

Department of Defense Workbook Information File
In Support of AWS-3 Transition Planning for the 1755-1780 MHz Band
Rev. 9/10/14

AWS-3 auction bidders should read and comprehend this document in its entirety as it contains critical content that bears on the 1755-1780 MHz post-auction transition.

The Department of Defense (DoD) has prepared the DoD 1755-1780 MHz Workbook (hereafter referred to as the Workbook) to provide potential bidders in the AWS-3 auction with information about potential impacts to AWS-3 frequency blocks and market areas as DoD incumbent users migrate, in most cases, to other frequency bands or other applications. It provides the refined Protection Zones for coordination of AWS-3 base stations with incumbent DoD operations as specified in the Joint Public Notice, released by the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA), announcing AWS-3 coordination details.¹ This adjunct Information File is provided to help in the understanding and use of the Workbook. The Workbook may be found at www.ntia.doc.gov/category/aws-3-transition.

As explained in the Joint PN, sharing between AWS-3 auction winners and the incumbent federal operations will occur via a coordination process that will take place during the transition. Transition timelines (i.e., the time it takes a DoD operation to migrate to another frequency or medium) vary between operations and military Services. A limited number of operations will remain in the band indefinitely. Many aspects of the incumbent spectrum uses involve sensitive, non-public information that is redacted in the publicly available Transition Plans. For example, almost all DoD frequency assignments have restrictions on distribution which prevents their public release. The presentation of this information in the Workbook excludes critical RF parameters and usage characteristics such that distribution limitations can be honored. At the same time, the information is presented at a high level of resolution (e.g., at the census tract level) in order to provide bidders additional information about the DoD incumbent use and coordination obligations to plan for the AWS-3 auction.

The value of the Workbook comes from an understanding of how coordination will be implemented in the AWS-3 frequency blocks to allow sharing during the transition period. All of the DoD frequency assignments have an authorized point and radius or area of operation. Working groups associated with the Commerce Spectrum Management Advisory Committee (CSMAC) performed first-cut sharing assessments between most affected DoD systems and expected AWS-3 commercial wireless technologies – these assessments addressed both the potential for interference to federal systems from AWS-3 transmitters and the potential for interference to AWS-3 receivers from federal transmitters. The results of these assessments provided both a minimum and maximum range of values for different federal system types. For preparation of the Workbook, the worst case (maximum) values were

¹ See Coordination Procedures in the 1695-1710 MHz and 1755-1780 MHz Bands, *Public Notice*, GN Docket No. 13-185, DA 14-1023 (rel. Jul. 18, 2014) (Joint PN), available at <http://www.ntia.doc.gov/files/ntia/publications/pn-aws3-procedures.pdf> and https://apps.fcc.gov/edocs_public/attachmatch/DA-14-1023A1.pdf.

tabulated and retained to identify zones between DoD systems and AWS-3 systems within which coordination would be required to avoid harmful interference in a sharing environment. The CSMAC distances represent coordination distances, not exclusion zones. The coordination zones associated with DoD operations with valid frequency assignments are based on the sum of the authorized points and radii or area of operation and the coordination distances calculated for the DoD operations in question. Figure 1 illustrates the concept of a center location, authorized area of operation, and the inclusion of the additional coordination distance which yields the full coordination zone.

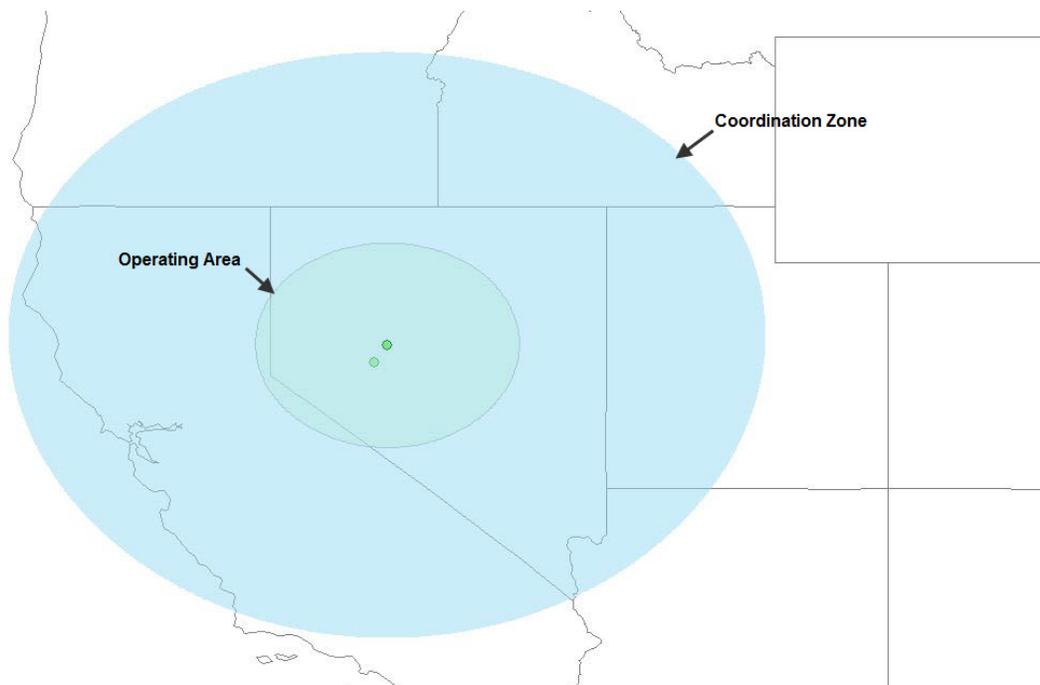


Figure 1. Example of operating area and coordination distance.

Coordination zones for approximately 1400 DoD operations were determined and mapped into a Geographic Information System (GIS) application.² Files containing US census tracts were also mapped into the GIS tool – approximately 75,000 census tracts. As mentioned above, the use of census tracts was chosen to provide a high degree of fidelity in representing the impact of DoD operations on geographic areas. A crosswalk of census tracts to FCC licensing areas is also provided at www.ntia.doc.gov/category/aws-3-transition.

Note: In order to ensure greater consistency with information provided by the FCC about AWS-3 license areas, the updated Workbook uses 2010 census tract boundaries instead of 2013 tract boundaries.

² Analysis was based on mobiles and portables transmitting up to 20 dBm Effective Isotropic Radiated Power (EIRP).

The GIS tool was used to determine the overlap of DoD coordination zones and census tracts for each of the five 5 megahertz segments within the 1755-1780 MHz band. Figure 2 shows one such intersection of a coordination area with census tracts. Census tracts totally or partially within a particular coordination zone are considered to be impacted by that DoD system. Any one census tract may be impacted by more than one DoD system, as specific local areas typically support many types of DoD operations. Sharing during the transition period requires coordination through the Defense Spectrum Organization (DSO) 1755-1780 MHz Band Coordination Portal prior to deployment.

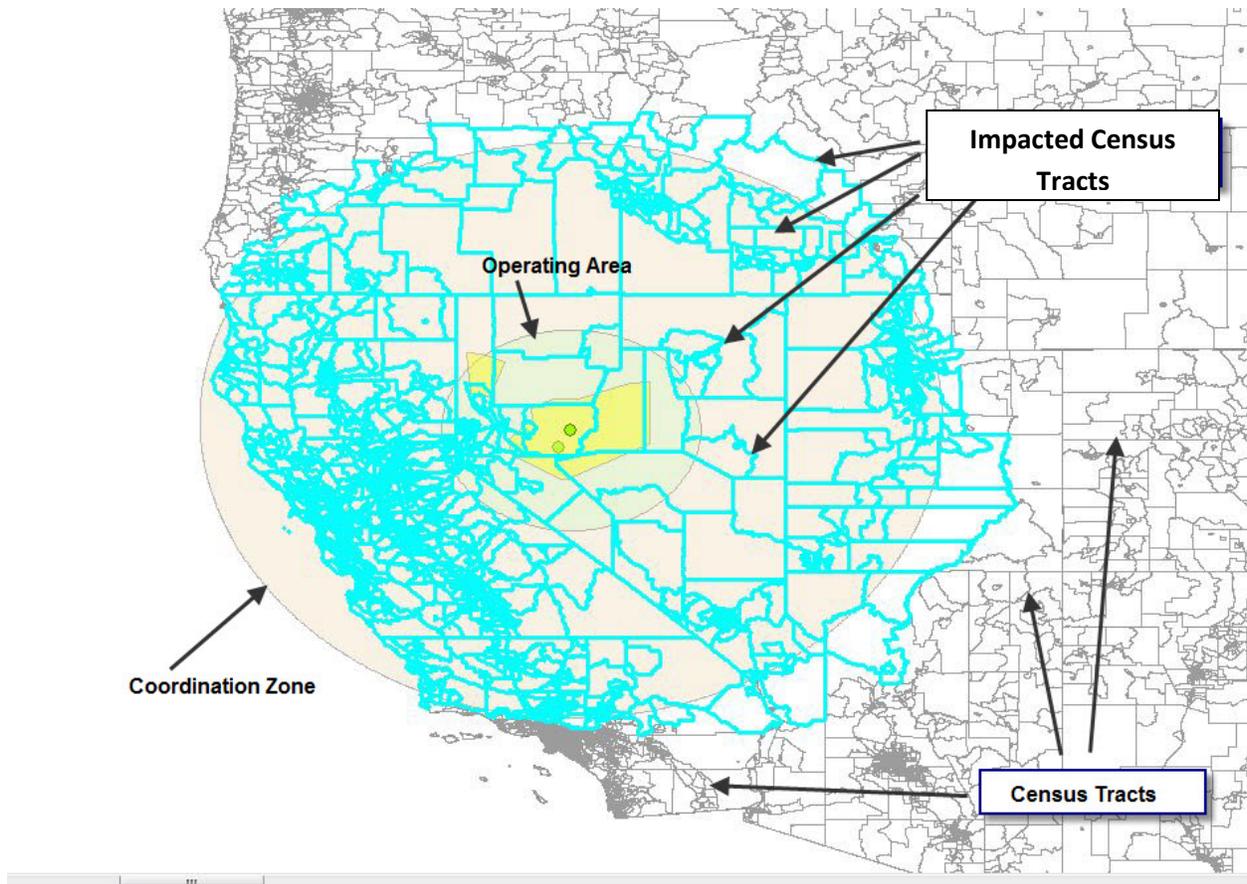


Figure 2. Intersection of census tracts and coordination area.

DOD will take the following steps to maximize the potential for successful coordination and accelerated access to spectrum for licensees during the transition period. As licensees submit coordination requests, DoD will conduct electromagnetic compatibility (EMC) analyses that incorporate refinements to specific elements of the analyses conducted during the CSMAC Working Groups. These refinements will include real-world assumptions about terrain, clutter, network loading, and other parameters to the maximum degree possible. DoD's analyses will also incorporate the actual characteristics of the proposed commercial deployment and incumbent federal operations. DoD successfully used such an approach to help significantly reduce the coordination distances for Aeronautical Mobile Telemetry (AMT) systems from the CSMAC Working Group 5 analysis results. To enable validation of, and future enhancements to, the real-world assumptions, DoD has established a comprehensive Spectrum Sharing

Test and Demonstration (SSTD) Program that will be initiated with pre-auction funds and continue with post-auction funds for several years. The SSTD, in collaboration with the National Advanced Spectrum and Communications Test Network (NASCTN), will further enhance the technical approaches and tools beyond those used by the CSMAC Working Groups to drive further reductions in protection distances. This overall effort will take into account both improved propagation models as well as increased interference tolerances of both LTE and DoD systems, all validated with test data. The EMC analysis to be conducted will use those assumptions/models that have been validated at the time of the coordination request. As the SSTD effort progresses, it is anticipated that less conservative EMC assumptions/models will be validated and used for the coordination requests. As a result, commercial operations and federal operations will be able to more effectively share spectrum within much reduced coordination zones than those set forth in the Workbook, thus enabling greater access by commercial operations than that described in the Workbook for most geographic areas.

The Workbook is a set of two Excel files comprised of spreadsheets for each of the 5 megahertz segments within the 1755-1780 MHz band (i.e., 1755-1760 MHz, 1760-1765 MHz, . . . , 1775-1780 MHz). The two Excel files (DoD Workbook Tab1 and DoD Workbook Tab 2) correspond to the “Tab 1” and “Tab 2” discussion in the *Joint PN*.³ Tab 1 provides information related to potential harmful interference from AWS-3 transmitters to DoD systems (ProtectDoD) and Tab 2 provides information related to potential harmful interference from DoD transmitters to AWS-3 receivers (ProtectInd). The Tab 1 file depicts, for each 5 megahertz segment, potential interference from AWS-3 transmitters to DoD receivers and identifies areas and frequency segments where coordination with DoD is required if an AWS-3 licensee wishes to deploy prior to completion of DoD’s migration out of those areas/frequencies. The Tab 2 file depicts, for each 5 megahertz segment, potential interference from DoD transmitters to AWS-3 receivers and provides notice to prospective AWS-3 licensees that they may receive (and will be required to accept) interference from DoD operations prior to the completion of the migration. Tab 2 is purely informational and does not define Protection Zones where successful coordination is required (Note: The Joint PN requires coordination with federal earth stations which transmit in the band; a framework agreement is contained in Appendix C of the Joint PN).⁴

For both Tab 1 and Tab 2, each 5 megahertz segment has all census tracts listed as rows in the spreadsheet. The spreadsheet includes columns that focus on individual system uses. There are two columns associated with each of the system use types. At the intersection of a census tract row and the two columns for a system use, the value in the first (e.g., ACTS) column represents the total number of operations of that system use type that impacts that census tract and the value in the second (e.g., ACTS TT) column is the maximum transition timeline (TT = Maximum Transition Timeline in months) of any of the systems as reflected in DOD’s Transition Plans. Figure 3 shows an example of a Workbook worksheet.

³ See Joint PN at 8-9.

⁴ See Joint PN at 9. Coordination requirements for the 25 federal uplink earth stations are addressed in Section V and Appendix C.

Census Tracts	State	Latitude	Longitude	Total Ops	Total TT	ACTs	ACTs TT	AMT	AMT TT	Micro	Micro TT	Other	Other TT	PGM	PGM TT	Robo	Robo TT	TRR	TRR TT	TT&C	TT&C TT	UAS	UAS TT	Video
1001020100	AL	32.4817943	-86.4902488	9	66			0				3	12					1	12			2	66	3
1001020200	AL	32.475758	-86.4724678	9	66			0				3	12					1	12			2	66	3
1001020300	AL	32.4740243	-86.4597033	9	66			0				3	11					1	12			2	66	3
1001020400	AL	32.4710304	-86.4448353	9	66			0				3	12					1	12			2	66	3
1001020500	AL	32.4589157	-86.4218165	9	66			0				3	12					1	12			2	66	3
1001020600	AL	32.4473674	-86.4768327	9	66			0				3	12					1	12			2	66	3
1001020700	AL	32.4303487	-86.4369714	9	66			0				3	12					1	12			2	66	3
1001020801	AL	32.4180838	-86.527137	10	66			0														3	66	3
1001020802	AL	32.5466429	-86.5312317	10	66			0														2	66	3
1001020900	AL	32.6370123	-86.5149469	9	66			0														2	66	3
1001021000	AL	32.6061376	-86.7489849	7	66			0														1	66	3
1001021100	AL	32.4574129	-86.7290029	10	66			0				4	12									3	66	3
1003010100	AL	31.1104762	-87.7868713	21	120			1	120			3	12			1	66	2	60			10	66	4
1003010200	AL	30.9478929	-87.6787306	21	120			1	120			3	12			1	66	2	60			10	66	4
1003010300	AL	30.8244356	-87.8710563	22	120			1	120			4	12			1	66	2	60			10	66	4
1003010400	AL	30.7200267	-87.6245437	21	120			1	120			3	12			1	66	2	60			9	66	5

Figure 3. Example Workbook worksheet.

There are several key items to note regarding certain aspects of the Workbook and the associated implications for coordination requirements.

- For those System Use types that will remain in the 1755-1780 MHz band indefinitely, this has been represented as “99999” in the Transition Timeline field.
- There are a significant number of Army Tactical Radio Relay (TRR) operations shown in the Army Transition Plan that have a value of 12 months in the Transition Timeline field. As noted in Tab I of the Army’s Releasable Transition Plan, this value means that when an AWS-3 licensee deploys service to the associated license area, the TRR operations will either vacate the band or attempt to coordinate with the licensee for continued operations in the license area. DoD will not cease operations in the band in support of ongoing missions in areas where AWS-3 licensees do not deploy service. To best facilitate this component of the transition, DOD requests that licensees notify DoD via the DSO Coordination Portal of build-outs occurring at any future time for areas where the Protect Industry Tab indicates potential impacts to industry from TRR operations. Such notification will enable DoD to ensure that associated Army TRR operations categorized as “12 months” are removed from the spectrum when licensees deploy in their license areas, or allow DOD to coordinate their continued operation with the licensee.
- Due to the approach that has been employed for creating the Workbook from the various DoD Transition Plans, the initial Workbook represented all DoD operations in the band (as of the date of the submission of the applicable plan). These operations include facilities or systems that use frequencies in the band under experimental licenses. Pursuant to Section 6.4 of the NTIA Manual, experimental classes of stations operate via temporary assignments and on a secondary basis to stations of all other services. While such assignments may be converted to regular assignments to the extent that they support ongoing operations, the experimental assignments represented in the plans will eventually expire and will not require coordination by AWS-3 licenses. Many of these experimental operations exist at locations that also support numerous other regular assignments that have longer timelines

and require coordination. Based on the fact that experimental authorizations operate on a secondary and “not-to-interfere” (NIB) basis, they are not represented in the updated Workbook in either Tab 1 (ProtectDoD) or Tab 2 (ProtectInd), though they are included in the DoD Transition Plans. The DoD will be preparing a product similar to Tabs 1 and 2 that addresses experimental operations and which will be posted on the NTIA AWS-3 website prior to start of the AWS-3 auction. Experimental operations do have specific transition timelines established in the Transition Plans so it will be beneficial to industry to know where such operations exist and on what timelines the Transition Plans indicate they will vacate the band in the event that a licensee does not first commence operations in the area. Experimental operations will be required to cease operations or seek to coordinate with applicable licensees for continued access once a licensee has deployed in a license area..

- Certain DoD operations required unique treatment or have aspects regarding them that are of special note. As discussed above, DoD airborne telemetry operations were incorporated into the Workbook development process based on modified Transition Plan information that significantly reduced the impacted geographic areas and therefore the associated census tracts for each 5 megahertz segment. The DoD Satellite Operations (TT&C) systems (ground based uplink earth stations) transmit in this band so they are not represented on the Tab showing impacts to DoD receivers.
- The following is a key to the System Use abbreviations found as column headings as well as explanations of the various System Use types.

System Use	Workbook Label	<u>System Use Definition</u>
Microwave	Micro	<u>Fixed Point-to-Point Microwave</u> : Frequency assignments for microwave operations that have specific sets of coordinates for both transmitter and receiver locations. Excludes Air Combat Training System fixed point-to-point microwave links.
TRR	TRR	<u>Military Tactical Radio Relay (TRR)</u> : Frequency assignments for microwave operations that are integrated into a transportable platform. This type of system operates within a specified radius of operation with a specific set of coordinates identifying the center of the radius, or the transmitter/receiver may operate within a specific bounded area.
ACTS	ACTS	<u>Air Combat Training Systems (ACTS)</u> : Frequency assignments in support of military air combat training systems, which include operations that are air-to-ground, ground-to-air, air-to-air operations, and fixed point-to-point microwave links. The fixed point-to-point microwave links that support ACTS are included for system continuity.
PGM	PGM	<u>Precision Guided Munitions (PGM)</u> : Frequency assignments for air-to-ground munitions receiving guidance commands from an airborne platform.
Video	Video	<u>Video Surveillance Applications</u> : Frequency assignments are mobile air-to-ground excluding UAS's, ground-to-air, air-to-air, and fixed ground or transportable operations.
TT&C	TT&C	<u>Telemetry, Tracking, and Command(ing) (TT&C) for Federal Space Systems</u> : Frequency assignments for satellite ground station uplink systems which ensure the proper orbit(s) of satellites via telemetry, tracking, and command operations. TT&C assignments in the 1755-1780 MHz band are for earth-to-space links only; as such, telemetry operations are not included.
Telemetry	AMT	<u>Mobile Telemetry</u> : Frequency assignments for air-to-ground, ground-to-air and ground-to-ground telemetry operations that are not specifically identified to operate under different functions. Includes Aeronautical Mobile Telemetry (AMT).

Robotics	Robo	<u>Land Robotic Functions</u> : Frequency assignments for terrestrial operations that incorporate either the transmission of sensor data from or control information to land based robotic systems. Operations include, but are not limited to, explosive ordnance disposal.
UAS	UAS	<u>Unmanned Aerial Systems, Unmanned Aerial Vehicles (UAV), or Remotely Piloted Vehicles (RPV)</u> : Frequency assignments for air-to ground, ground-to-air, and air-to-air operations for the purpose of transmitting or receiving information acquired by sensor systems located on the airborne vehicle or controlling the airborne vehicle by a ground based transmitter that is not specifically identified to operate under different functions.
Other	Other	<u>Other Systems</u> : Frequency assignments for operations not defined under any of the other system use categories. Systems in this category include systems such as software defined radios (JTRS), airborne Tactical Targeting Networking Technology (TTNT) systems, and systems used for electronic warfare (EW).

- The following is a key to the labeling of the Tabs in the Workbook:
 - ProtectDoD – Impacted census tracts identified based on distances to protect DoD receivers from AWS-3 systems
 - ProtectInd - Impacted census tracts identified based on distances to protect AWS-3 receivers from DoD systems
 - Segment G – 1755 – 1760 MHz
 - Segment H – 1760 – 1765 MHz
 - Segment I – 1765 – 1770 MHz
 - Segment J1 – 1770 – 1775 MHz
 - Segment J2 – 1775 – 1780 MHz

The Workbook and the underlying data draws directly from the approved DoD transition plans and Government Master File records. However, it was prepared and processed by DoD and has not been verified or validated by NTIA or the FCC. Additionally, this information release does not supersede any rights and obligations specified by law, rule, or other NTIA or FCC action.