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# DP082 ‘2.4GHz Channel Management’ Problem statement – version 1.0

## About this document

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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

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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<sup>1</sup> using specified licence exempt frequency channels<sup>2</sup>. The significant majority of other HAN connected smart metering Devices (circa 85%<sup>3</sup> 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 of risk for some time. Suppliers have reported some performance issues noted by customers, including:

- Other devices losing connectivity;
- Interference; and
- Loss of smart data, etc.

and from their own operations, including:

- Missed reads; and
- Intermittent Service Request success.

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 deployments of 2.4GHz ZigBee Smart Metering Systems into MDUs where all smart metering equipment and Communications Hubs are deployed in meter rooms<sup>4</sup>.

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 Smart 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. This would be via a site visit involving a Communications Hub exchange and a subsequent re-commissioning of the HAN.

<sup>1</sup> Communications between the Communications Hub and Electricity Meter.

<sup>2</sup> Sixteen channels (2.4GHz) are available for use by devices permitted under the licence exempt regulatory framework.

<sup>3</sup> 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.

<sup>4</sup> 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.

It is acknowledged that this is an example of a non-standard roll-out scenario. However, 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.

### **Channel management opportunities**

Providing a simple mechanism to allow the Communications Hub channel to be set at installation and changed after installation would provide an additional tool to allow Suppliers to resolve the impacts of poor HAN performance. This would help 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 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. 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?

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### 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 updates to IDHs every 10 seconds. At the present time, it is unclear whether this is close to the maximum channel occupancy or not<sup>5</sup>.

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.

### Use cases

There are several external interference factors that could alter the performance of HANs in MDU deployments after 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 most 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 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 performance.

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. Therefore, if the ZigBee traffic in an MDU meter room 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. Furthermore, 4G operating in the 2,350 – 2,390MHz range and new deployments in the shared 2,390MHz band could also affect lower ZigBee channels.

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<sup>5</sup> 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 impacts of doing nothing?

### Channel management

An Other SEC Party advised the current ZigBee and GBCS specifications do not directly address the ability to change the channel after the HAN has been commissioned. Once HAN performance decreases on the selected channel, the Supplier will have no choice but to de-commission and then re-commission the HAN. This would involve a Communications Hub exchange; this is a tedious and very expensive method which still relies on the new Communications Hub to select the optimum channel.

### The scale of the issue

The HAN WAN sub-group agreed that there was no evidence of any systemic or large-scale problem associated with 2.4GHz, and that the problem statement was related to two main use cases:

1. At install – ability for an installer to over-ride any channel selection algorithm and select a channel, especially in crowded meter rooms; and
2. Post install – ability for an energy supply to remotely change/ select channel to deal with “one-off” customer calls/ issues.

They estimated that a single digit percentage of the smart metering population is affected by the issue set out in this proposal. However, they added that even a small number of premise re-visits over the next 10 years (attributable to this issue) could prove costly. The sub-group then made the following estimates<sup>6</sup>:

- There are 15-17 million Communications Hubs commissioned on the 2.4GHz band.
- There is a cost of around £100-£200 for a Supplier to carry out a site visit.

Using a conservative estimate of 15 million Communications Hubs on the 2.4GHz band, a 1% error rate and a cost of £100 for a site visit, this could result in costs of at least £15,000,000 across the industry.

The group also noted the knock on impacts the issue could have if not resolved. A lack of a channel management tool could increase pressure on the 868MHz band as 2.4GHz performance decreases. This would be due to an increase in HANs operating on the 868MHz band to prevent interference from customer 2.4GHz devices.

An Other SEC Party provided its own view on the scale of the issue based on an estimate of 30 million commissioned HAN end points. It then estimated that 70% of commissioned HANs are communicating on 2.4GHz giving figure of 21,000,000. Using the 1% error rate noted above, this could affect 210,000 commissioned HAN end points.

## Who is impacted?

Two Parties and the HAN WAN sub-group advised that this proposal will benefit all SEC Parties and that it is not a dependency for the Alt HAN programme.

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<sup>6</sup> These are crude estimates in order to help understand the business case for change. There is no documented evidence to back these estimates up.

### **Impact on Alt HAN**

One Party commented that associating this problem statement with MDUs is more to do with the number of Electricity Smart Meters (and therefore Communications Hubs) in the same meter room, rather than whether the Alt HAN solution will carry the traffic to the room with the Communications Hubs. Their understanding is that the Alt HAN solution is expected to deliver connectivity without needing this functionality, and the issues set out are therefore independent of that.

Where this proposal could benefit an Alt HAN scenario is where a Supplier starts commissioning a Smart Metering System (SMS) in an MDU building from scratch. It could enable Suppliers to plan the distribution of the communication and use the entire frequency spectrum by pre-allocating the channels. This is an example of where channel selection prior to commissioning the HAN is of value.

### **Impact on single premises**

There will also be impacts in single premises as well. Parties have identified existing 2.4GHz ZigBee issues driven by their Customers' own equipment operating at 2.4GHz. This equipment has been seen to saturate the channels where the ZigBee kit is trying to operate, and this has happened in both single premises and MDUs. 2.4GHz band use is continuing to develop for a wide range of consumer purposes, with consumers installing 2.4GHz products post SMS installation. Therefore, understanding the options to solve sites which stop working now is important and that importance is likely to grow.

Furthermore, customers are increasingly installing their own 2.4GHz devices. These devices interfere with the Communications Hub and are not always visible to the Supplier at the time of commissioning the HAN. This is due to the potential for customers to install their own 2.4GHz devices at any time and after the commissioning of the HAN. Furthermore, the Communications Hub does not take any additional 2.4GHz devices into account and therefore will not adjust its channel to the optimum frequency.

## What are the views of the industry?

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### Views of SECAS

SECAS noted 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.

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 it does not know what the Alt HAN solution will be, though it expects it to provide the functionality for channel selection. Taking this into account, the DCC advised that it is difficult for it to provide a view on any proposals at this stage. However, as noted in this problem statement, SEC Parties and members of other industry groups advised that this proposal is not specific to Alt HAN.

The DCC anticipates 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

#### Views of a Large Supplier

The Supplier explained the factors contributing to the issue outlined in this proposal. During the commissioning process, if each new HAN channel is chosen as the Communications Hubs are turned on and equipped with other Devices, then they should spread-out across HAN channels. However, there is a risk that some of the ZigBee chips may not choose their channel optimally and end up saturating some channels. There is also a potential risk that if all the Communications Hubs get turned on before any PPMIDs have been added to the SMS, there isn't enough traffic to push subsequent Communications Hubs across to other channels.

The Supplier supports further discussions to understand the range of solutions available and agrees that a business case should be developed alongside, prior to deciding how to proceed. The proposal must ensure that it considers existing industry groups' discussions including any previously identified proposals, particularly where these could consider using a simple method as a solution.

#### Views of an Other SEC Party

A meter manufacturer does not believe this will have a major impact to the SEC Technical Specifications as they believe a solution can be achieved only requiring minor changes to the SEC Technical Specifications. They added that this proposal is not limited to Alt HAN and that it is beneficial to the wider 2.4GHz ZigBee Device installation. These views are detailed further up this document.

### ***The current commissioning processes***

Currently, when the installer commissions the HAN, the Communications Hub selects the channel. In theory the Communications Hub should do a full energy scan before it selects it. But there have been incidences where the Communications Hub defaults to channel 11 (first ZigBee channel). Other Communications Hubs select randomly, and others select the first empty quiet channel they meet. All are slightly different processes, and this could be because the GBCS is quiet about channel selection.

### ***Channel management benefits***

The meter manufacturer advised that it is not easy for a Supplier to select the channel as there are no agreed tools to determine this. A tool could be developed, which would have two key advantages:

- It would give Suppliers the opportunity to plan the HAN channel selection in an MDU.
- It would give the ability to change the channel once the HAN is commissioned. This would provide an insurance policy for Suppliers, as the alternative would be a home visit by the Supplier to de-commission and then re-commission the HAN.

### **Views of the HAN WAN sub-group**

The HAN WAN sub-group advised that this proposal is not solely of benefit to Alt HAN and that the title of the proposal should be changed to reflect this. It added that channel management would also benefit single premises, as customers increasingly install their own 2.4GHz devices, putting more pressure on the 2.4GHz band.

Using conservative estimates outlined further up this document, the group advised that doing nothing to advance channel management could result in costs of at least £15 million to the industry.

### **Views of Panel Sub-Committees**

#### **Views of the Operations Group**

The Operations Group expressed an interest in this proposal.

#### **Views of the SSC**

The Security Sub-Committee (SSC) expressed an interest in this proposal.

#### **Views of the TABASC**

The Technical Architecture and Business Architecture Sub-Committee (TABASC) agreed that this proposal is of interest to it and would like to be updated on its progress.

A member asked about a possible title change, stating that by saying it was Alt HAN, it could position the proposal away from other industry respondents.

Some members questioned the need for channel management, stating their testing didn't reveal any issues with this. One member stated that the testing may not have been fully reflective as it had been carried out in unoccupied MDUs with no other consumer internet connections.

The TABASC agreed that a mechanism should be introduced to alter channels without on-site management.

### Views of the Change Sub-Committee

Noting that this proposal will likely have large impacts on the SEC Technical Specifications, a member advised that should a Modification Proposal be required it would be relatively expensive to develop and implement a solution.

A member questioned how much the Alt HAN Forum had been consulted prior to this Draft Proposal being raised. With [SECMP0012 'Channel selection to support Shared HAN solutions'](#) seemingly being led solely by the Proposer, they questioned whether this was the case with this proposal. SECAS advised it will seek the views of the Alt HAN Forum to establish how big the issue is and whether other Parties on the forum feel the need for it. This will be used to form a business case to help the Change Sub-Committee make its recommendations to the Panel.

After investigating the business case for this modification, SECAS presented its findings to the Change Sub-Committee. The Change Sub-Committee subsequently agreed that there is a business case for exploring a solution, and that this Draft Proposal should be converted to a Modification Proposal to develop a solution to the issue.