

Wing Box HIRF Direct Drive CW Test

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Submitted by

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This STA is required to conduct testing necessary to support airframe certification for induced lightning and high intensity radiated fields (HIRF). The test data will be used to validate low frequency HIRF models and assure compliance with HIRF and lightning requirements as specified by the following:

1. FAA issue paper SE-2, Boeing 777, "Lightning Protection Requirements."
2. JAA document JAR25X899, Boeing 777, Electrical Grounding and Protection Against Lightning and Static Electricity."
3. FAA issue paper SE-1, Boeing 777, Protection from High Intensity Radiated Fields (HIRF)."
4. JAA HIRF Certification Review Item D-5 – Stage 2, Boeing 777, Special Condition Protection from External High Intensity Radiated Fields."
5. FAA Special Condition #25-ANM-25, Boeing 747-400 & 747-400F, "Boeing 747-400 Lightning and Radio Frequency Energy Protection."
6. JAA Special Condition AAB7747-400F/02, Boeing 747-400F, "Lightning Protection Indirect Effects."
7. JAA Special Condition AAB7747-400F/01, Boeing 747-400F, "High Intensity Radiated Fields (HIRF)."

The tests to be conducted are direct drive, swept CW transfer function tests on production aircraft components. These tests require driving a transmission line

formed by the aircraft component over and under a wire grid. Current is driven onto the aircraft component by directly attaching the output of a 25 watt RF amplifier to one end of the aircraft component. A stepped swept test is required to measure as many aircraft component and cable resonances as possible. Testing, using widely spaced discrete frequencies would miss critical resonant frequencies.

The dwell time per frequency point will be a maximum of 75 milliseconds per point based on 401 points in a 30 seconds maximum sweep. The maximum number of sweeps per test will be 64. The minimum time between tests is 2 minutes. A testing instance occurs at times as required by Boeing Engineering to evaluate the aircraft component for the duration of the license to assure compliance with the above cited requirements. Other aircraft components may be tested which have similar shapes, sizes, weights, composition and purpose. The test RF parameters and location are not permitted to change.

The primary difference in this application, compared with our normal tests conducted on full scale aircraft inside the flight test hanger, is that we will be testing a 12' long wing box mockup in a quasi-coaxial ground return setup. The ground plane base dimensions will be 11' wide x 15' long. The end ground planes are 11' wide by 8' tall. Poultry netting will be used to complete the ground return over the top of the wing box. CW swept signals will be injected into the wing box and returned through the quasi-coaxial ground return. The tests will be performed inside a shielded room laboratory within the 2-122 building. The laboratory has conductive wall treatments and solid heavy metal doors. All doors are conductive and have RF gaskets. All doors are closed during testing.

As shown in the diagrams, the set up is a direct-drive non-intentional radiator. At best, the test set up is a very inefficient antenna at higher frequencies. Even though the test is conducted in a shielded room, Boeing believes that this test will not cause RF interference. Boeing has been licensed to perform these tests before, all without interference.

The inputs to the HP 3577B Network Analyzer are several current probes that utilize a fiber optic cable transmission system. A computer is used to read the measurements and plot the results for the test results.

Boeing expects that prior coordination with FAA-Seattle as with previous STAs.

The occupied bandwidth of the emission shall not extend beyond the band limits.