



PR_smart_Part4_Comms

Final

V4.0 2010 03 29

**PRODUCT REQUIREMENTS FOR
SMART METERING SYSTEMS
PART 4: TELECOMMUNICATIONS HUB**

MARCH 2010

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PRODUCT REQUIREMENTS FOR SMART METERING SYSTEMS - PART 4: TELECOMMUNICATIONS HUB

INTRODUCTION

This document describes the smart meter system requirements for phase 3 of the smart metering trial using information captured from various sources including discussions with some manufacturers and phases 1 and 2 of the trial. This document is expected to change as phase 3 of the trial progresses. This document concentrates on requirements for the comms hub within a smart metering system.

This document is part of a series of specifications as follows:

- Part 1: General System Architecture;
- Part 2: Gas meter;
- Part 3: Electricity meter;
- Part 4: Telecommunications hub (this document);
- Part 5: In-home display.

This document shall be read in conjunction with Part 1: General System Architecture, and should be read in conjunction with all other documents in this series.

For the purpose of this product requirements specification, a comms hub is a mains powered device that communicates locally to the smart meter system (gas and electricity meters, in-home display unit and any other device associated with the system) via a home area network (HAN). The comms hub is responsible for establishing the HAN. Such local communication would normally be low power radio using Zigbee (2.4GHz) Smart Energy Certified and be developed in line with the Smart Energy Profile and any private extension necessary to support British Gas functional requirements.

The comms hub also communicates remotely with the head-end system via a wide area network (WAN). Such communication shall initially be via a GSM/GPRS network and shall include 'in fill technology' yet to be specified. It is expected that technologies shall be introduced over a period of time which requires the comms hub to be developed in a modular fashion.

The comms hub may be required to maintain a permanent GPRS connection or temporarily establish a connection for the purposes of making or receiving a call from the Head End System. In the latter case the comms hub may be required to act to an out-of-band 'wake up call' via the Head End.

Thus, the comms hub forms a gateway between the head-end and local smart metering systems and allows the exchange of commands and data between them. It also incorporates mechanisms to ensure that such exchanges are made in a secure manner that are highly resistant to external tampering or hacking.

The purpose of the comms hub is to deliver the functionality described in section 10.

1. SCOPE

1.1 This document defines the minimum British Gas product requirements for:

- a) A Telecommunications (comms) hub associated with a smart metering system;

- b) Reception, transmission and utilisation of data to and from all components in the smart meter system via the HAN and WAN as appropriate.

2. REFERENCES

- 2.1 This suite of documents makes references to the documents listed in Appendix A of Part 1: General System Architecture. Unless otherwise specified, the latest edition of the documents applies, including all amendments.

3. DEFINITIONS

- 3.1 The requirements and definitions applying to this document are listed in Appendix B of Part 1: General System Architecture.

4. CERTIFICATION

- 4.1 Zigbee communications shall conform to Smart Energy Certification.
- 4.2 The design of the comms hub shall be such that it can be on the approved products list of the WAN provider.

5. SAFETY

5.1 Intrinsic safety requirements

- 5.1.1 Any part of the comms hub that is directly wired to, and/or is physically attached to, or is intended to be within 150 mm of, the gas meter shall meet, as a minimum, the requirements for use in a hazardous area classification zone 2 (ATEX category 3) as defined in BS EN 60079-10-1.

Note: This clause applies, independent of the distance between the comms hub and the gas meter, to any circuitry within a comms hub that is wired directly to the gas meter.

6. DESIGN AND MATERIALS

- 6.1 The comms hub shall be constructed of materials complying with appropriate European, International or British Standards (also see Part 1: General System Architecture with regard to appropriate European Directives e.g. RoHS and WEEE).
- 6.2 The comms hub should meet the basic requirements of BS EN 60950-1 or equivalent Standard.

Note 1: There may be no specific construction Standards that are directly applicable to smart metering comms hubs as they are technologically a recent development, but may be deemed to be a dedicated WiFi router..

- 6.3 The total weight of the comms hub should not exceed 500g.
- 6.4 The comms hub shall be able to be fixed to a standard meter board.

Note: It is expected every installation shall be unique dependant on various on-site factors, however, it is expected that the comms hub shall be as small as possible to allow for installation in as many instances as possible.

- 6.5 The comms hub shall be provided with means of easily mounting to a wall.

- 6.6 The colour of the comms hub 's case should be neutral; e.g.: white, cream, light grey etc. and be with the written agreement of British Gas.
- 6.7 The comms hub should be constructed in a modular fashion (e.g. the WAN module shall be a separate component to the HAN module) to allow the replacement of individual sections of the comms hub by authorised personnel.

Note 1: This will allow for an easier migration path towards alternative and emerging communications services.

Note 2: Any such construction methods will need to take account of security; see Part 1: General System Architecture: Security

- 6.8 The comms hub shall use a Machine to Machine (M2M) type Subscriber Identity Module (SIM). It should be installed as securely as possible and should be rendered unusable if removed or tampered with.

Note 1: M2M SIMs are new technology and although British Gas requires that they will need to meet appropriate Standards, these have yet to be determined.

Note 2: Also see Part 1: General System Architecture: Security.

7. ENVIRONMENT

- 7.1 This section imposes additional requirements to those described in Part 1: General System Architecture: Environment, of this suite of documents.

7.2 Temperature and humidity

- 7.2.1 The comms hub shall be suitable for use over the temperature range -25 °C and +55 °C and relative air humidity between 30% and 100% condensing for up to 30 minutes

7.3 Ingress protection (IP)

- 7.3.1 The comms hub shall be so constructed such that the collection of water is prevented and should provide the degree of protection equivalent to, as a minimum, IP52 in accordance with BS EN 60529.

Note: Lower IP ratings may be used in conjunction with additional means of avoiding the build up of water or condensation within the components. These methods are to be with the written agreement of British Gas.

7.4 Impact

- 7.4.1 The comms hub shall withstand impact without significant damage; i.e., there shall be no damage that could lead to the failure of any internal parts nor shall there be damage such that any internal circuit boards or mechanisms are exposed. Slight damage, which does not impair the protection against indirect contact or the penetration of solid objects, dust and water is acceptable.
- 7.4.2 The comms hub shall be tested with a spring hammer (test Ehb, of EN 60068-2-75).
- 7.4.3 The comms hub shall be mounted in its normal working position and the spring hammer shall act on the outer surfaces of the case (including any displays where applicable) and on any terminal covers with a kinetic energy of 0,2 J ± 0,02 J.

Note: In the case where a comms hub is wired directly to a gas meter, the necessary tests to meet zone 2 (ATEX category 3) as defined in BS EN 60079–10-1 approval (see section 5), may require a more stringent impact test. In such a case, the more stringent test applies.

7.5 Contaminants

7.5.1 The surface finish of the comms hub shall resist dirt, chemical effects and ultraviolet light which may appear in a typical domestic environment.

7.6 Noise

7.6.1 See Part 1: General System Architecture.

8. POWER SUPPLY AND BATTERY

8.1 Mains power

8.1.1 The comms hub shall be powered, primarily, from the mains either live-side or load-side of the electricity meter to support the following scenarios:

- a) Dual fuel – hub powered live-side of the electricity meter or load-side of the electricity meter;
- b) Electricity only - hub powered live-side of the electricity meter or load-side of the electricity meter;
- c) Gas only - hub powered live-side of electricity meter only.

Note: Mains provision to be permanently wired (i.e. connection via a mains plug is not suitable).

8.1.2 The comms hub shall be designed to minimise power consumption and in any case should not exceed the combined smart meter system consumption described in Part 1: General System Architecture: General Requirements: power consumption.

8.2 Back-up batteries – general requirement

8.2.1 The comms hub shall include back-up batteries, or similar as appropriate, to maintain low level functionality (e.g. real time clocks) during temporary power losses. Also see Part 1: General System Architecture: Real Time Clocks.

Note: Due to the relatively high power consumption required maintaining the HAN and WAN, it is not expected that these will remain functional during such power losses.

8.2.2 The back-up battery shall be of sufficient capacity to allow, as a minimum, a single message to be sent to the head-end system when the permanent supply is lost.

8.2.3 Where a comms hub is powered live-side of the electricity meter the battery should be of sufficient capacity to support WAN communications and all functionality for a minimum period of 3 days.

8.2.4 The back-up battery shall have a service life equal to that of the comms hub.

8.2.5 The back-up battery shall be leak resistant.

9. INDICATORS

- 9.1 The comms hub shall incorporate a means of displaying hub status.
- 9.2 Information that shall be displayed includes, but is not limited to the following:
- a) Power on;
 - b) Successful communications established to each component in the smart metering system and HAN signal strength to each component (see clause 12.1.1);
 - c) Hub in an alert state (but not for tampers see Part 1: General System Architecture: Events, Exceptions, Alerts, Faults and Tampers);
 - d) WAN signal strength (see clause 12.1.1)
 - e) Data session active.

10. FUNCTIONALITY

- 10.1 The comms hub shall be responsible for:
- a) All data transfers;
 - b) All commands;
 - c) All alerts;
 - d) Binding, pairing devices in the HAN.
- 10.2 All communications exchanges, between smart meter components, the smart meter system and the head-end systems shall take place securely and unimpeded:
- 10.3 The comms hub shall be responsible for:
- a) Establishing and maintaining the GPRS connection;
 - b) Establishing and maintaining the HAN;
 - c) Maintaining a local security trust centre;
 - d) Establishing a dialogue with the head-end system at commissioning time and managing local security under the control of the head-end;
 - e) Unpacking and decrypting messages received from the head-end system, temporarily storing them , if appropriate, and relaying them to the correct component;
 - f) Compressing and encrypting, un-compressing and decrypting messages from the smart metering components, temporarily storing them, if appropriate, and transmitting them to the head-end;
 - g) Messages between the comms hub and the head end shall be combined wherever possible to reduce message length.
 - h) Collating metering data and forwarding it to the head-end at configurable times;
 - i) Managing the synchronisation of meter messages;
 - j) Providing configurable message acknowledgements;
 - k) Managing local time synchronisation:
 - 1) The comms hub shall maintain time synchronisation with the head-end system;

- 2) All smart metering components shall maintain time synchronisation with the comms hub.
 - l) Managing firmware updates for all components on the HAN including itself;
 - m) Installation and commissioning in conjunction with or without a Hand Held Terminal (HHT)
 - n) The comms hub shall support a secure port to facilitate secure key exchange for example on initial install.
 - o) Maintain communications, on a single and dual fuel basis, to a second supplier;

Note: This would allow the comms hub to work, simultaneously, with more than one supplier's equipment, segregating and maintaining separation of data allowing independent operation of each meter/fuel type. It is accepted, currently, that such technology may not be available;
 - p) Providing, in conjunction with the other components of the smart metering system various diagnostics e.g. Faults, alerts, and recovery.
- 10.4 If the comms hub detects a loss of mains power during any updating process between the head-end and hub, or hub and any component, it shall terminate the process. Upon restoration of power, it shall determine whether or not the update process can re-start (e.g. check that files are uncorrupted). Where corruption has been detected, the comms hub shall generate an appropriate alert that shall be transmitted to the head-end.
- 10.5 The comms hub shall routinely re-initialise the WAN modem at a configurable frequency.
- 10.6 The comms hub shall monitor the WAN modem and if it detects incorrect operation, should re-initialise the modem.
- 10.7 The comms hub shall monitor HAN traffic and in the case of abnormal activity, shall generate a tamper alert. (Also see also see Part 1: General System Architecture: Security and Part 1: General System Architecture: Alerts: Faults Tampers and exceptions).
- 10.8 It is anticipated that the WAN SIM shall not require a PIN. However, in the eventuality that a PIN is required the comms hub shall be required to automatically enter a PIN when the WAN comms module is restarted, re-initialised, etc. If a PIN is required, the PIN shall be remotely configurable by authorised personnel.
- 10.9 The comms hub shall support total generation meters that are providing generation data for the electricity meter and IHD.

11. DATA STORAGE AND MEMORY

- 11.1 The comms hub shall incorporate memory to temporarily hold information prior to its forward transmission. It shall hold the information until the intended recipient has sent an acknowledgement of receipt back to the comms hub.
- 11.2 The memory shall be non-volatile meaning that during the loss of power to the memory it shall have a minimum retention time of the operation design life of the comms hub, over the temperature ranges as specified in section 7.2.
- 11.3 The memory shall be capable of being read from, and written to, over the temperature range specified in section 7.2.

- 11.4 Where the data is continually being updated, the data storage shall operate on an over-write First In First Out (FIFO) principle.
- 11.5 All data held in memory shall be accessible, both locally and remotely, by authorised personnel.
- 11.6 All data, with the exception of the serial number and MAC address should be capable of being individually reset by authorised personnel. Such an action shall only be possible with the use of a password and the action shall generate an event flag in the comms hub.

Note: Some resetting is likely to be required during the life of the comms hub; e.g., a change of supplier. Whether such resetting is performed locally or remotely, the action needs to be recorded on the head-end system. An event flag will allow such a recording.

- 11.7 The memory, as a minimum, shall be of sufficient size to store the following simultaneously:
- a) The currently operating firmware of the hub including the GPRS and Zigbee modules together with the previous version, if applicable;
 - b) The larger of the following firmware images:
 - 1) Gas meter;
 - 2) Electricity meter;
 - 3) IHD;
 - 4) Combined Zigbee (i.e. for all components simultaneously).

Note: This is to allow the comms hub to receive and temporarily store a complete firmware image for subsequent transmission to the appropriate component. The various components of a smart metering system will not be expected to receive firmware upgrades simultaneously, other than those associated with Zigbee.

- c) The current configuration files of the:
 - 1) Gas meter;
 - 2) Electricity meter;
 - 3) IHD;
 - 4) Comms hub.
- d) Messages that have temporarily, been prevented from reaching a component;
- e) A copy of all current register readings of the gas and electricity meters;
- f) A minimum to support the manufacturer fault location but as a minimum the most recent 40 transaction events and;
- g) The most recent 40 hub events in the fault logs;
- h) The most recent 40 hub events in the tamper logs;
- i) Time and date stamp for each data item;
- j) Hub details:
 - 1) Serial number;
 - 2) MAC address;
 - 3) MPRN/MPAN;
 - 4) Energy Supplier information;

- 5) Install code.

12. DATA COMMUNICATIONS

12.1 General

12.1.1 All parts of the smart metering system shall incorporate appropriate methods of communicating data. These may be categorised as follows:

- a) Long range, two way communications with the head-end systems, designated as WAN (Wide Area Network);
- b) Short range, two way communications, between local components (e.g. meters and comms hub, and/or meters and IHD, etc.) designated as HAN (Home Area Network);
- c) Short range, two way communications, between components and the HHT.

12.1.2 All communications shall continue to be fully functional irrespective of the mode of operation of meters;

12.1.3 All configuration, retrieval and removal of data from all components shall be capable of being carried out by authorised personnel remotely and locally.

12.1.4 All communications shall be secure; see section 12.

12.2 WAN (Wide Area Network)

12.2.1 The comms hub shall communicate with the head-end systems using a WAN.

12.2.2 The WAN shall, as minimum, utilise GPRS or 'In Fill' technology.

12.2.3 The comms hub shall incorporate a mechanism whereby, in the event of a communications failure, it shall retry. The timings and number of re-tries shall be remotely configurable by authorised personnel.

12.2.4 The comms hub should be capable of classifying messages as "critical" or "non-critical". This classification shall allow for different numbers of re-tries as described in clause 12.2.3 to be configured for each class of message.

12.2.5 The comms hub should refresh the context periodically (e.g. every 24 hours) as appropriate.

Note 1: The frequency of the context refresh or whether it's needed at all is something which will become clear after selection of the WAN supplier.

Note 2: "Refresh the context" means 'disconnecting the current PDP context and immediately re-establishing a fresh PDP context'.

Note 3: Where available, a modem capable of simultaneous multiple context activation in order to enable communications to more than one head end system.

12.2.6 The comms hub should contain a GPRS dual band modem and should be approved and tested by all UK operators.

12.2.7 The modem should, where agreed with British Gas, support EDGE and/or 3G in addition to GPRS in order to provide a future upgrade path.

Note: The comms hub will need to operate with new or existing technologies as they become viable.

- 12.2.8 The comms hub shall support network selection, where applicable, to 2G, EDGE or 3G communications, remotely by authorised personnel.
- 12.2.9 It shall be possible to increase the sensitivity of the comms hub. The comms hub should include an optimal internal (i.e. fixed inside the comms hub itself) antenna design. An optional, easy to install, dual band inductively coupled (or similarly robust) extension antenna arrangement should be available to the installer to improve the received signal. Antenna connections should be simple and tamper-resistant.

Note: Also see Part 1: General System Architecture: Data Communications.

- 12.2.10 The comms hub shall have means of indicating the WAN's signal strength and an average, taken over 30 seconds, of this data should be sent to the head-end system during installation and commissioning. WAN network Cell ID shall also be recorded and available at commissioning locally or remotely. The Cell ID shall also be available upon request from the head-end system.
- 12.2.11 WAN communication protocols shall be secure, open, extendable and publicly available.
- 12.2.12 The comms hub shall detect and alert where communications are attempted with an unauthorised source. (Also see also see Part 1: General System Architecture: Security and Part 1: General System Architecture: Alerts: Faults Tamperers and exceptions).
- 12.2.13 The WAN should be able detect and have the capability to block classes of attacks including, but not limited to the following:
1. Denial of Service;
 2. Anomalous network traffic e.g. port scanning;
 3. Unauthorised connections;
 4. Brute force attacks;
 5. War-dialling/war-driving;
 6. Virus, worms and trojans.
- 12.2.14 The comms hub should be capable of maintaining a transaction log of detailed communications events which can be retrieved locally or remotely by authorised personnel. Details of the required events shall be with the written agreement of British Gas. Typical logged events may be (but not exclusively):
- a) Successful or unsuccessful establishment of GPRS context;
 - b) Attempted security events via the WAN interface as listed in 12.2.12;
 - c) Receipt of acknowledgements;
 - d) Rejected messages.
- 12.2.15 Data transactions should be so configured to utilise as minimum bandwidth as is reasonably practicable.

Note: This, for example, may be by compression techniques and by not transmitting zero data from empty registers etc.

- 12.2.16 Data transactions and in particular meter synchronisations should be transmitted within a configurable time window. The communications window duration and nominal start time of communications should be remotely configurable.

- 12.2.17 The comms hub should be capable of transmitting synchronisation data to the head-end system at semi-random times within the configuration window specified in clause 12.2.16.

Note: Allowing the comms hub to vary its communication start times will minimise infrastructure network traffic peaks.

- 12.2.18 The manufacturer shall provide information with regard to the number and size of data packets for all the various data transfer activities including transmitting meter readings, tamper alerts and configuration file changes.

Note: This information can be used to determine the data transmission costs for the various activities involved with running a smart metering system.

12.3 HAN (Home Area Network)

- 12.3.1 All meters and the IHD shall communicate with the comms hub using the HAN.

- 12.3.2 The HAN shall be Zigbee (2.4GHz) Smart Energy Certified, be developed in line with the Smart Energy Profile and any private extension necessary to support British Gas functional requirements.

Note: Alternative HAN technology may be utilised to ensure full deployment of smart metering systems, and as such any communication standard used must support all British Gas requirements.

- 12.3.3 The HAN should operate for maximum range within the optimal power consumption budget.

- 12.3.4 All devices on the HAN should pair during commissioning following a command and key exchange (also see Part 1: General System Architecture: Installation, Commissioning and Decommissioning) and re-pair automatically following temporary system failure.

- 12.3.5 The connectivity status including link quality of components associated with the HAN shall be stored at the point of installation and be available upon request from the head-end system.

- 12.3.6 The current signal strength/status for the WAN and HAN and associated components shall be available upon request from the head-end system

- 12.3.7 HAN communication (i.e. IEEE 802.15.4) protocols shall be open, extendable and publicly available.

Note: Alternative HAN technology may be utilised to ensure full deployment of smart metering systems, and as such any communication standard used must be open, extendable and publicly available.

13. EMC

- 13.1 This section shall be read in conjunction with Part 1 General System Architecture: Section 22 EMC.

- 13.2 The comms hub shall take account of the possibility of simultaneous transmission using the HAN, and the WAN. In such cases, tests appropriate to RF transmissions shall be performed with both sources transmitting simultaneously. Alternatively, the comms hub shall incorporate means to inhibit simultaneous transmissions

- 13.3 The following lists the influence quantities that shall be applied to the comms hub:

- a) Voltage transients on signal lines (if applicable):
 - 1) The comms hub shall be tested in accordance with BS EN 61000-4-4 (or equivalent) level 3;
 - b) Electrostatic discharges:
 - 1) The comms hub shall be tested in accordance with BS EN 61000-4-2 (or equivalent) using 10 contact discharges at severity level 3 (6 kV) at intervals of 10 s to each of:
 - i) The conductive surfaces;
 - ii) A horizontal and;
 - iii) A vertical coupling plane.
 - 2) The comms hub shall be tested in accordance with BS EN 61000-4-2 (or equivalent) using 10 air discharges at severity level 3 (8 kV) at intervals of 10 s to insulating surfaces. During the test, the inlet boss of the comms hub shall be connected to the ground plane used during the test;
 - c) Radio frequency electromagnetic fields:
 - 1) The comms hub shall be tested in accordance with test level 3 of BS EN 61000-4-3 (or equivalent).
 - d) Conducted radio frequency electromagnetic fields on signal lines (if applicable):
 - 1) The comms hub shall be tested in accordance with class 2 of BS EN 61000-4-6 (or equivalent);
 - e) Surges on signal lines (if applicable):
 - 1) The comms hub shall be tested in accordance with class 1 of BS EN 61000-4-5 (or equivalent);
 - f) Power frequency magnetic fields:
 - 1) The comms hub shall be subjected to test level 3 of BS EN 61000-4-8 (or equivalent) for 15 minutes;
 - g) Pulse magnetic field immunity test:
 - 1) The comms hub shall be subjected to test level 3 of BS EN 61000-4-9 (or equivalent) for 15 minutes.
 - h) Any other quantity likely to influence in a significant way the operation of the comms hub.
- 13.4 The comms hub shall meet the radio interference suppression requirements of BS EN 55022 (or equivalent), class B.
- 13.5 All radio transmitting devices shall comply with the appropriate ETSI test Standard as appropriate, including, but not limited to:
- a) EN 300 328
 - b) EN 301 511
 - c) EN 301 489-01
 - d) EN 301 489-07
 - e) EN 301 489-17
 - f) EN 301 489-24

- g) EN 301 908-01
- h) EN 301 908-02
- i) BS EN 50360
- j) BS EN 50371

And, Council and European Parliament recommendation:

- k) 1999/519/EC.

ENDNOTES

History

First published as	Release Date
Working draft	March 2009
Split to five documents	Sept 2009
updated as result of British Gas workshop reviews	Oct 2009
Amended version	15 October 2009
Final Version	29 March 2010

Key changes

Section	Amendments
	New document

Comments

Comments and queries regarding the technical content of this product requirement document should be directed to:

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