

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

Unlicensed Operation in the TV Broadcast
Bands

ET Docket No. 04-186

PROPOSAL BY NOMINET UK
TO SERVE AS A WHITE SPACES DATABASE ADMINISTRATOR

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Introduction and Summary

Nominet UK is thankful for the opportunity to apply to the Federal Communications Commission's ("FCC's" or "Commission's") Office of Engineering and Technology ("OET") to be designated as a white spaces database administrator.¹

Nominet is an internet company delivering public benefit and is the trusted guardian of the UK namespace – one of the world's largest country code registries.² Nominet manages and runs the infrastructure for over 10 million domain names that end in .uk as well as Welsh Top Level Domains ("TLDs") .cymru and .wales and 35 other branded and generic TLDs, including .bbc and .london. Over 3 million businesses, and millions more consumers, rely on its domain registry services. It has a team of 170 people based in Oxford and London (UK), and Philadelphia (U.S.).

With the proceeds of its successful registry business, Nominet set up and supports the charitable foundation Nominet Trust, the UK's leading social tech funder.³

Nominet has been actively involved in projects to provide affordable internet access for several years now. We have focused our attention on TV White Spaces ("TVWS") connectivity, which we firmly

¹ Nominet submits this application in accordance with applicable Commission rules and the Commission's Public Notice soliciting proposals from prospective database managers. *See Office of Engineering and Technology Invites Proposals from Entities Seeking to be Designated TV Band Device Database Managers*, Public Notice, 24 FCC Rcd. 14,136 (OET 2009) ("Database Manager Public Notice"). *See also Unlicensed Operation in the TV Broadcast Bands et al.*, Order, 26 FCC Rcd. 554, ¶ 19 (OET 2011) ("Initial Database Administrator Designation Order") (setting forth additional requirements for database administrators). Although the Database Manager Public Notice established a filing deadline "to allow orderly processing of the initial prospective database administrators," "this deadline was not intended to preclude other parties from requesting designation as a database administrator at a later date." *Unlicensed Operation in the TV Broadcast Bands et al.*, Order, 26 FCC Rcd. 10,599, ¶ 10 (OET 2011). Rather, the TVWS rules "were designed with the expectation that there could be changes in database administrators over time" *Id.*

² *See generally* Nominet, <https://www.nominet.uk> (last visited Nov. 9, 2017).

³ *See generally* Nominet Trust, <https://www.nominettrust.org.uk> (last visited Nov. 9, 2017).

believe has the potential not only to increase access to the internet, but also to enable emerging Internet of Things (“IoT”) technologies. Leveraging our extensive experience in running authoritative national internet infrastructure services, Nominet established and operates a successful TVWS database in the UK. We also played a central role in Europe's first commercial TVWS broadband rollout, which took place on the remote Isle of Arran off the coast of Scotland. Our TVWS database was the first to complete the UK’s regulator’s⁴ qualification process, and has since been used for academic research, for exhibits, and in live trial projects. We have since continued to engage extensively with the national regulator to inform the on-going development of their TVWS regulatory framework.

Nominet is applying its considerable TVWS expertise and technologies beyond the UK to bring affordable internet access to remote and rural communities internationally, working in close partnership with Microsoft. We believe that delivering a trusted and reliable database will provide the foundation allowing the TVWS market to grow in any country.

The announcement that Mr. Brad Smith, President and Chief Legal Officer at Microsoft, made in July 2017 presenting Microsoft’s strategy to connect rural America⁵ has given the U.S. TVWS market a new sense of purpose and direction. As the TVWS market will evolve from pilots with a handful of radios to large scale deployments, it becomes essential that database services are provided by trusted and reliable entities.

Nominet is now moving to leverage its knowledge, capabilities, strong partnerships, and experience in international markets to serve as a white spaces database administrator in the U.S. We believe we are uniquely positioned to be able to provide a comprehensive service that exceeds the Commission’s functionality expectations and requirements. We are pleased to set out our qualifications and information regarding the details of our proposed database below.

⁴ See generally Ofcom, www.ofcom.org.uk (last visited Nov. 9, 2017).

⁵ See Brad Smith, *A Rural Broadband Strategy: Connecting Rural America to New Opportunities*, Microsoft (July 10, 2017), <https://blogs.microsoft.com/on-the-issues/2017/07/10/rural-broadband-strategy-connecting-rural-america-new-opportunities/>.

Nominet Proposal to Provide a Comprehensive White Spaces Database Solution

Nominet’s Global TVWS Platform Features

Nominet’s Global TVWS Platform is a production-grade modular cloud-based system designed to answer the needs of national country regulators and network operators.

Nominet has recently completed the first implementation of the Dynamic Spectrum Alliance’s⁶ (“DSA’s”) model rules for TVWS as part of the development for the Global TVWS Platform, and are leading efforts within DSA to clarify, improve, and make these rules more spectrum efficient.

The platform, which utilizes worldwide datasets including for the U.S., can be localized to comply with different regulatory rulesets and is already deployed as commercial software. Nominet has also developed a set of sophisticated mapping, planning, and wide-scale spectrum investigation tools.

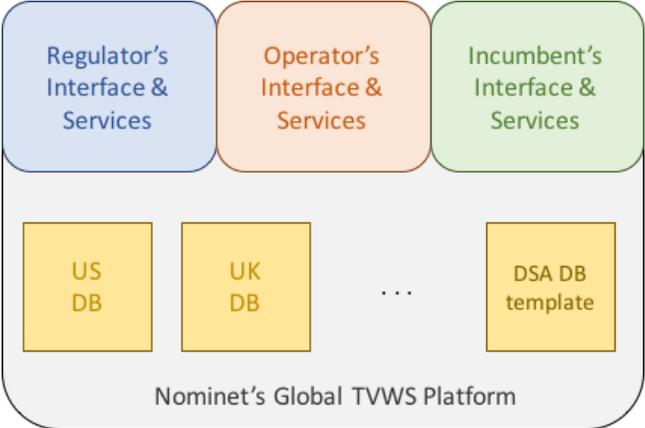


Figure 1: Global TVWS Platform Architecture

In the table below we list the features included in the Global TVWS Platform to support regulators, network operators and incumbents.

Global	Features
Regulators	<ul style="list-style-type: none"> • Support for several coexistence rules • Template of the coexistence rules based on the DSA model

⁶ See generally Dynamic Spectrum Alliance, <http://dynamicspectrumalliance.org/> (last visited Nov. 9, 2017).

	<ul style="list-style-type: none"> • Customizable TVWS coexistence rules • Terrain-based radio propagation model (i.e. Longley-Rice, also known as Irregular Terrain Model for network planning purposes and DSA model rules) • FCC Curves propagation model (for FCC’s regulatory framework) • Okumura-Hata propagation model (for Ofcom’s regulatory framework) • Customizable parameters of the radio propagation model • Policy advice based on the global markets • Impact analysis of the rules through “if-then” scenarios • Graphical interface for spectrum utilization monitoring and interference management • Graphical interface for protection areas management • Graphical interface for TV transmitter’s information update • Potential to support other frequencies.
Operators	<ul style="list-style-type: none"> • Standard interface for radios to connect to the database (IETF PAWS) • In-channel interference report • Unique planning tools • Advanced feasibility studies • Device monitoring tools.
Incumbents	<ul style="list-style-type: none"> • Service registration • Venue registration • Grey spaces registration, monitoring, and monetization.

Table 0-1: Global TVWS Platform Features

Nominet’s Platform Features for the U.S. Market

Nominet’s platform is purposely designed to accommodate multiple regulatory frameworks, including the FCC rules. With respect to the features indicated in Table 0-1, not all of them can be available in every country. In the case of the U.S. market, the following features will be available:

U.S. Market	Features
Regulator	<ul style="list-style-type: none"> • Support for the FCC coexistence rules • FCC Curves propagation model (for FCC’s regulatory framework)

	<ul style="list-style-type: none"> • Terrain-based radio propagation model (i.e. Longley-Rice, also known as Irregular Terrain Model) for network planning purposes • Graphical interface for spectrum utilization monitoring and interference management • Potential to support other frequencies.
Operators	<ul style="list-style-type: none"> • Standard interface for radios to connect to the database (IETF PAWS) • In-channel interference report • Unique planning tools • Advanced feasibility studies • Device monitoring tools.
Incumbents	<ul style="list-style-type: none"> • Service registration • Venue registration.

Table 0-2: Features for the U.S. Market

Required Database Functions

Nominet fully intends to provide the entire suite of database functions identified by the Commission, including managing a data repository, performing calculations to determine available channels, and registering fixed unlicensed devices and licensed services not listed in the Commission’s databases.⁷ Nominet will not rely on other entities to perform any of the database functions. The FCC’s Public Notice requests a description of the database system architecture, including the operation of each proposed database function. The data repository, registration, query, and synchronization processes depicted in the following diagram are described in greater detail below.⁸

⁷ See Database Manager Public Notice at 14,137 (requiring a database administrator applicant to “describe in detail the scope of the database functions that it intends to perform . . .”).

⁸ See *id.* (“The entity must provide diagrams showing the architecture of the database system and a detailed description of how each function operates and how each function interacts with the other functions.”).

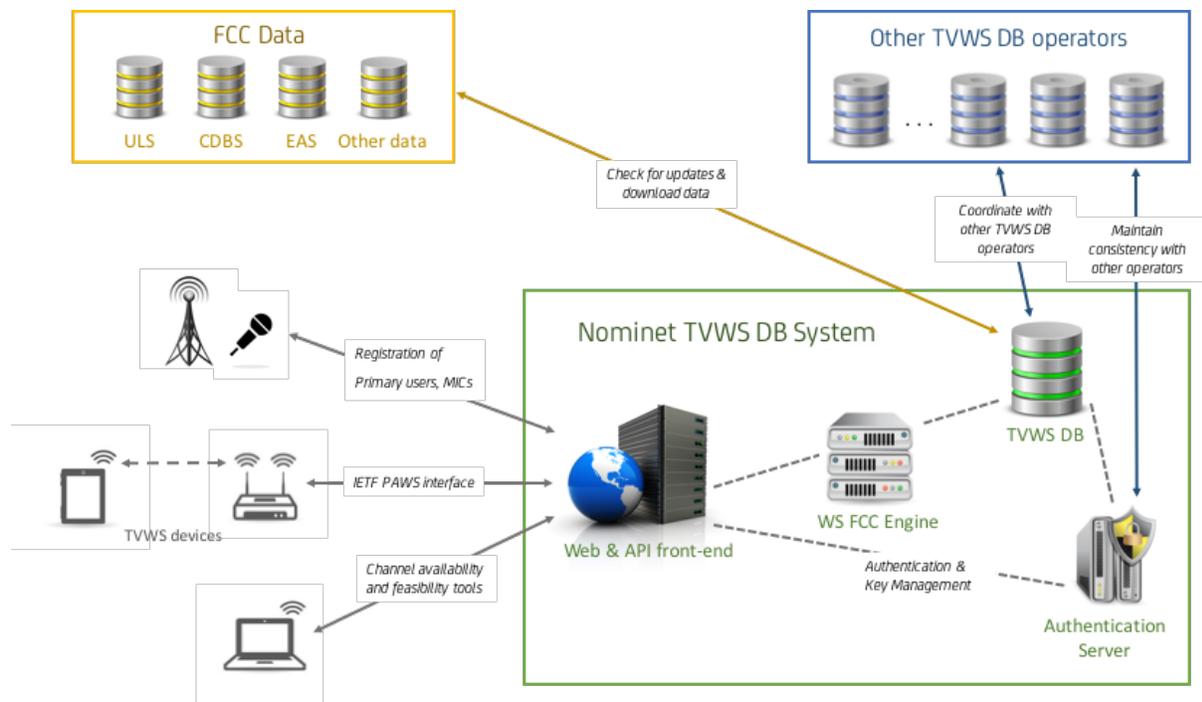


Figure 2: TV White Spaces Database Architecture

Data Repository

The FCC’s white spaces rules require databases to contain information about protected services from several different sources. Much of this information will come from FCC databases, as illustrated at the top of Figure 2. These databases include the Universal Licensing System, the Consolidated Database System, and the Equipment Authorization System. In addition, the FCC has made available other information, such as private land mobile radio services waiver sites (“PLMRS”) and cable headend and translator receive sites for which the FCC has granted a waiver of the 80 km distance limit. Nominet will obtain data about these services from the FCC according to the various access methods established by OET.

Finally, the rules require information to be included in relation to protected services that are registered with individual database providers rather than recorded in Commission databases.⁹ Services that register directly with the Nominet database are described below, while services that

⁹ See 47 C.F.R. § 15.713(b)(2).

register with another white spaces database provider will be accommodated by synchronizing the Nominet database with the other providers through methods developed in concert with OET.

Data Registration Process

The FCC requests information about the registration of services that are not listed in FCC databases.¹⁰ Such locations include fixed white spaces devices, multichannel video programming distributor headends, eligible licensed wireless microphone locations, 600 MHz band operations in areas where the licensee has commenced operations, and locations of health care facilities that use channel 37 Wireless Medical Telemetry Service equipment.¹¹ Nominet will provide capability to register and coordinate this information with other database providers. Registration will be accomplished through a user-friendly web interface.

Query Process

As illustrated in Figure 1, Fixed and Mode II devices will communicate with the database through a query process according to the Internet Engineering Task Force (“IETF”) Protocol to Access White-Space (“PAWS”) standard. This process will include operations that return a list of available channels based on the type of device and geographic coordinates provided.

For the white spaces database, Nominet will determine available channels using the service contours and distance calculations set forth in the Commission’s rules.¹² The database will respond with a list of available channels at that location.

¹⁰ See Database Manager Public Notice at 14,137.

¹¹ See 47 C.F.R. § 15.713(b)(2). In addition, the Commission’s rules contemplate that “unlicensed wireless microphone users in the 600 MHz band may register with and access the database manually via a separate Internet connection” to satisfy the requirement that they “register with and check a white space database to determine available channels prior to beginning operation at a given location.” 47 C.F.R. § 15.713(f). See also 47 C.F.R. § 15.713(i) (setting forth registration requirements for 600 MHz band wireless microphone operations).

¹² See 47 C.F.R. § 15.712.

Nominet's Global TVWS Platform already supports a variety of propagation models and regulatory frameworks and, in the event the Commission changes its rules, it can accommodate other methods of determining protection for incumbent licensed services. However, for the calculation of the protection of the incumbents in the U.S., the ultimate determination of channel availability will always be made consistent with the FCC's rules.

Synchronization of Data Between Multiple Databases

As noted above, each database designated by the FCC has the ability to register protected services whose information is not available from Commission databases.¹³ Accordingly, Nominet will implement an efficient process for providing the data it collects regarding these facilities on a timely basis, including cable television headends and direct-broadcast satellite receive sites; Class A television receive sites; low-power television station receive sites; television translator station receive sites; sites where licensed low-power auxiliary stations such as wireless microphones and wireless-assist video devices are used and their schedule for operation; 600 MHz band operations in areas where the licensee has commenced operations; locations of health care facilities that use channel 37 Wireless Medical Telemetry Service equipment; and fixed TV band device registrations.

Because the Commission has designated multiple database providers, the FCC's rules require a standardized process for database coordination and synchronization.¹⁴ Nominet will implement the data exchange system as designed by the other database providers and is open to collaboration to improve the design, if necessary.

Secure Database Communications

The FCC requested database applicants to demonstrate that unauthorized parties cannot access the database, and that communications among devices and databases will be secure.¹⁵ Nominet ensures

¹³ See 47 C.F.R. § 15.713(b)(2).

¹⁴ See 47 C.F.R. § 15.715(l).

¹⁵ See Database Manager Public Notice at 14,137 (an applicant's description of communications methods "must include a description of the security methods that will be used to ensure that unauthorized parties can not access or alter the database or otherwise corrupt the operation of the database system in performing its intended functions.").

that communications among white spaces devices and databases, as well as communications among multiple databases, are authorized and secure.

Via a secure web interface, operators generate unique security tokens for each of their devices. These tokens are loaded onto the devices by the installers. The device attaches this token to each of its queries to the database as proof that the query is genuinely from that device under the control of its registered owner. This mechanism is already in place in the UK and existing TVWS device manufacturers already support it.

Nominet will also ensure that its database will provide reliable continuous service. The Nominet database provides channel availability information only to certified devices whose eligibility is determined by querying the Equipment Authorization System database as required in Section 15.713(a)(1) of the Commission's rules.¹⁶ This functionality also enables the database to deny channel availability information to devices no longer approved by OET. A separate authentication mechanism is used to allow authorized users (*e.g.* licensed wireless microphone operators) to input location information into the database.

In addition, Nominet will work with other database administrators to ensure that synchronization among databases is implemented securely.

Finally, Nominet will provide a reliable database service by following best practices for continuance of database operations. These solutions include geo-distributing the service using multiple servers, implementing backup servers that replicate the database functionality, deploying intrusion provision systems, and taking measures to prevent/minimize denial-of-service attacks. Our services will be hosted on the Microsoft Azure platform and therefore challenges such as server unavailability, off-site backups of record information, and providing physical safeguards such as hosting servers in secure locations with back-up power supplies will be ensured.

¹⁶ 47 C.F.R. § 15.713(a)(1).

Operating a Database: Technical Expertise and Five-Year Business Plan

Nominet has the technical expertise necessary to administer a white spaces database and the capability to operate the database for the required term.¹⁷

The .uk DNS name servers, for which we are responsible, have been consistently available for over 15 years and Nominet has developed the reputation for being one of the most reliant and resilient registries in the world. Our servers handle more than 6 billion requests every day, so our systems need to be highly reliable. We have invested millions of pounds to make our systems highly resilient to attack, compromise, accident or error. We continue to invest heavily which means that, even in the most extreme circumstances, our registry systems will continue to provide a reliable service and that website traffic and emails will continue to be routed correctly for the 11 million .uk domain names.

Nominet has operated commercially a TVWS database in the UK since January 2016. Our revenue projections give us confidence that the white space database operation is sustainable in the long term, and we have developed an agile business model for operating the database and the added-value services that can adapt to different countries and regulations. In fact, thanks to the Global TVWS Platform we can provide our services to wireless network operators, spectrum regulators, and incumbents potentially anywhere in the world a TVWS regulation is in place or investigated. This allows Nominet to provide stability to the global TVWS market while making sure that the database business plan can have the best opportunities to be viable.

Nominet's revenue model for commercial operation of the TVWS database in the U.S. is a fee based subscription model to grant access the database and its services. The main customers in this model are wireless network operators, however, we are also exploring the opportunity to offer TVWS-related services to other interested customers.

¹⁷ See Database Manager Public Notice at 14,137 (requiring database administrator applicants to demonstrate “sufficient technical expertise” to administer a database as well as a “viable business plan to operate the database for the five-year term . . .”).

Compliance with Additional Requirements Specified by the Commission

In its initial order designating database administrators, the Commission requested commitments from database administrators regarding certain aspects of database operation.¹⁸ Nominet will comply with the applicable requirements.¹⁹ First, Nominet agrees to make the database services that enable compliance with the white spaces rules available to all unlicensed white spaces device users on a non-discriminatory basis, and agrees that it will not use its capacity as a database administrator to engage in any discriminatory or anti-competitive practices, or any practices that may compromise user privacy.

Second, Nominet will provide any information contained in the database to the Commission and remove information from the database upon direction from the Commission. Nominet will make Application Programming Interfaces available to the FCC and/or allow authenticated web-based access according to FCC requirements. Nominet will provide FCC access to information used to determine channel availability along with access to log records. Nominet will also include the capability to respond to specific inquiries, as well as bulk downloads of relevant data, consistent with OET requirements.

Third, Nominet will make all information that the rules require to be contained in a white spaces database publicly available.²⁰ This information includes information obtained from FCC database records as well as fixed white space database registrations and information submitted by protected entities. Consistent with FCC rules, however, Nominet will not make the information submitted by 600 MHz band licensees under 47 C.F.R. § 15.713(j)(10)(v)-(vi) publicly available.²¹

¹⁸ See Initial Database Administrator Designation Order ¶ 19.

¹⁹ The Initial Database Administrator Designation Order also required database administrators to attend workshops conducted at the FCC Lab in 2011. Although these workshops have now concluded, Nominet has reviewed the relevant materials that OET subsequently published on the Commission's White Space Database Administrator website. See FCC, *White Space Database Administration*, <https://www.fcc.gov/general/white-space-database-administration> (last visited Nov. 9, 2017).

²⁰ 47 C.F.R. § 15.715(m).

²¹ See *id.*

Finally, Nominet will cooperate with all other measures that OET deems necessary to ensure compliance with the Commission's rules. Nominet initially designates Adam Leach (adam.leach@nominet.uk) and Pasquale Cataldi (pasquale.cataldi@nominet.uk) as its responsible parties who will represent Nominet and ensure compliance with the conditions set forth by OET. The team working on TVWS can be collectively contacted at the following email address: tvws@nominet.uk.

In Regard to the Changes to Database Procedures Set in 2015

The initial database operator designation order required applicants to indicate how they would comply with the *Second Memorandum Opinion and Order*, which the Commission adopted subsequent to submission of the initial round of applications.²² For avoidance of doubt, Nominet's database will implement the rules set in 47 C.F.R. Part 15, Subpart H – White Space Devices, including the changes to procedures to implement the decisions made in the Commission's *Report and Order* in ET Docket No. 14-165.²³

In relation to the changes presented in that docket, we observe that Nominet's global platform is already able to include the device location accuracy in the calculation of the power limits. In fact, the white space database operating in the UK is based on the ETSI EN 301 598 V2.0.5 (2017-04)²⁴ standard, where location must be reported with 95% accuracy and must include uncertainty.

In relation to the requirement to inform white space devices about changes in channel availability in the area where licensed wireless microphones reserve channels,²⁵ we acknowledge OET's decision to

²² See Initial Database Administrator Designation Order ¶ 19.

²³ See generally *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37 et al.*, Report and Order, 30 FCC Rcd. 9551 (2015).

²⁴ See ETSI, *Draft ETSI EN 301 598 V2.0.5 (2017-04)* (2017), available at http://www.etsi.org/deliver/etsi_en/301500_301599/301598/02.00.05_20/en_301598v020005a.pdf.

²⁵ See 47 C.F.R. § 15.711(i).

extend through March 31, 2018 a waiver of the push notification requirements and that the waiver would remain in effect until the Commission takes a final action addressing the petitions for reconsideration of the push notification rules,²⁶ Nominet is open to discussing practical solutions based on its UK experiences.

Conclusions

Nominet believes that the adoption of dynamic spectrum sharing techniques is essential to avoid the impending wireless spectrum crunch, caused by the rapid growth of smartphone usage and IoT devices. This would be in line with any national spectrum regulator's commitment to see spectrum used in the most economically efficient manner. The existing static models used for allocating spectrum are inherently inefficient and are ill-suited when it comes to handling the continued rapid growth of wireless data traffic.

Nominet believes that TVWS represent an extraordinary opportunity to leverage underutilized spectrum to bring broadband and other services to U.S. businesses and citizens. The use of dynamic spectrum management for TVWS has shown that it can be successfully implemented and it is an important first step for using the approach more widely in other spectrum bands.

Nominet has observed with interest the developments in the U.S. TVWS market and believes that by entering the market now it will provide stability and reliability to the ecosystem and allow the market to grow. In fact, we expect the cost of the equipment to become more affordable and therefore finally enable large scale deployments for different use cases, not only in the rural parts of the U.S.

Nominet is pleased to present this database proposal to the Commission and looks forward to utilizing our knowledge and experience to provide a comprehensive white spaces database solution.

²⁶ See Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands & Duplex Gap, & Channel 37, Order, ET Docket No. 14-165 and GN Docket No. 12-268, DA 17-900 (OET rel. Sep. 15, 2017).

Respectfully submitted,

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