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Antenna Designs

Radio antenna performance is something often ignored during aircraft design and construction, but we come to depend more and more on radio links for communication, navigation and radar transponding. It's about time someone did more than copy simple antenna designs from a ham radio manual and apply them without proper analysis and testing to composite aircraft installations.

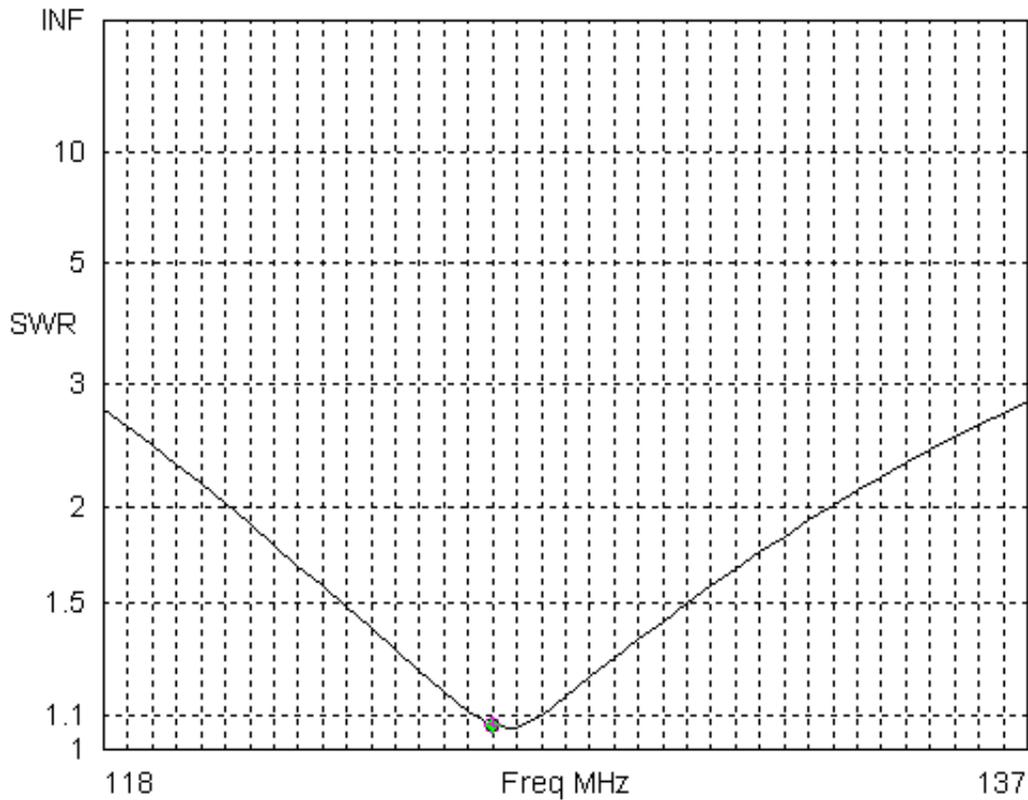


External antennas are easy to install because they can come pretuned from the supplier but they are expensive, add unnecessary drag and require a metal counterpoise be installed surrounding the antenna.

Copper foil antennas applied to the inside of the composite skin are inexpensive and completely eliminates the drag problem. The dipole configuration does not require a counterpoise, however if an antenna designed to be hung in the air is applied to a composite skin the tuning shifts, resulting in the bad reputation for these antennas.

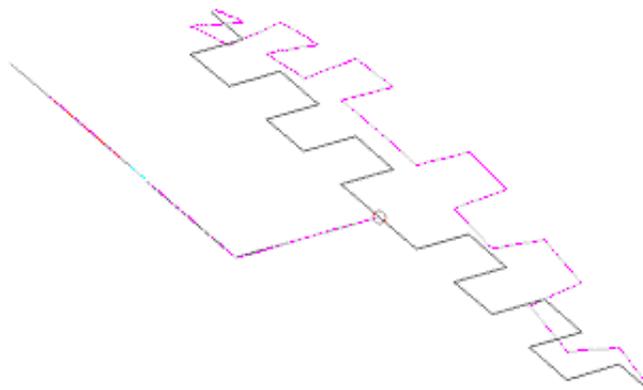


Also a full size dipole really does not fit in the spaces available in the EXPRESS aircraft resulting in degradation and interaction with other aircraft equipment. The new EXPRESS antennas use a meander line dipole design to shorten the antenna about 30% to allow them to be installed in several places in the wings, tail and fuselage.



The natural 72 Ohm impedance of a straight dipole does not match well to the 50 Ohm coaxial cable. The computer design of the new EXPRESS meander line antennas precisely matches the antenna impedance to 50 Ohms resulting in better transfer of the radio energy from the cable to the antenna.

EZNEC



Finally there is the problem of coupling the radio energy from the antenna onto the outside of the coaxial cable and then back into the avionics stack and other instruments. With a metal skin aircraft and external antennas there

is a natural decoupling of the antenna and cable. Inside an airframe you cannot route the cable perpendicularly away from the antenna, so considerable coupling from the antenna to the cable exists. The EXPRESS antennas were analyzed by computer modeling to include the cable and ferrite toroids placed to drastically reduce the coupling and potential for radio interference problems.

When these antennas are installed on the composite wing, tail or fuselage part the resonant frequency shifts down, an amount depending on the amount of material in close proximity to the antenna elements. The solution is to use an antenna analyzer to measure the operation of the antenna across the frequency band. The antenna is then trimmed and rechecked with the antenna analyzer until the resonant point is in the center of the frequency band.

Only with the application of proper design, analysis and tuning techniques do internal aircraft antennas reach their potential for a high performance, cost effective and no-drag solution for your EXPRESS aircraft.

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