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May 16, 2016

REDACTED – FOR PUBLIC INSPECTION

VIA ECFS

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Amdocs, Inc.
Proposal to be Designated Spectrum Access System Administrator
GN Docket No. 15-319

Dear Ms. Dortch:

Amdocs, Inc. ("Amdocs"), by its counsel, submits Amdocs' proposal to become a Spectrum Access System ("SAS") administrator ("Proposal") in response to the Federal Communications Commission ("Commission") *Public Notice*.[1] As detailed in the Proposal, Amdocs intends to build an SAS system in compliance with the Commission's rules governing Citizens Broadband Radio Service commercial operations in the 3550- 3650 megahertz band,[2] the *First Report and Order and Second Further Notice of Proposed Rulemaking,*[3] and the *Order On Reconsideration and Second Report and Order*.[4]

Pursuant to section 0.459 of the Commission's rules,[5] Amdocs requests that the Commission withhold from public inspection and accord confidential treatment to marked portions of the confidential copy of the Proposal filed with the Office of the Secretary in the

[1] Wireless Telecommunications Bureau and Office of Engineering and Technology Establish Procedure and Deadline for Filing Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Applications, GN Docket No. 15-319, Public Notice, DA 15-1426 (rel. December 16, 2015) ("*Public Notice*"); ; Wireless Telecommunications Bureau and Office of Engineering and Technology Extend "First Wave" Filing Deadline for Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Proposals, GN Docket No. 15-319, *Public Notice*, DA 16-397 (rel. April 14, 2016).

[2] 47 C.F.R. Part 96, Subpart F.

[3] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Report and Order and Second Further Notice of Proposed Rulemaking*, FCC 15-47 (rel. April 21, 2015).

[4] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Order On Reconsideration and Second Report and Order*, FCC 16-55 (rel. May 2, 2016).

[5] 47 C.F.R. § 0.459

REDACTED – FOR PUBLIC INSPECTION

above-referenced proceeding. Amdocs is also filing via ECFS the redacted version of the attached Proposal for public inspection.

Please do not hesitate to contact the undersigned with any questions regarding this matter.

Sincerely,

Caressa D. Bennet /RAS

Caressa D. Bennet
Robert A. Silverman
Counsel for Amdocs, Inc.

cc: Paul Powell, Wireless Telecommunications Bureau
Becky Schwartz, Wireless Telecommunications Bureau
Navid Golshahi, Office of Engineering and Technology

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Wireless Telecommunications Bureau and	)	GN Docket No. 15-319
Office of Engineering and Technology	)	
Establish Procedure and Deadline for Filing	)	
Spectrum Access System (SAS)	)	
Administrator(s) and Environmental Sensing	)	
Capability (ESC) Operator(s) Applications	)	

PROPOSAL BY AMDOCS, INC. TO BE DESIGNATED SPECTRUM ACCESS SYSTEM ADMINISTRATOR

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May 16, 2016

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Administrator(s) and Environmental Sensing	)	
Capability (ESC) Operator(s) Applications	)	

PROPOSAL BY AMDOCS, INC. TO BE
DESIGNATED SPECTRUM ACCESS SYSTEM ADMINISTRATOR

I. Introduction and Summary

Amdocs, Inc. ("Amdocs" may refer to the applicant or, when the context requires, to its affiliates) submits its proposal to the Federal Communications Commission ("Commission" or "FCC") to become a Spectrum Access System ("SAS") Administrator as set forth in the FCC's rules with respect to Citizens Broadband Radio Service ("CBRS") commercial operations in the 3550-3650 megahertz band ("3.5 GHz Band") and in response to the *Public Notice* of the FCC's Wireless Telecommunications Bureau and Office of Engineering and Technology in GN Docket No. 15-319.[1] Specifically, Amdocs intends to build an SAS system in compliance with the FCC's CBRS rules and regulations set forth in Part 96, subpart F of the FCC's rules ("SAS Rules")[2] the *First Report and*

[1] Wireless Telecommunications Bureau and Office of Engineering and Technology Establish Procedure and Deadline for Filing Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Applications, GN Docket No. 15-319, *Public Notice*, DA 15-1426 (rel. December 16, 2015) ("*Public Notice*"); Wireless Telecommunications Bureau and Office of Engineering and Technology Extend "First Wave" Filing Deadline for Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Proposals, GN Docket No. 15-319, *Public Notice*, DA 16-397 (rel. April 14, 2016).

[2] 47 C.F.R. Part 96, Subpart F.

Order and Second Further Notice of Proposed Rulemaking,[3] and the *Order On Reconsideration and Second Report and Order*.[4]

Amdocs is also investigating partnership opportunities with specialists in radiofrequency ("RF") sensing in connection with a potential application to become an Environmental Sensing Capability ("ESC") operator in the future. As part of operating in the broader CBRS ecosystem, Amdocs intends to comply with all the interfacing rules with any third-party ESC operator as necessary for the effective operation of SAS.

Amdocs is a member of the Wireless Innovation Forum ("WInnForum")[5] consistent with Commission expectations that stakeholders work collaboratively to develop standards, procedures and industry best practices for the CBRS ecosystem, particularly the following external interface definitions: SAS-to-Citizens Broadband Radio Service Device ("CBSD") and CBSD-to-SAS (with and without a domain manager intermediary); SAS-to-SAS; and ESC-to-SAS; and the SAS requirements. Amdocs will actively participate and contribute to the development of standards in the CBRS ecosystem and intends to incorporate WInnForum standards and recommendations into its SAS solution.

The responses in this proposal are framed to address specific information requests and questions in the *Public Notice* and to describe how the Amdocs SAS will comply with requirements and core functions set forth in the SAS Rules.[6]

[3] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Report and Order and Second Further Notice of Proposed Rulemaking*, FCC 15-47 (rel. April 21, 2015) ("3.5 GHz Order").
[4] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Order On Reconsideration and Second Report and Order*, FCC 16-55 (rel. May 2, 2016) ("3.5 GHz Order on Reconsideration").
[5] http://www.wirelessinnovation.org/
[6] *See Public Notice* at 5-7.

II. Overall SAS Functional Scope

Describe the scope of the functions that the SAS and/or ESC would perform.[7]

Amdocs proposes to provide the full scope of SAS functionality set forth in the SAS Rules. The Amdocs SAS also will comply with the relevant SAS standards ratified by WInnForum's Spectrum Sharing Committee WG1.[8]

The broad functional areas and responsibilities of the Amdocs SAS will include:

- *Registration, Authentication, and Authorization of CBSDs.* Confirming and verifying the identity of any CBSD seeking to use the 3.5 GHz Band prior to authorizing its operation consistent with Section 96.57 of the Commission's rules, including preventing CBSD operations within any Protection Zones and calculating and enforcing Priority Access License ("PAL") Protection Areas,[9] using a combination of: 1) Rules and Policy Engines 2) Interference Estimations3) Frequency Assignments per given geographical areas and 4) verification against the FCC databases of approved and licensed CBSDs.
- *Coordination*. Providing advanced, highly automated frequency coordinations for users of the 3.5 GHz Band using a combination of: 1) Rules and Policy Engines; 2) Interference Estimations; 3) Frequency Assignments; 4) Coordination mechanisms across various user groups (Incumbents, PAL, General Authorized Access ("GAA")); and 5) Operational Synchronization with external entities including ESC operators, FCC databases and other SAS providers.
- *Frequency Optimization*. Providing protection to higher tier users from harmful interference from lower tier users and optimizing frequency use to facilitate coexistence between all users in the band by using a combination of: 1) Rules

[7] *See Public Notice* at 5.
[8] Spectrum Sharing Committee, Working Group 1 Operational & Functional Requirements; WINNF-15-S-0112; Requirements for Commercial Operation in the U.S. 3550-3700 MHz Citizens Broadband Radio Service Band (May 12, 2016), *available at* http://groups.winnforum.org/p/cm/ld/fid=85&tid=338&sid=5781 ("WINNF-15-S-0112").
[9] 47 C.F.R. § 96.57

and Policy Engines; 2) Interference Estimations; and 3) Frequency Assignments per given geographical areas.

- *Protocols/Procedures*. Implementing protocols and procedures to realize the core functions of an SAS, including:
    - Maintaining secure and reliable communication between all SASs and all CBSDs (or domain proxies) using mechanisms such as HTTPS (Secure Sockets Layer ("SSL") or Transport Layer Security ("TLS")) to encrypt data in transit;
    - Maintaining secure and reliable communication between the Amdocs SAS and all ESCs using mechanisms such as HTTPS (SSL or TLS) to encrypt data in transit;
    - Maintaining secure and reliable communication among other SASs in the ecosystem using mechanisms such as HTTPS (SSL or TLS) to encrypt data in transit; and
    - Ensuring that incumbent operations – including federal radar systems and non-federal fixed satellite service ("FSS") earth stations – are protected from harmful interference by using a combination of 1) Rules and Policy Engines; 2) Interference Estimations; and 3) Frequency Assignments per given geographical areas.
- *Databases*. Gathering and maintaining accurate information from various sources such as CBSD registrations, relevant FCC databases such as the Universal Licensing System ("ULS"), ESC reporting mechanisms and other SAS administrator systems.
- *Security*. Providing security and protection for all information databases in the SAS system with role based access and potential additional solutions such as encrypted data objects.
- *Responsiveness to FCC*. Responding to FCC requests for information stored or maintained by Amdocs by providing authorized FCC personnel 24/7 access to all available reports and a help desk.
- *Supporting the CBSD Secondary Market.* Amdocs anticipates that its SAS will accept and support Priority Access spectrum manager lease notifications

pursuant to Section 96.66 of the Commission's rules,[10] and will likely support SAS-managed spectrum exchanges to meet market demand pursuant to the *3.5 GHz Order on Reconsideration*.[11]

Moreover, Amdocs will ensure that its SAS will fulfill the following purposes consistent with Section 96.53 of the FCC's rules:[12]

- To enact and enforce all policies and procedures that Amdocs develops as an SAS Administrator pursuant to Section 96.63 of the FCC's rules.[13]
- To determine and provide to CBSDs the permissible channels or frequencies at their location.
- To determine and provide to CBSDs the maximum permissible transmission power level at their location.
- To register and authenticate the identification information and location of CBSDs.
- To retain information on, and enforce, "exclusion zones" and "protection zones" in accordance with Sections 96.15 and 96.17 of the FCC's rules.[14]
- To communicate with the ESC to obtain information about federal incumbent user transmissions and instruct CBSDs to move to another frequency range or cease transmissions.
- To ensure that CBSDs operate in geographic areas and within the maximum power levels required to protect federal incumbent users from harmful interference, consistent with the requirements of Sections 96.15 and 96.21 of the FCC's rules.[15]
- To ensure that CBSDs protect non-federal incumbent users from harmful interference, consistent with the requirements of Sections 96.17 and 96.21 of the FCC's rules.[16]
- To protect Priority Access Licensees from interference caused by other PALs and from GAA users consistent with Section 96.25 of the FCC's rules.[17]

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[10] 47 C.F.R. § 96.66
[11] *3.5 GHz Order on Reconsideration* at ¶234.
[12] 47 C.F.R. § 96.53.
[13] 47 C.F.R. § 96.63
[14] 47 C.F.R. §§ 96.15 and 96.17.
[15] 47 C.F.R. §§ 96.15 and 96.21.
[16] 47 C.F.R. §§ 96.17 and 96.21.

- To facilitate coordination between GAA users operating Category B CBSDs, consistent with Section 96.35 of the FCC's rules.[18]
- To resolve conflicting uses of the band while maintaining, as much as possible, a stable radio frequency environment.
- To ensure secure and reliable transmission of information between the SAS and CBSDs.
- To protect grandfathered wireless broadband licensees consistent with Sections 90.1307, 90.1338 and 96.21 of the FCC's rules.[19]
- To implement the terms of current and future international agreements as they relate to the CBRS.
- To receive reports of interference and requests for all additional protections from Incumbent Access users and promptly address interference issues.

III. Technical Capability to Operate and Administer a SAS

Demonstrate that Amdocs possesses sufficient technical expertise to operate an SAS and/or ESC, including the qualifications of key personnel who shall be responsible for operating and maintaining the SAS and/or ESC.[20]

Technical Expertise

Amdocs is a leader in communications software solutions and services for the world's largest communications, entertainment and media service providers. Amdocs has been in business for more than 30 years. Amdocs provides solutions in the areas of Billing Support Systems ("BSS"), Operational Support Systems ("OSS"), Network Management, Network Optimization, Network Control, and Network Functions Virtualization (NFV) software. Amdocs has worked with many of the leading standards bodies (European Telecommunications Standards Institute ("ETSI"), Metro Ethernet Forum ("MEF"), Next Generation Mobile Networks ("NGMN") Alliance, Tele Management Forum ("TMF") to bring standards to market that benefit the communications industry. In order to collaborate

[17] 47 C.F.R. § 96.25.
[18] 47 C.F.R. §§ 96.35.
[19] 47 C.F.R. §§ 90.1307, 90, 1338 and 96.21.
[20] *See Public Notice* at 5.

in and contribute to the development of standards for the emerging shared spectrum arena, Amdocs has joined the WInnForum.

Key Personnel

Specifically, Amdocs has 1000+ engineers in the areas of network engineering, management and optimization. Amdocs' engineers who would be responsible for operating and maintaining the SAS regularly perform activities such as:

- Managing and optimizing the Radio Access Networks ("RAN");
- Carrying out spectrum re-farming;
- Running operational RAN Self Optimizing Network ("SON") systems;
- Developing new spectrum management SON algorithms;
- Developing propagation and prediction models for SON product algorithms;
- Developing propagation and prediction models for offline RAN optimization recommendations;
- Developing RF measurement based geographic RAN optimization products; and
- Designing RF network and model tuning for various technologies including GSM, UMTS and LTE.

Products and Services

Amdocs has developed a number of products and services that are deployed by communications service providers today covering all the above mentioned areas. Additionally, Amdocs has deployed and operates 24/7 systems that automatically manage multi-vendor and multi-technology networks (including UMTS and LTE). Some of the UMTS and LTE networks managed by Amdocs consist of over 10,000 base stations. This management includes a number of SON use cases that involve multiple aspects of frequency management, the coordination of changes across multiple network base stations, and the resolution of conflicts. Further detailed technical information regarding the above-mentioned technical products and product capabilities can be found in **Section A of the Appendix** hereto.

IV. Commercial Context

Demonstrate that Amdocs is financially capable of operating an SAS and/or ESC for a five-year term, including a description of the Amdocs' business structure and ownership information and a description of the fee collection process and the entities from which the fees shall be collected.[21]

Financial Capability and Ownership

Amdocs is a large public company whose financial statements are a matter of public record. Amdocs has sufficient funds to successfully build, operate and maintain the proposed SAS for the FCC's proposed five-year term. **Section B of the Appendix** contains a detailed company overview, ownership structure, a discussion of Amdocs' SAS business plan, and other relevant financial information. As such, Amdocs has the financial wherewithal to develop and operate its SAS system for the proposed five-year period.

Fees

Amdocs is currently evaluating various business models that would fit the FCC's CBRS framework and provide value to prospective customers. The Commission states that SAS Administrators are permitted to charge PALs and GAA users reasonable fees,[22] and Amdocs intends to develop a viable business model for its SAS administration services based on revenue from such fees. Amdocs intends to develop a direct billing relationship with PALs and GAA users for the purposes of collecting reasonable fees. If appropriate and consistent with the Commission's expectation that a competitive market for SAS services will emerge, Amdocs will consider developing a direct billing relationship with CBSD manufacturers and any other entities representing potential users of SAS administration services with the intent of simplifying the CBSD end user operational procedures.

Amdocs is currently evaluating an annual registration fee model per CBSD. Amdocs also may offer additional related services to customers to support their operational needs. In any case, Amdocs is a large and viable provider of network engineering,

[21] *See Public Notice* at 5.
[22] 3.5 GHz Order at ¶359.

management and optimization services, and if designated then Amdocs intends to stand behind and fully support its SAS Administrator operations.

Post-Term

In the event that Amdocs does not wish to continue after the end of its term, or if its term is not renewed, Amdocs will reasonably cooperate in the transfer of its database along with the information necessary to access the database to another designated SAS pursuant to the 3.5 GHz Order.[23]

V. SAS to ESC Communications

Describe how data shall be securely communicated between the SAS and its associated ESC and how quickly and reliably these communications shall be accomplished.[24]

Amdocs' approach will be consistent with the FCC's directive of maintaining "exclusion zones" in phase 1 (no ESC required) and converting them to "protection zones" in phase 2 (after ESC approval) for geographical areas under Amdocs SAS's administration.

As part of its SAS operations in the broader CBRS ecosystem, the SAS to ESC communications of Amdocs' SAS will comply with all the interfacing protocols associated with any FCC-approved third party ESC operator as necessary to meet Section 96.61 of the FCC's rules on information security requirements.[25]

Amdocs will contribute to the definition of the SAS-to-ESC interface while working with other partners in the ecosystem and use industry groups such as the WInnForum to collaborate on defining a timely, reliable and secure interface protocol between the Amdocs SAS and ESCs.

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[23] *Id*.
[24] *See Public Notice* at 6.
[25] 47 C.F.R. § 96.61.

VI. SAS Architecture

Provide technical diagrams showing the architecture of the SAS and/or ESC and a detailed description of how each function operates and how each function interacts with the other functions.[26]

Amdocs proposes to provide all the necessary functional components to effectively operate a SAS to comply with the Commission's rules. The high level functionality descriptions of the various components for the proposed SAS are provided below, and the proposed SAS framework and functional architecture are depicted in Figure 1 below. The SAS functionalities will comply with the FCC's SAS rules and as enumerated in the relevant SAS sections of the requirements documents ratified by the WInnForum's Spectrum Sharing Committees WG1[27] and WG3.[28] [29]

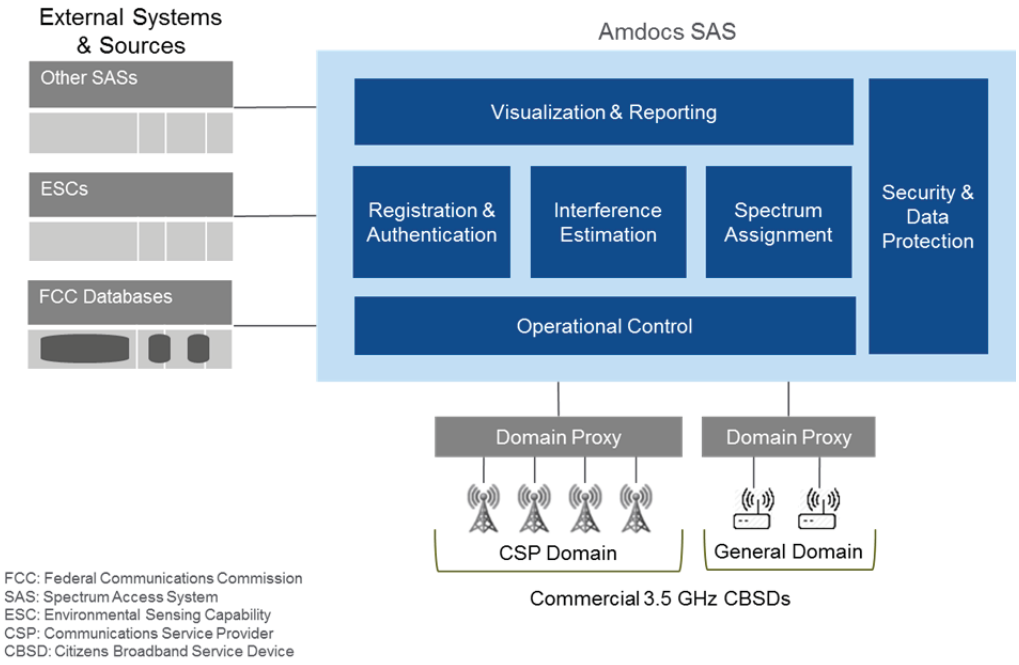

Figure 1: Amdocs SAS Framework & Functional Architecture

[26] *Id*.
[27] WINNF-15-S-0112.
[28] Spectrum Sharing Committee, Working Group 3 Interim SAS to SAS Protocol Technical Report; WINNF-16-P-0003 ("WINNF-16-P0003").
[29] Spectrum Sharing Committee, Working Group 3 SAS to CBSD Protocol Technical Report; WINNF-15-P-0062 ("WINNF-15-P-0062").

A. In accordance with FCC rules, Operational Control functions will provide:

- Interfaces with all the internal SAS components and external systems including ESCs, FCC databases, and other SASs;
- Support for the processes to manage the CBSDs, including regular status message exchanges, authorization grants, and registration processes;
- Synchronization functions for all the required information from other SASs; and
- Synchronization functions for all the required information from external FCC databases.

B. In accordance with FCC rules, Registration and Authentication functions will provide:

- Verification and validation of CBSD hardware by way of such equipment's FCC identifier ("FCC ID") from the Commission's Equipment Authorization System to ensure that all authorized CBSD equipment is in compliance with 3.5 GHz Band rules for operation.
- Responses to CBSDs or associated domain proxies with a CBSD ID for all accepted registrations; rejected registrations will respond with error codes explaining the reason for rejection.

C. In accordance with FCC rules, Interference Estimation functions will provide:

- Predictions of coverage and calculations of the interference at geographic locations for each channel; using various methods such as propagation modeling, fixed contour modeling and measurement based modeling depending on data availability.
- Identification of the geographic protection zones to classify the interfering CBSD users for shutdown or retuning.

D. In accordance with FCC rules, Spectrum Assignment functions will provide:

- Available and assignable frequencies (if any) for the requesting CBSDs; and

- Synchronization and checks on the frequency assignments based on the priority type of the CBSD (i.e., PAL or GAA user).

E. In accordance with FCC rules, Visualization and Reporting functions will provide:

- Reports and audits of the current databases;
- Non-compliance reports for any CBSD's frequency assignment that has not followed the frequency allocation requests of the SAS;
- Activity logs of SAS and SAS to CBSD interactions;
- Spectrum/channel availability per census tract; and
- CBSD statuses connected to the SAS and presence of incumbent activity in the census tracts.

F. In accordance with FCC rules, Security and Data Protection functions will provide:

- Methods, protocols and procedures to ensure security and accuracy to all the interactions external to SAS (SAS-to-CBSD, SAS-to-FCC, SAS-to-ESC) to prevent unauthorized alterations to exchanged messages; and
- Methods to ensure security to all the functions internal to SAS in order to prevent unauthorized access to the SAS system, associated functions and databases.
- Further detail on the security and data protection that will be employed by the Amdocs SAS is provided in Section XVI of this Proposal regarding SAS Information Security.

VII. Utilized Propagation Model

Describe the propagation model and any other assumptions that Amdocs proposes to use to model operations and facilitate coordination in the band.[30]

Propagation Models

The Amdocs SAS will use various propagation models along with measurement data (wherever available) to assess permissible coverage at a given location for a given frequency channel and band. Propagation models ultimately need to be tuned to specific morphology and clutter types. Amdocs intends to evaluate several models for use in its SAS. Based on its network optimization experiences, Amdocs can confirm that coverage estimation and interference prediction are most accurate when mobile measurements are used whenever available. These measurements could be provided by the CBSDs, or respective domain proxies. Amdocs intends to explore these areas further to increase the effectiveness of aggregated interference level at a given location area.

Further detailed technical information regarding the above mentioned methodologies can be found in **Section A of the Appendix**.

Alternative Models

In scenarios where one or more installation parameters (such as exact location of one more CBSDs belonging to a CBRS operator) are not available, Amdocs will use alternative solutions for obtaining the CBSDs coverage boundaries[31] while still conforming to the SAS Rules. Amdocs intends to comply with WInnForum's ratified requirements for collecting any specific CBSD information and measurements.

[30] *See Public Notice* at 6.
[31] Spectrum Sharing Committee, Working Group 1 – PAL Task Group contributions; WINNF-16-I-0109, WINNF-16-I-0110 ("WINNF-16-I-0110").

VIII. SAS Maintenance

Describe the methods that shall be used to update software and firmware and to expeditiously identify and address security vulnerabilities.[32]

Amdocs is in an excellent position to provide software-based operational services, as it is already providing these services to many of the top 100 communications service providers worldwide today.

Amdocs will maintain and test the system continually to identify and address any security vulnerabilities in a timely manner, and develop and deploy software updates to increase quality and reliability. These software updates can be pushed to the SAS system automatically and expeditiously using auto-update mechanisms to the SAS system during maintenance window time periods. Amdocs expects to implement the anticipated types of system updates without SAS system downtime.

Amdocs' core business is to design, deploy and operate software product based solutions for communications service providers. Amdocs' support provides a staffed 24/7 help desk that delivers a comprehensive set of support services that enable service providers to accelerate the value gained from their investment in Amdocs, while maintaining continuous systems operations.

Interaction with the help desk can be either electronic, through raising a support case, or, when the situation requires it, by direct phone calls. The help desk will either resolve the incident directly or connect to experts appropriate for the incident. The help desk operates on service level agreements ("SLA") based on the priority of the reported incident. For example, a reported critical incident could have an SLA response time of within one hour, whereas a minor incident could have an SLA response time of within three days.

Furthermore, Amdocs intends to provide event based alerts for highly critical events. These alerts can keep the various stakeholders informed of any remarkable activities for the respective CBRS operator.

[32] *See Public Notice* at 6.

IX. Affirmation to Support FCC Rules

Affirm that Amdocs (and its respective SAS and/or ESC) shall comply with all of the applicable rules as well as applicable enforcement mechanisms and procedures.[33]

As an SAS administrator, Amdocs affirms that it and its respective ESC will comply with all the applicable rules governing CBRS as found in the SAS rules as well as applicable enforcement mechanisms and procedures associated with running an SAS.

X. CBSD Information Management

Desribe how the SAS shall retain, secure, and verify information from CBSDs (including location data), licensees, associated ESCs, and other SASs.[34]

Amdocs' SAS will retain information information from CBSDs (including location data), licensees, associated ESCs, and other SASs in several internal databases. The following are the broad categories of databases that the system is expected to maintain:

- CBSD databases for Priority Access and GAA users
- PAL license databases
- Spectrum databases
- Protected FSS locations as set forth in Section 96.17 of the FCC's rules
- Exclusion zone databases
- ESCs and protection zone databases

Amdocs intends to adopt the final ratified versions of CBSD information management, registration procedures and interface protocols requirements from the WinnForum.[35] [36]

Data protection refers to protecting data while in-transit (as it travels to and from different sub-systems) and at rest (while it is stored on disks). Amdocs' systems will avail standard IT practices to protect data in transit by using HTTPS (Secure Sockets Layer ("SSL") or Transport Layer Security ("TLS")) to encrypt data in transit; client certificates

[33] *See Public Notice* at 6.
[34] *Id*.
[35] *See* WINNF-16-P0003.
[36] *See* WINNF-15-P-0062.

prevent impersonation and man-in-the-middle attacks. To further strengthen the security of private and sensitive data (e.g., activity and audit logs) Amdocs' SAS will consider solutions such as encrypting data objects before saving the data on disks and decrypting while downloading the objects.

Amdocs' SAS will verify the CBSD's FCC ID and Call Sign match against the CBSD's entry in the FCC databases. This is to ensure that the CBSDs and the licensees are approved by FCC.

Amdocs' SAS will also verify that the location reported is the within acceptable margins of the currently stored location of the CBSD (with latitude/longitude coordinates or implied latitude/longitude coordinates based on address). All locations will also be verified that they reside within the geographic operational area of the Amdocs SAS.

A new registration request would be initiated if Amdocs' SAS determines that there has been a change in location or installation parameters.

Moreover, Amdocs will ensure that its SAS' information gathering and retention capabilities are compliant with Section 96.55 of the FCC's rules as follows:

- The Amdocs SAS will maintain current information on registered CBSDs, the geographic locations and configuration of protected FSS locations as set forth in Section 96.17 of the FCC's rules, and the federal incumbent user exclusion zones and protection zones.
    - For registered CBSDs, such information shall include all information required by Sections 96.39 and 96.45 of the FCC's rules.
    - Amdocs will make all information necessary to effectively coordinate operations between and among CBSDs available to other SAS Administrators.
    - Amdocs will make CBSD registration information available to the general public, but will obfuscate the identities of the licensees providing the information for any public disclosures.

- For non-federal incumbent users, the Amdocs SAS will maintain a record of the location of protected earth stations as well as the all registration information required by Section 96.17 of the FCC's rules.

- The Amdocs SAS will maintain records not pertaining to federal incumbent user transmissions for at least 60 months.
- The Amdocs SAS will only retain records of information or instructions received regarding federal incumbent user transmissions from the ESC in accordance with information retention policies established as part of the ESC approval process.
- The Amdocs SAS will be technically capable of directly interfacing with any necessary FCC database containing information required for the proper operation of an SAS.
- The Amdocs SAS will process and retain acknowledgements by all entities registering CBSDs that they understand the risk of possible interference from federal incumbent user radar operations in the band.

XI. Interference Management

Demonstrate that the SAS shall be capable of resolving various sources of interference between and among Citizens Broadband Radio Service users and/or Incumbent users.[37]

Describe how the SAS shall ensure that non-federal FSS earth stations and grandfathered 3650-3700 MHz licensees are protected from harmful interference consistent with the rules.[38]

Amdocs' SAS will support a tiered interference management assigning different priorities of interference management as set forth in the FCC's rules.

A. Protection of Federal Incumbent Users:

Consistent with the *3.5 GHz Order*, the *3.5 GHz Order on Reconsideration*, and Section 96.15 of the FCC's rules, in Phase 1 of the SAS rollout Amdocs will strictly use the exclusion zones provided by Commission for incumbent areas and FSS/grandfathered

[37] *See Public Notice* at 6.
[38] *Id.*

contours to provide inteference protection for the incumbents users. Amdocs' SAS will restrict any CBSDs inside these exclusion zones to transmit and also shall keep the interference levels inside the exclusion zone near minimum.

During phase 2 of the SAS rollout Amdocs, will integrate with an FCC-approved ESC network to monitor for incumbent activity in the protection zones.

Amdocs' SAS will address incumbent arrival (notification through an ESC) and trigger protection mechanisms by following steps and procedures as enumerated below:

a) ESC reports incumbent activity at a particular location to Amdocs' SAS;
b) Amdocs' SAS will fetch all the required information from its spectrum assignment database, and its CBSD database will identify the protection zone and corresponding CBSDs transmitting within the same channel;
c) After estimating inferference for all the channels, Amdocs' SAS will identify the interfering CBSDs in the incumbent areas;
d) Amdocs' SAS will then check against protocols established by the FCC's rules and identify the available new frequencies (if any for these CBSDs);
e) Amdocs' SAS will then send an update to the affected CBSDs to request them to stop using their current frequencies. The Amdocs SAS will expect the affected CBSDs to confirm that they no longer use these frequencies.
f) After departure of the incumbent or reported inactivity of incumbent by the ESC, Amdocs' SAS will permit the impacted CBSDs in the area to retune back to their licensed channel.

B. Protection of Existing FSS Earth Stations in the 3600-3650 MHz Band and 3700-4200 MHz Band:

Consistent with the *3.5 GHz Order*, the *3.5 GHz Order on Reconsideration*, and Section 96.17 of the FCC's rules, Amdocs' SAS will trigger a protection mechanism for existing FSS earth stations in the 3600-3650 MHz Band and FSS earth stations in the 3700-4200 MHz Band used for telemetry, tracking and control ("TT&C") by the steps and procedures enumerated below:

a) ESC reports non-federal transmission activity or planned event from non-federal incumbent;
b) Amdocs' SAS will use the FSS earth stations and grandfathered device antenna model, transmit power and other installation parameters from the incumbent database to run coverage prediction;
c) Amdocs' SAS will identify the protection zone and run the interference model to identify the CBSDs and geographic areas that are interfering;
d) Amdocs' SAS will then check against protocols established by the FCC's rules and identify the available new frequencies (if any for these CBSDs);
e) Amdocs' SAS will then communicate to the corresponding CBSDs expecting the CBSD's to send a relinquish request and vacate the frequency; and
f) After departure of the incumbent or reported inactivity of the incumbent by the ESC, Amdocs' SAS will permit the impacted CBSDs in the area to retune back to their licensed channel.

C. Operation Near Canadian and Mexican Borders:

Pursuant to Section 96.19 of the FCC's rules, Amdocs' SAS will implement terms of current and future international agreements with Mexico and Canada in the matters of CBRS operation in the 3.5 GHz Band. These coordination rules will be part of the Amdocs SAS system.

D. Protection of Existing Operators in the 3650-3700 MHz Band:

Pursuant to Section 96.21 and Sections 90.1307 and 90.1338 of the FCC's rules, certain existing operators in the 3650-3700 MHz band("3.65 GHz Band") that have been deemed grandfathered wireless broadband licenses shall be afforded incumbent status with protection from harmful intereference within their registered Grandfathered Wireless Protection Zones until April 17, 2020. The Amdocs SAS will support the registration requirements of such 3.65 GHz Band licencees under this status. The Amdocs SAS will extend incumbent status to these existing operators for interference protection mechnaisms.

XII. SAS Coordination

Describe how coordination shall be effectuated (e.g., through data synchronization) between multiple SASs, if multiple SASs are authorized, and how quickly this synchronization of data shall be accomplished.[39]

Amdocs' SAS will support communications with other FCC-approved SASs to effectuate coordination between them. The duration of synchronization would depend on the scope of information exchange between the SASs. In dynamic operational situations involving spectrum assignments, Amdocs foresees a need for near-real time synchronization of a small but key set of information exchanges to help with accurate channel tracking of all CBSDs in the area regardless of the SAS with which the CBSDs are registered. This would be supported by the Amdocs SAS solution. In other non-dynamic scenarios (e.g., when the Amdocs SAS requires periodical synchronization with another SAS for database accuracy concerning all the CBSDs or PAL coverage areas), Amdocs also sees a need for the SASs to synchronize on a slower non-real-time basis. SASs may also exchange PAL registration mechanisms.[40] Amdocs intends to comply with the ratified standards in the areas of SAS to SAS communications currently being developed by the WInnForum.[41]

XIII. Scope of SAS Functionality

If not performing all SAS functions, provide information on the entities operating other functions and the relationship between Amdocs and these other entities. In particular, address how the Commission can ensure that all of the requirements for SAS Administrators in Part 96, subpart F are satisfied when SAS functions are divided among multiple entities, including a description of how data shall be transferred among these various related entities and SASs, if multiple SASs are authorized, and the expected schedule of such data transfers (i.e., real-time, once an hour, etc.).[42]

Amdocs is proposing to deliver the full scope of SAS Administrator functionality as defined in the SAS Rules and consistent with external interfaces defined by WInnForum standards. Amdocs' SAS will perform all the operating functions associated with the

[39] *See Public Notice* at 6.
[40] *See* WINNF-16-I-0110
[41] *See* WINNF-16-P0003.
[42] *See Public Notice* at 6.

secure and effective operation of SAS in compliance with the FCC's rules and regulations and as further set forth in its Proposal.

XIV. Interfacing Methods

Describe the methods (e.g., interfaces, protocols) that shall be used by: (1) CBSDs to communicate with the SAS; (2) the SAS to communicate with CBSDs; (3) the SAS to communicate with other SASs; and, if applicable, (4) the SAS to communicate with one or more ESCs. Also describe the procedures, if any, to verify that a CBSD can properly communicate with the SAS.[43]

A. SAS – CBSD and CBSD – SAS Interface:

Amdocs intends to comply with the protocols developed and ratified in WInnForum to allow the following interfacing functions and procedures:[44]

- Amdocs' SAS will authenticate CBSDs during registration by verifying the validity of the FCC ID of any CBSD seeking access to its services prior to authorizing the CBSD to begin providing service. Upon successful verification Amdocs' SAS will assign a unique ID to each CBSD. The SAS system will also maintain unique channel/frequency IDs for each unique channel assignment with respect to a CBSD. These IDs will remain the same provided there is no change in the CBSD's channel or frequency.
- Amdocs' SAS will manage the CBSDs by exchanging regular status messages with them. The Amdocs SAS will maintain its database according to information exchanged in the status messages. Such information includes attributes such as broadcasting channel, power, and device location. The frequency of the regular status message exchange is being considered by the WInnForum.
- Amdocs' SAS will communicate with any transmitting CBSDs to control their channel allocation when incumbents and PALs require protection.

[43] *Id*.
[44] *See* WINNF-15-P-0062.

B. SAS – SAS interface:

Amdocs' SAS will support communications with other FCC-approved SASs. Amdocs intends to comply with the ratified standards in the areas of SAS–to-SAS protocols and communications that are being developed by the WInnForum.[45]

C. SAS – ESC interface:

During phase 2 of the SAS rollout, Amdocs will integrate with an FCC-approved ESC network to monitor for incumbent activity in the protection zones. Amdocs' SAS will support the necessary interface protocols and methods as agreed with one or more ESC providers, as applicable.

XV. Affirmation to Support FCC ESC Data Retention Rules

Affirm that, consistent with section 96.55 of the Commission's rules, the SAS shall only retain records and information or instructions received regarding federal transmissions from the ESC in accordance with information retention policies established as part of the ESC approval process.[46]

Consistent with Section 96.55 of the Commision's rules, Amdocs affirms that its SAS will retain only records and information or instructions received regarding federal transmissions from the ESC in accordance with information retention policies established as part of the ESC approval process. Amdocs will work with the FCC-approved ESC provider(s) to effectuate these policies.

[45] *See* WINNF-16-P0003.
[46] *See Public Notice* at 6.

XVI. SAS Information Security

Describe the security methods that the prospective SAS Administrator plans to use to ensure that unauthorized parties cannot access or alter the SAS or otherwise corrupt the operation of the SAS in performing its intended functions, consistent with the Commission's rules.[47]

Amdocs will ensure all the security features are consistent with the Commission's rules and regulations. Amdocs intends to adopt and implement security related requirements being defined by the WinnForum.[48]

Data protection refers to protecting data while in-transit (as it travels to and from different sub-systems) and at rest (while it is stored on disks). Amdocs' systems will implement standard IT practices to protect data in transit such as by using HTTPS (SSL/TLS) to encrypt data in transit. Client authentication can be secured by requiring the client to posses a valid Public Key Certificate. To further strengthen the security of private and sensitive data (e.g., activity and audit logs) Amdocs' SAS will consider solutions such as encrypting data objects before saving it on disks and decrypting while downloading the objects.

Amdocs understands that different stakeholder groups (e.g., SAS administrators, FCC, CBRS providers, and the public) will have different privileges to access and view data. Amdocs will implement appropriate authentication and access levels to restrict information to a user group pursuant to FCC rules.

Amdocs is an ISO 27001 certified organization and has established Information Security management systems and processes to ensure data security for Amdocs' customers and their information assets.

The Amdocs Information Security staff hold industry standard certifications, including: Certified Ethical Hacker ("CEH"), Licensed Penetration Tester ("LPT"), Certified Information Systems Security Professional ("CISSP"), Certified Information Security Manager ("CISM"), Certified Information Systems Auditor ("CISA"), Certified in Risk and Information Systems Control ("CRISC"), and AppScan Specialist.

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[47] *Id*.
[48] *See* WINNF-15-S-0112.

The Amdocs Secure Development Life Cycle ("SDLC") includes security processes and procedures at every stage of the development life cycle, starting from the requirement stage up to and including design, construction, testing, (secured) deployment, and operation. The Amdocs SDLC is based on Microsoft Security Development Lifecycle ("SDL"), other leading standards in the industry such as the Open Web Application Security Project ("OWASP"), and Amdocs' best practices.

One of the important aspects in Amdocs SDLC is the security testing, which is conducted in two vectors:

- Functional security testing – which aims to verify that the security features of all relevant systems in scope operate correctly in accordance with the requirements; and
- Non-functional security testing – which aims to bypass the security mechanism of the system. This comprises code scans and penetration testing performed by experts with extensive experience.

For maintaining data separation, Amdocs has operational experience for multiple solutions including role-based access and Virtual Private Databases (an Oracle™ relational database technology).

As discussed above, Amdocs applications use a common security framework for information security that provides solid, open and robust protection of sensitive information and resources. This security framework ensures that Amdocs products are secured according to all industry standards and regulations. As a result Amdocs has experience in making solutions Payment Card Industry Data Security Standard ("PCI DSS") ready, enabling customers to easily achieve PCI DSS certification.

Amdocs' security capabilities include:

- Ability to encrypt and mask sensitive information;
- A unified and strong authentication and authorization mechanism based on industry best practices including single user repository, user account management console and security audit logs;

- Ability to manage sessions across Amdocs applications and use single sign-on; and
- Ability to integrate with external services like Lightweight Directory Access Protocol ("LDAP").

XVII. Spectrum Assignment Use Cases

Describe dynamic use-case scenarios for how the SAS shall manage and assign spectrum resources to ensure that geographically and spectrally adjacent operations are coordinated consistent with the Commission's rules. Use case scenarios should include the methodology and protection approach for cases of radio interference due to adjacent blocking, out-of-band emissions, and aggregate co-channel interference. Describe how multiple SASs shall coordinate the calculation of aggregate interference for protecting Incumbent users and Priority Access licensees.[49]

Amdocs' SAS will support all the relevant use cases pertaining to spectrum assignment and re-assignment pursuant to the FCC's rules. The following is a non-exhaustive set of use cases that Amdocs intends to support:

A. Geographical Use Cases

- Channel assignment at geographical census tract boundaries
  - Between same PAL Licensee
  - Between different PAL Licensees
  - In exclusion zones

B. Spectral Use Case

- GAA channel re-allocation due to arrival of an assigned PAL
- GAA re-allocation due to arrival of an incumbent

Section C of the Appendix contains a detailed description and discussion of the above-listed use cases.

Amdocs' SAS will synchronize with all the relevant databases from other SASs and run the spectrum assignment and interference calculation whenever there is any updated data on the channel assignments reported from other SASs.

[49] *See Public Notice* at 6.

XVIII. Support for Commission Requests

Describe the methods that the SAS shall use to make information stored or retained by the SAS available in response to a request from authorized Commission personnel.[50]

Amdocs' SAS will provide authorized Commission staff with 24/7 access to all the available reports. Furthermore, Amdocs intends to support event-based alarms and triggers that can be pushed to intended recipients at the Commission, and Amdocs intends to provide authorized Commission staff with reporting corresponding to such alarms and triggers. **Section D of the Appendix** details some of the potential reports, audits and visualization capabilities that could be provided.

To improve information security and control Amdocs would request that the Commission appoint specific individuals who would be considered "authorized Commission personnel" and would serve as points of contact between the Commission and Amdocs for the exchange of information. These points of contact will then follow appropriately defined security procedures.

Amdocs understands that different stakeholder groups (e.g., SAS administrators, FCC, CBRS providers, and the public) will have different privileges to access and view data. Amdocs will implement appropriate authentication and access levels to restrict information to a user group.

XIX. Conclusion

Amdocs believes it would be an excellent choice for an SAS Administrator because of its:

- Communications industry and RAN experience;
- Experience of running complex and business critical IT systems for the leading telecommunications service providers in the United States and globally;
- Commitment to moving the communications industry forward and enabling industry players to embrace new innovations and business models; and
- Commitment to comply with the FCC's rules and regulations.

[50] *Id.*

On the basis of its Proposal, Amdocs respectfully requests that the Commission "conditionally approve" Amdocs as an SAS Administrator.

Respectfully submitted,

AMDOCS, INC.

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APPENDIX

AMDOCS, INC.

PROPOSAL TO BE DESIGNATED
SPECTRUM ACCESS SYSTEM ADMINISTRATOR

GN Docket No. 15-319

REDACTED