment Mode**
- 4388 A mode of operation of GSME or ESME whereby payment is generally made in advance of
4389 Consumption.
- 4390 **Price**
- 4391 The amount of money in Currency Units charged for one kWh unit of gas Consumed for
4392 GSME or one kWh of electricity Consumed via the relevant measuring element for ESME.
- 4393 **Privacy PIN Protection**
- 4394 The prevention of the display of information and access to Commands on the User Interface
4395 of GSME or ESME.
- 4396 **Private Key**
- 4397 The Key in a Public-Private Key Pair which must be kept secure by the entity to which it
4398 relates.
- 4399 **Public Key**
- 4400 The Key in a Public-Private Key Pair which can be distributed to other parties.
- 4401 **Public-Private Key Pair**
- 4402 Two mathematically related numbers that are used in Cryptographic Algorithms.
- 4403 **Random Number Generator**
- 4404 A component used to generate a sequence of numbers or symbols that lack any predictable
4405 pattern.
- 4406 **Reactive Energy**
- 4407 The integral with respect to time of Reactive Power in units of volt-amperes reactive-hours
4408 (varh) or standard multiples thereof (for example, kvarh).
- 4409 **Reactive Power**
- 4410 The product of voltage and the out of phase component of current measured in units of volt-
4411 amperes reactive (var) or standard multiples thereof (for example, kvar).
- 4412 **Replay Attack**
- 4413 A form of attack on a Communications Link in which a valid information transmission is
4414 repeated through interception and retransmission.
- 4415 **Response**
- 4416 A response to a Command received or sent over any interface.
- 4417 **RMS**
- 4418 Root mean squared.
- 4419 **Role**
- 4420 The entitlement of a party to execute one or more Commands.

- 4421 **Season Profile**
- 4422 Rules defined in a Switching Table specifying a Week Profile for each week of a season.
- 4423 **SECAS**
- 4424 The Smart Energy Code Administrator and Secretariat.
- 4425 **Secure Perimeter**
- 4426 A physical border surrounding GSME, ESME or the PPMID.
- 4427 **Security Credentials**
- 4428 Information used to Authenticate a Device, party or system.
- 4429 **Sensitive Event**
- 4430 Each of the following events:
- 4431
 - a failed Authentication or Authorisation;
- 4432
 - a change in the executing Firmware version; and
- 4433
 - unusual numbers of malformed, out-of-order or unexpected Commands received.
- 4434 **SHA-256**
- 4435 The Hashing algorithm of that name approved by the NIST (see
- 4436 http://csrc.nist.gov/groups/ST/toolkit/secure_hashing.html).
- 4437 **Single Element Electricity Metering Equipment**
- 4438 Electricity metering equipment containing a single measuring element.
- 4439 **Smart Energy Code**
- 4440 The document of that name, as designated by the Secretary of State under Condition 22 of
- 4441 the DCC Licence.
- 4442 **Smart Metering Equipment Technical Specifications (SMETS)**
- 4443 These Smart Metering Equipment Technical Specifications that are contained within
- 4444 Schedule 9 of the Smart Energy Code.
- 4445 **Smart Metering Home Area Network**
- 4446 A communications network allowing the exchange of information between Devices.
- 4447 **Smart Meter Operational Integrity**
- 4448 The state of an ESME or GSME where its functionality is working as intended.
- 4449 **Special Day**
- 4450 A day defined in a Switching Table where allocation to Tariff Registers, setting the
- 4451 commanded state of Auxiliary Load Control Switches or HAN Connected Auxiliary Load
- 4452 Control Switches, or specifying Non-Disablement Periods is based on a specified Day
- 4453 Profile.
- 4454 **Sub GHz Bands**
- 4455 The 863 – 876 MHz and 915 – 921 MHz harmonised frequency bands.
- 4456 **Supplier**
- 4457 A person authorised by licence to Supply gas to Premises for GSME and a person
- 4458 authorised by licence to Supply electricity to Premises for ESME.

4459 **Supply**

4460 The supply of gas to Premises for GSME and the supply of electricity to Premises for ESME
4461 and 'Supplied' shall be construed accordingly.

4462 **Switching Table**

4463 Separate rules for:

- 4464 • allocating Consumption to Tariff Registers for the purposes of Time-of-use Pricing;
- 4465 • setting the commanded state of Auxiliary Load Control Switches or HAN Connected
4466 Auxiliary Load Control Switches; and
- 4467 • the purposes of specifying Non-Disablement Periods.

4468 **Tariff**

4469 The structure of Prices and other charges relating to a Supply.

4470 **Tariff Register**

4471 Storage for recording Consumption for the purposes of Time-of-use Pricing.

4472 **Time-based Debt Recovery**

4473 A means of recovering debt based on an amount in Currency Units per unit time.

4474 **Time-of-use Band**

4475 A contiguous or non-contiguous number of Days for GSME or half-hour periods for ESME
4476 over which Tariff Prices are constant.

4477 **Time-of-use Pricing**

4478 A pricing scheme with one or more Time-of-use Bands.

4479 **Time-of-use Tariff**

4480 A Tariff for Time-of-use Pricing.

4481 **Timer**

4482 A mechanism for measuring a time period.

4483 **TOU**

4484 Time-of-use.

4485 **Transactional Atomicity**

4486 The order of the constituent parts of a Command.

4487 **Trusted Source**

4488 A source whose identity is confidentially and reliably validated.

4489 **Twin Element Electricity Metering Equipment**

4490 Electricity metering equipment containing two measuring elements.

4491 **Type 1 Device**

4492 A Device, other than GSME, ESME, Communications Hub Function or Gas Proxy Function,
4493 that stores and uses the Security Credentials of other Devices for the purposes of
4494 communicating with them via its HAN Interface.

- 4495 **Type 2 Device**
- 4496 A Device that does not store or use the Security Credentials of other Devices for the
4497 purposes of communicating with them via its HAN Interface.
- 4498 **Unauthorised**
- 4499 Not Authorised.
- 4500 **Unauthorised Physical Access**
- 4501 Unauthorised access to the internal components of GSME, ESME or the PPMID through its
4502 Secure Perimeter.
- 4503 **Unique Transaction Reference Number (UTRN)**
- 4504 A number used to convey credit to GSME or ESME operating in Prepayment Mode.
- 4505 **Unlock**
- 4506 To establish a state whereby the GSME or ESME can determine the Supply state,
4507 'Unlocked' shall be construed accordingly.
- 4508 **User Interface**
- 4509 An interface for providing local human interaction with GSME, ESME, IHD or PPMID which
4510 supports input and visual output.
- 4511 **UTC**
- 4512 Coordinated Universal Time.
- 4513 **UTRN Counter**
- 4514 A number derived from a UTRN.
- 4515 **Valve**
- 4516 A component that can open or close (including on receipt of a Command to that effect) to
4517 Enable or Disable the flow of gas to Premises.
- 4518 **Week**
- 4519 The seven day period commencing 00:00:00 Monday Local Time and ending at 00:00:00 on
4520 the immediately following Monday.
- 4521 **Week Profile**
- 4522 Rules defined in the Switching Table specifying the Day Profile for each day of a week.
- 4523 **ZigBee Smart Energy Profile (SEP)**
- 4524 The version of the document ZigBee Smart Energy (ZSE) Profile Specification identified in
4525 the GBCS.

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