Windscreen Shield Monitoring Using a Spiral Transmission Line

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In this paper we investigate two new methods of testing the integrity of EMI gaskets surrounding aircraft windscreens. This is normally accomplished by placing an RF source on the exterior of the window, and checking for fields leaked into the interior. Currently used methods require disassembly of portions of the interior of the cockpit, so we look for more convenient methods using a Spiral Transmission Line (STL) on the interior. The first method uses a second STL on the exterior, which allows us to successfully locate the position of a leak using time domain measurements. The second method uses a stripline on the exterior, similar to the "blanket" that is currently used. In this configuration, we observed a 30-40 dB difference between the leaky and sealed configurations, over a frequency range of 50-200 MHz.

Gasket integrity is normally tested by placing an RF source on the exterior of the window, and checking for leaked fields on the interior. In principle, this is a straightforward process; however, newer aircraft present some challenges. In some cases, one must remove a significant amount of molding to get access to the interior of the windscreen in the cockpit. A simpler process could reduce the cost of testing.

To address this challenge, we investigate the use of a Spiral Transmission Line (STL) to detect the presence of fields leaked into a cockpit from damaged electromagnetic gaskets. The STL could be either permanently installed, or it could be temporarily placed on the windscreen during testing. To excite the field on the exterior, one could use either a second STL or a stripline. The stripline is currently used in the form of a "blanket," which is an approximate TEM transmission line.

We have successfully detected leakage through slots using an STL on the interior, and a variety of antennas on the exterior. These include a second STL, a 9-in diameter half IRA, a Farr Research model TEM-1-50 sensor, an Impulse Slot Antenna, and a stripline similar to the "blanket" that is currently used. We have also used a variety of test methods to detect the presence of a leak. These include time domain measurements, frequency domain measurements, and frequency domain measurements converted to the time domain. Furthermore, the two time domain methods found the relative position of the leaks to an accuracy of 0.2%, when used with dual STLs.