DEFENSE INFORMATION SYSTEMS AGENCY
The IT Combat Support Agency

HF 30 MHz VHF 300 MHz UHF 3,000 MHz SHF 30 GHz EHF

Advanced Wireless Services-3 (AWS-3) Spectrum Sharing Test & Demonstration (SSTD) Program

Improve Propagation

Federal Communications Commission (FCC) AWS-3 Auction

Following a Notice of Proposed Rulemaking in July 2013, the FCC adopted a Report and Order in March 2014 with allocation, technical, and licensing rules for commercial use of the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz bands. The FCC conducted Auction 97 from Nov. 13, 2014 to Jan. 29 2015. The auction generated over $44 billion in proceeds and initiated a 10 year transitional period where licensees were required to coordinate with federal agencies for the use of purchased AWS-3 licenses.

DOD Early Entry Assessments

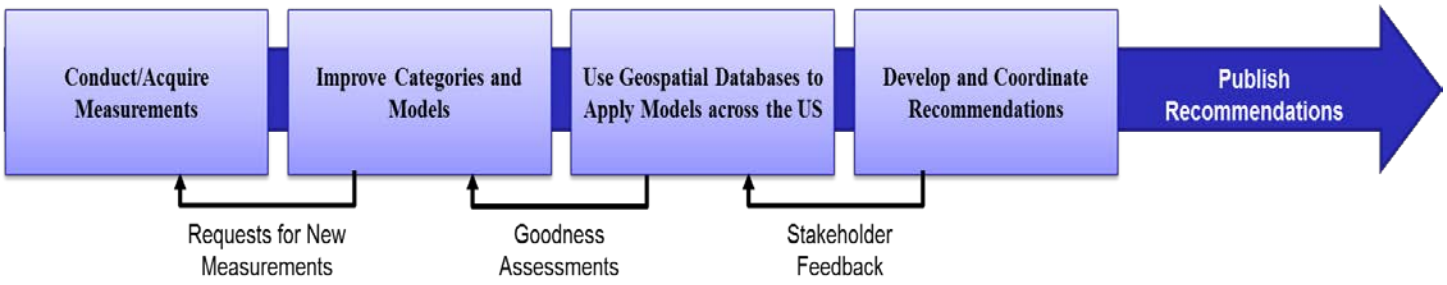
DOD performs electromagnetic compatibility (EMC) analyses for the base station sector laydown proposed in a licensee coordination request (CR). If the predicted aggregate interference exceeds the interference protection criteria (IPC) for a DOD asset, sectors in the CR are removed until the predicted aggregate interference falls below the IPC. The SSTD Program performs analyses and makes recommendations to stakeholders on ways to make the aggregate interference assessments used by DOD increasingly realistic.

SSTD Objectives and Initiatives

The SSTD Program has two overarching objectives:

- Facilitate expedited and expanded entry (FEEE) of commercial deployments into the 1755-1780 MHz band.
- Identify, assess, test/demonstrate, and operationalize (IATO) coexistence assessments, interference mitigation, and other spectrum sharing enablers that support increased sharing between LTE and incumbent DOD systems.

In pursuit of these objectives, SSTD has identified four initiatives: improve propagation, characterize LTE, characterize DOD receivers, and assess aggregate interference.



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SSTD Improve Propagation Process Overview

The SSTD Program uses a contextually-focused (AWS-3 early-entry assessments), model-based, measurement-validated, iterative approach to improve the propagation and clutter (man-made and foliage) modeling used when assessing aggregate interference levels from incoming AWS-3 commercial LTE systems. The program acquires a wide range of measurement data both from its own activities and from other published sources that is used to validate/improve situational partitioning (categories) as well as propagation and clutter models. These models in turn are used along with geospatial data (i.e., terrain elevation and land use) to develop recommendations for improved propagation modeling in the early-entry analyses.

Measurements: For over three years, SSTD has been conducting measurement using multiple techniques and at various locations across the U.S. The measurement activities include measurement of ground-to-ground and ground-to-air (aerostat and drone) links in everything from ultra-dense urban to rural and heavily forested to barren morphologies. SSTD also looks for applicable published data taken from other measurement efforts for use in its category and model improvement activities.

Models: SSTD continually evaluates the applicability and usefulness of various propagation models and techniques for use in target propagation and clutter categories. These models are validated for a given category by comparing them to measured data from that category. Propagation models in use today, or under consideration for future use include, TIREM, SEM, ITU P.528, IF-77, ITM, APM, TEMPER, Wireless InSite, eHata, ITU P.452, ITU P.2108.

Estimating Measurement Uncertainty and Using Best Practices: The best measurement equipment will still have some amount of uncertainty. Estimating the uncertainty is an important aspect to measurement best practices. Because SSTD propagation modeling relies heavily on measured data to validate models, best practices are required for SSTD measurement events. A best practices document was created and is periodically updated by SSTD partner NTIA/ITS in Boulder, Colorado.

Assessing Propagation Variability: Even a perfect measurement system taking repeated measurements will detect changes in propagation for a given path. Sometimes characterized as situation, location, and time variability these changes in the propagation effects are important to understand and model.

Mapping Near Measurements to Far Modeling: Due to restrictions in transmit power, measurement activities are often not equipped to assess real world AWS-3 scenarios where slant ranges can exceed 150 km. Using shorter range measurements to validate models for long range paths suffers from at least two shortcomings. The variability due to multipath can be significant for short range paths but will diminish as the slant range grows. Additionally the time-based variability due to atmospherics increases with slant range.

Use of Elevation Angle: AWS-3 aggregate interference assessments include the impact to airborne systems from LTE early entry systems with a potentially wide range of elevation angles. As elevation angle increases, the overall effects of clutter diminish and the emergence of line-of-sight paths leads to bi-modal distributions.

Better Categories: Refinement of the categories for atmospheric/terrain and clutter modeling. In particular, understanding the impacts of foliage in suburban and rural environments is under consideration.

Informing Risk Management Frameworks: As a stochastic process propagation plays a role in contributing to the risk of interference from AWS-3 early entry systems to DOD operations.

For additional information:
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