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DP082 'Alt HAN channel selection' Problem statement – version 0.1

About this document

This document provides a summary of this Draft Proposal, including the issue or problem identified, the impacts this is having, and the context of this issue within the Smart Energy Code (SEC).

Proposer

This Draft Proposal has been raised by Angel Oses de Leon from Scottish Power.

What is the issue or problem identified?

Background

ZigBee is the technology selected by the Smart Metering Implementation Programme in Great Britain for Home Area Network (HAN) communications between smart metering Devices. All Communications Hubs will communicate at 2.4GHz[1] using specified licence exempt frequency channels[2]. The significant majority of other HAN connected smart metering Devices (circa 85%[3] of Gas Meters, In-Home Displays (IHDs), Pre-Payment Meter Interface Devices (PPMIDs) and Consumer Access Devices (CADs)) will also operate in the 2.4GHz band. The HAN shares the 2.4GHz band with other communication technologies such as WiFi and Bluetooth. Co-existence of Devices using those technologies is managed using, for Europe, a regulatory framework of obligations, rules and standards.

What are the challenges facing HAN channel management?

As the smart metering rollout progresses, more and more Devices will be installed and used. How Devices coexist in dense deployments of Smart Metering Systems using the 2.4GHz band has been managed as a Programme risk for some time. Suppliers have reported some performance issues noted by customers (e.g. other devices losing connectivity, interference, loss of smart data, etc.) and from their own operations (e.g. missed reads and intermittent Service Request success etc.).

It is noted that this risk will likely increase as the rollout starts to focus on deployments within Multi Dwelling Units (MDUs). To date, there is unlikely to have been large scale real-life deployments of 2.4GHz ZigBee Smart Metering Systems into the MDUs where all Electricity Smart Metering Equipment (ESME) and Communications Hubs are deployed in meter rooms[4].

As smart metering deployments start in MDUs, using both standard and Alternative HAN (Alt HAN) technologies, there could be well over a hundred Communications Hubs and Electricity Meters in some meter rooms operating constantly (i.e. all communicating at least every 10 seconds). In radio terms these will be virtually co-located - and hence be competing for access to the available ZigBee radio channels. It is also of note that the ZigBee 2.4GHz channel selected at install will be set for the life of the Smart Metering System unless the system is subject to external intervention via a Supplier visit involving a Communications Hub exchange.

It is acknowledged that this is an example of a non-standard roll-out scenario, it will be encountered and need to be considered as part of the rollout. Whilst extreme it does focus on the capability of current ZigBee HAN implementation approach to manage co-existence challenges. However, impacts from customer devices have been seen to disable 2.4GHz HANs in single premises when certain high capacity streaming solutions occupy the same channels as the HAN.

[1] Communications between the Communications Hub and Electricity Meter.

[2] Sixteen channels (2.4GHz) are available for use by devices permitted under the licence exempt regulatory framework.

[3] 70% of premises are likely to have a wholly 2.4GHz HAN solution – but the majority of '868 sites' will have a mix of 2.4 & 868 kit and indicatively all Alt HAN sites will have 2.4 kit. Therefore, closer to 85% of HAN Devices will be 2.4GHz.

[4] This is due to the restricted range of the current ZigBee HAN communications which limits the number of premises in an MDU where IHDs and Gas Meters can be installed and still communicate with the Communications Hubs.

Channel management opportunities

It is considered that providing a simple mechanism to allow the Communications Hub channel to be set at installation or changed after installation would provide an additional tool to allow Energy Suppliers to attempt to resolve the impacts of poor HAN performance and maintain the positive experience of consumers.

It is proposed that solution options be considered, analysed and subject to a strong business case, taken forward through the Modifications Process for future implementation.

The risks, issues and the opportunity to develop and implement an appropriate and cost-effective solution was discussed within energy supplier meetings under Alt HAN Forum governance. Additionally, discussions went ahead at the BEIS-led HAN WAN Transitional Business Design Group (TBDG) Sub-group attended by representatives of the Data Communications Company (DCC), Communications Service Providers (CSPs), Suppliers and Device manufacturers. Positive acknowledgement of the points made within this note was evident from those groups, with a broad consensus that solution options should be explored and, where a case exists, taken forward for implementation.

How does this issue relate to the SEC?

The SEC and SEC Subsidiary Documents do not mandate channel selection at the 2.4GHz band and should channel selection at 2.4GHz become available, the SEC should mandate the rules and technical specifications around this. Therefore, it is anticipated that any solution via a Modification Proposal will likely require amendments to the following parts of the SEC:

- SEC Section H ‘DCC Services’;
- SEC Appendix I ‘CH Installation and Maintenance Support Materials’;
- SEC Schedule 8 ‘Great Britain Companion Specification’ (GBCS);
- SEC Schedule 10 ‘Communications Hub Technical Specifications’ (CHTS); and
- SEC Appendix AD ‘DCC User Interface Specification’ (DUIS).

What is the impact this is having?

How does this issue affect the HAN?

There is anecdotal evidence from test laboratories run by Suppliers that it is possible to operate a large number of Devices on a single HAN channel when providing the required consumption 10 second updates to IHDs. At the present time, it is unclear whether this is close to the maximum channel occupancy or not[5].

Based on Supplier feedback, Communications Hubs tend to congregate on the lower ZigBee channel numbers when selecting a channel during the install and commissioning process. This could be due to the nature of the channel scanning algorithms used within ZigBee software stack implementations.

There are several external interference factors that could alter the performance of HANs in MDU deployments subsequent to installation:

- It is common practice to install the ESME and Communications Hub together, whilst the premises have been powered down. This results in the Communications Hub being powered up and selecting the HAN channel whilst all other 2.4GHz systems are not operating.
- In new build premises, the Communications Hubs are installed before the majority of premises are occupied. As a result, the radio environment revealed by any ZigBee channel scan on installation could change significantly as premises become occupied.
- There is always the prospect of new 2.4GHz non-smart metering devices being installed in premises near the Communications Hubs after any HAN installation is complete. If this is being used for wireless video streaming or for some of the domestic multi-room audio systems, it could occupy a significant proportion of ZigBee channels. This may not be an issue for single HAN installations, but if many HANs are occupying the same channel, significant channel occupancy from another system could affect communications for many of those HANs.
- Since smart metering equipment is largely static and does not usually deploy antenna diversity, it is possible for communications between devices to be affected by static fading in the radio channel. This could be induced by a change in furnishings, or, for example, if something like a metal filing cabinet is installed in the wrong place, adding radio attenuation which affects HAN communications.
- Within the lifetime of the Smart Metering System, there could be one or more CAD Devices added to premises, requesting the same 10 second updates as the IHDs. This could roughly double the traffic on each HAN, so if the ZigBee traffic in a meter room in an MDU is operating close to capacity on a particular channel beforehand, a noticeable proportion of communications could end up being blocked.
- Interference suffered by the Smart Metering System at install may be completely different to that at different times of the day or week when the customer (or neighbours) may be using other 2.4GHz non-smart devices.
- 4G operating in 2,350 – 2,390 MHz and new deployments in the shared 2,390 MHz band could affect lower ZigBee channels.

[5] All systems fully commissioned and operating as 'in use' with normal end to end data traffic or connected to IHDs/PPMIDs/CADs.

What are the views of the industry?

Views of SECAS

SECAS note that this proposal would need to investigate how band frequency would be measured, as this would be key to identifying which channel should be selected, should this proposal enable channel selection.

They also anticipate that this proposal will have low security impacts, though the Security Sub-Committee (SSC) will be consulted as part of any solution. The Technical Architecture and Business Architecture Sub-Committee (TABASC) and the Operations Group will be required to provide significant input to any solution.

If a Modification Proposal is required, it is anticipated that this proposal will have a large impact on the SEC Technical Specifications.

Views of the DCC

On initial consideration of this problem statement, the DCC noted that they do not know what the Alt HAN solution will be, though they expect it to provide the functionality for channel selection. Taking this into account, the DCC advised that it is difficult for them to provide a view on any proposals at this stage.

Considering the information in the problem statement, the DCC anticipate that a solution would at least require new Service Requests and have impacts on the Data Service Provider (DSP), as well as modified Communications Hub functionality. Considering this and the proposed solution of a similar Modification Proposal, this would suggest an expensive solution for arguably a small use case and would therefore require a strong business case.

Views of SEC Parties

The views of Parties will be gathered during the Development Stage.

Views of Panel Sub-Committees

The views of Panel Sub-Committees will be gathered during the Development Stage.

Views of the Change Sub-Committee

The views of the Change Sub-Committee will be gathered during the Development Stage.