

Method to Determine the Lowest Interference Coupling Scheme From A Large Number of Antenna Layouts

Xie Ma⁽¹⁾, Vladimir Mordachev⁽²⁾ and Eugene Sinkevich⁽²⁾

(1) China Electronics Technology Cyber Security Co., Ltd., Chengdu, China

(2) Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus

Intensive development and expansion of communication vehicles equipped with radio systems, data transfer, control, navigation, and retransmitting essentially increases the intra electromagnetic interference of the system. The main reason of this is the complication of an electromagnetic environment caused by massive integrated wireless devices and their antennas.

Nowadays, the electromagnetic simulation technique is widely used in electronic design, mechanical design and system integration, including the antenna layout design of electronic system. A normal method to analyze coupling between antennas is to transform the system into a multi-port network first, calculate equivalent admittance matrix or equivalent S parameter matrix of the network using numerical analysis method, then utilize microwave network to calculate the coupling degrees of the multi-antenna system. But when there are plenty of antennas need to be installed in the vehicular platform, the horizontal comparison of various antenna layout schemes with mass of simulation data would be difficult for decision-make of antenna layout.

This paper presents a method to evaluate estimated coupling degree value of all available antenna layout schemes for vehicular system. In the proposed method, all possible antenna layout schemes located on installable positions of platform for antennas are required to be listed first, each layout scheme of the vehicular system is independent design, and every antenna is supposed to be paired with rest ones in each scheme. According to the practical transmitting/receiving circumstances of antennas and the spectrum analysis results of the wireless systems, each pairs of antenna are weighted by the effects of the interference between them to the system. With commercial electromagnetic simulation software and numeric post-process, it is possible to determine the lowest interference coupling antenna layout scheme for the vehicular system based on the weight factors. A default workflow of the method to determine the lowest interference coupling antenna layout is shown as below.

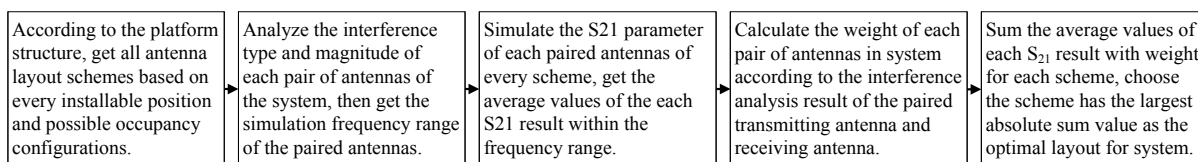


Figure 1. Work flow of the method.

For validating the feasibility of this method, an example application is demonstrated by using actual simulation data. By means of the algorithm to generate weight factors, the mass of antenna coupling simulation data of various schemes can be quickly transformed into a horizontal comparable value. With a practical example, the feasibility of the method can be verified by the test results. This proposed method would be very useful for improvement of the total performance of electronic vehicular system.