JARVINIAN

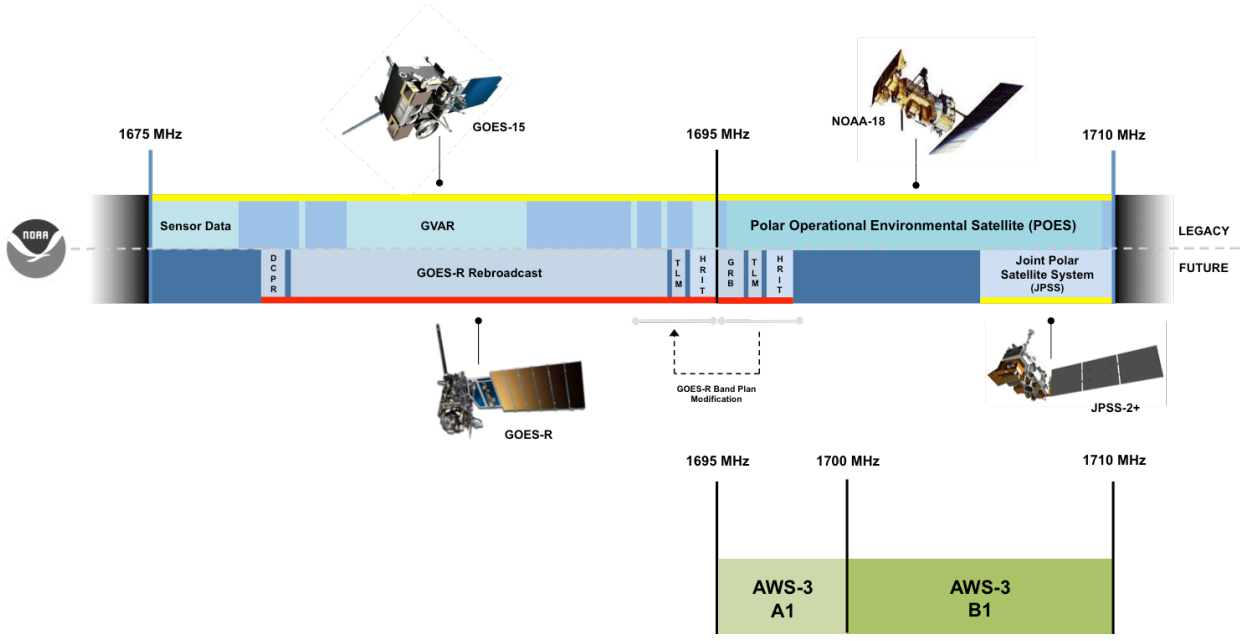
TECHNICAL EXHIBIT FOR EXPERIMENTAL LICENSE APPLICATION
FILE: **0059-EX-PL-2016**

Background

Recently made available via FCC Auction 97, the unpaired AWS-3 A1 and B1 Uplink Blocks span 1695-1710 MHz. This frequency range (1695-1710 MHz) and the immediately adjacent band (1675-1695 MHz) will continue to host critical satellite downlink channels for Federal meteorological satellite systems on a permanent basis.

In order to secure the integrity of meteorological satellite downlink activity in this band, the FCC has adopted rules establishing 27 Protection Zones that contain a total of 47 Earth Stations. These 47 Earth Stations will operate on a primary basis across 1675-1695 MHz or co-primary basis across 1695-1710 MHz with AWS-3 A1 and B1 licensees. All other Federal Earth Stations will continue operations on a secondary basis. AWS-3 A1 and B1 licensees seeking to operate inside designated Protection Zones will require prior coordination, and mobile device operations will be limited up to 20 dBm EIRP within an "inner" protection zone radius and up to 30 dBm EIRP within an "outer" protection zone radius.

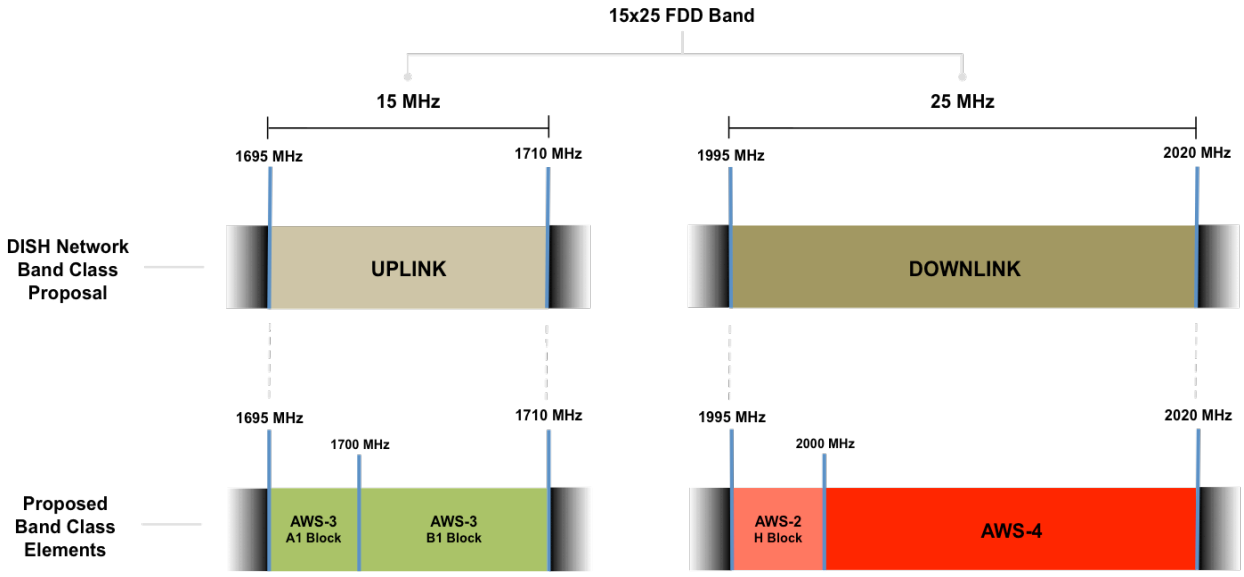
As AWS-3 A1 and B1 systems come online, it is expected that the satellite utilization of 1675-1710 MHz will have completed a long-anticipated evolution. Currently occupied by legacy GOES (Geostationary Orbiting Environmental Satellite) and POES (Polar Orbiting Environmental Satellite), the band will soon be utilized by next-generation GOES-R and JPSS (Joint Polar Satellite System) spacecraft. The GOES-R band plan will place a major geostationary system directly adjacent to the A1 Block, while the JPSS system will place a backup telemetry channel within the B1 Block (the 1.7 GHz LRD Channel may not be in early JPSS spacecraft).



Meteorological Satellite Band Plan: Current POES and GOES systems represent co-channel and adjacent band applications with a potential to be impacted by A1 and B1 Block operations. Going forward, GOES-R will remain the primary adjacent band operator. It is possible that JPSS-2 and beyond may occupy the upper portion of B1 Block for peripheral Low Rate Data (LRD) applications.

Objectives of Experimental License

While AWS-3 A1 and B1 Blocks are under the control of several parties, SNR Wireless and Northstar Wireless collectively own the majority of licenses across 1695-1710 MHz. Recently, DISH Network (principal investor in SNR / Northstar) has introduced a band class proposal to the 3rd Generation Partnership Project (3GPP), which standardizes commercial spectrum for operators and equipment manufacturers. This band class proposal pairs AWS-3 A1 and B1 Uplink (1695-1710 MHz) with AWS-2 H Block and AWS-4 Lower Downlink (1995-2020 MHz) to create a 15x25 MHz FDD band.



Proposed 3GPP Band Class: Having received FCC authorization to use its AWS-4 allocation exclusively for downlink, DISH sought unpaired AWS-3 A1 and B1 Blocks to provide a necessary uplink component. In a recent 3GPP (standards body) filing, DISH outlined a 15x25 MHz band class that includes AWS-3 A1+B1, AWS-2 H Block, and lower AWS-4.

A novel feature of the proposed band class is the use of two duplex gaps. The purpose of these dual gaps is to (a) permit operation where DISH Network does not control both A1 and B1 Blocks, and (b) permit uplink operation only on B1 Block where interference to meteorological satellite ground stations impedes operation of A1 Block. This second purpose highlights a potential asymmetry in the impact to Earth Stations from A1 and B1 operation.

The primary objective of the requested experimental license is to assess the relative impact of A1 and B1 Block operations on Earth Station performance. Secondary objectives of the requested experimental license include (a) refinement of path loss assumptions currently informing interference risk assessments, and (b) collection of pre-deployment noise + interference floor data at Federal Earth Stations.

Specifically, the proposed experiments aim to:

1. **Determine the impact of 5 MHz LTE operations over AWS-3 A1 Block on existing and future GOES operation *at* protected Earth Stations** – A1 Block emitters (5 MHz LTE channel) will be used to evaluate actual impact on current GOES operations at NOAA facilities. Future GOES-R will use the spectrum immediately below 1695 MHz more intensively than existing systems. Therefore, emissions data will be collected to infer impact on future GOES-R operations.

2. **Determine the impact of 10 MHz LTE operations over AWS-3 B1 Block on GOES operation** – B1 Block emitters (10 MHz LTE channel) will be used to evaluate actual impact on current GOES operations at NOAA facilities. Emissions data will be collected to infer impact on future GOES-R operations.

3. **Determine the impact of 5 MHz LTE operations over AWS-3 A1 Block on JPSS operation** – A1 Block emitters (5 MHz LTE channel) will be used to evaluate actual impact on current POES operations at NOAA facilities. The new SUOMI NPP spacecraft (precursor to JPSS) does not have 1.7 GHz capability, and the JPSS-1 may also delete 1.7 GHz Low Rate Data (LRD) transmission. Thus, legacy POES impact and general emissions data will be collected to infer impact on possible future JPSS operations.

4. **Determine the impact of 10 MHz LTE operation over AWS-3 B1 Block on JPSS operation** – B1 Block emitters (10 MHz LTE channel) will be used to evaluate actual impact on current POES operations at NOAA facilities. The new SUOMI NPP spacecraft (precursor to JPSS) does not have 1.7 GHz capability, and the JPSS-1 may also delete 1.7 GHz Low Rate Data (LRD) transmission. Thus, legacy POES impact and general emissions data will be collected to infer impact on possible future JPSS operations.

5. **Determine the impact of 15 MHz LTE operation over AWS-3 A1+B1 Blocks on GOES and JPSS operation** – A1+B1 Block emitters (15 MHz LTE channel and adjacent 5 MHz + 10 MHz LTE Channels) will be used to evaluate actual impact on current POES and GOES operations at NOAA facilities. The new SUOMI NPP spacecraft (precursor to JPSS) does not have 1.7 GHz capability, and the JPSS-1 may also delete 1.7 GHz Low Rate Data (LRD) transmission. Additionally, future GOES-R will use the spectrum immediate below 1695 MHz more intensively than existing systems. Thus, impact to legacy POES and GOES systems and general emissions data will be collected to infer impact on future GOES-R and possible future JPSS operations.

6. **Determine the impact of 5 MHz LTE operations over AWS-3 A1 Block on GOES operation *outside* protected Earth Stations** – Outside of protected Federal Earth Station, a number of Federal and Non-Federal users will rely upon GOES-R transmissions immediately adjacent to A1 Block. Specifically, agencies relying upon the Emergency Managers Weather Information Network (EMWIN) will have to access data through the GOES-R HRIT signal, which terminates at 1695 MHz. Equipment used for this reception may be especially sensitive to interference from adjacent band A1 Block operations.

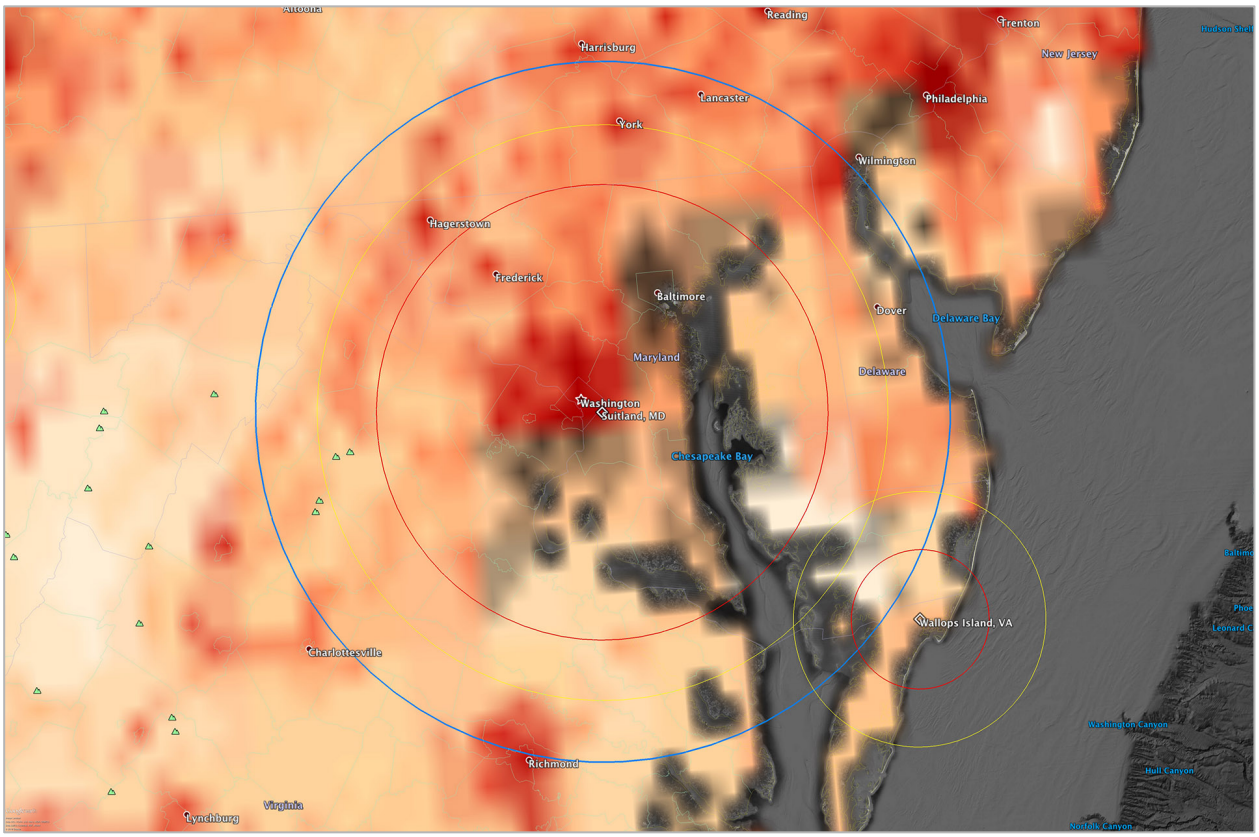
Geographic Coverage of Experiment

The requested experimental license will support testing in three geographic regions containing NOAA Earth Stations (*see* maps). Beyond the coordination requirements imposed by the requested license, experiments will be conducted collaboratively with Federal and Non-Federal operators both within and outside of protected Earth Stations.

1. **Suitland, MD** – This site contains the National Satellite Operations Facility (NSOF), which monitors polar and geostationary satellites on a continuous basis.

   Requested experimental license geography is 150 km radius (blue) from:

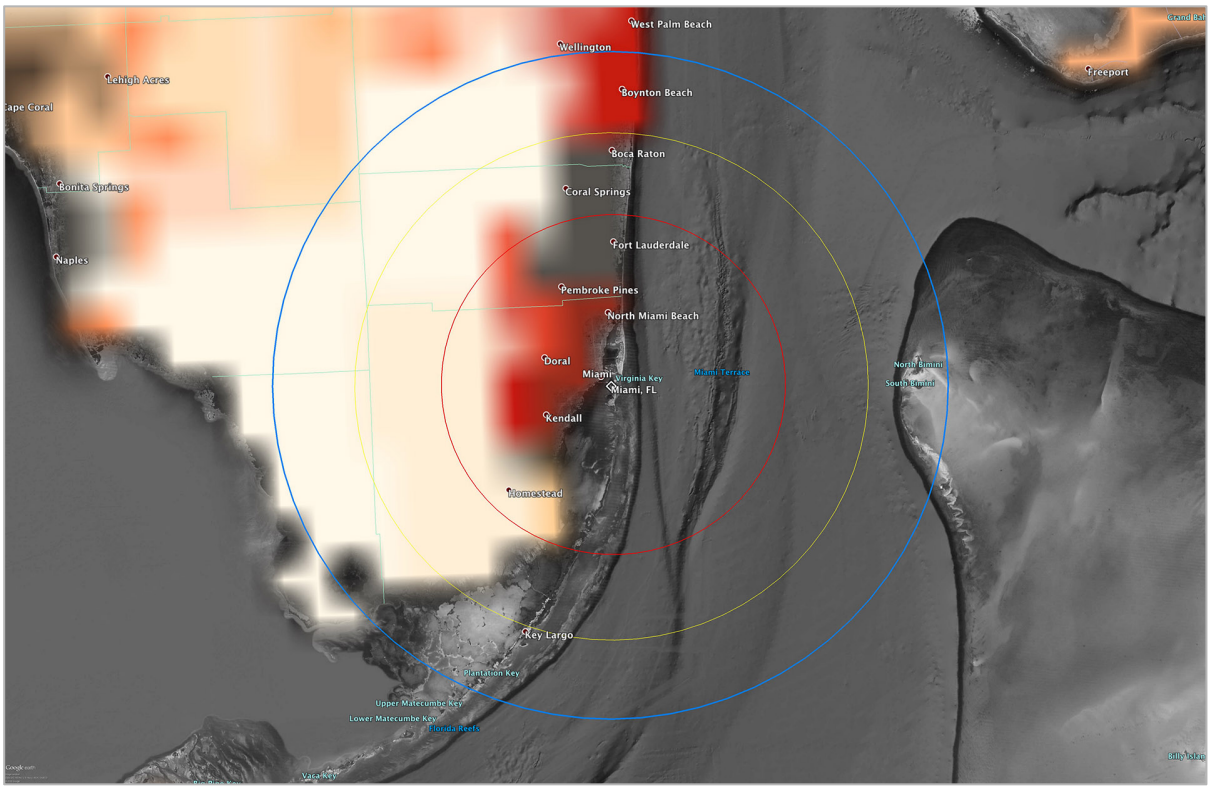
   Latitude: 38° 51' 07"
   Longitude: 076° 56' 12"



2. **Miami, FL:** This site contains the National Weather Service Forecast Office and National Hurricane Center (NHC), which monitor polar and geostationary satellites on a continuous basis.

   Requested experimental license geography is within 100 km radius (blue) from:

   Latitude: 25° 44' 05"
   Longitude: 080° 09' 45"



3. **Boulder, CO:** This site contains the NOAA Boulder Labs. Equipment at this site may support long-term or aggressive testing not possible at primary NOAA facilities, where extended disruption of geostationary satellite reception is impractical.

   Requested experimental license geography is within 50 km radius (blue) from:

   Latitude: 39° 59' 26"
   Longitude: 105° 15' 51"