

Accurate Reconstruction of Antenna Radiation Pattern from Measurements in a Small Non-ideal Chamber

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The results of this study are partially part of this research initiated three years ago to achieve the following objectives firstly reconstruction of antenna radiation pattern with a specific algorithm, achieving 3 times accuracy in the latter and extracted the reflected from walls, finally, our goal is to develop and expand the two-dimensional patterns into three-coordinates with high accuracy.

The point at issue is the latest results of our research in the field of retrieving the free space antenna radiation pattern (ARP) from non-anechoic measurements. Its outlines are based on the concept of the converging cluster of plane waves (CCPW). The retrieving procedure consists of two stages. Firstly, the illuminating field is sensed with the help of a precisely known probe $F(\alpha)$ and the spatial spectrum $\{A(\varphi)\}$ of CCPW is defined as a solution to the equation (1) below. Secondly, the antenna under test AUT signal $U(\alpha)$, which is a convolution of ARP and CCPW, is measured and the equation analogical to (1) is solving for the sought-for ARP.

$$V_{pro}(\alpha) \cong \int_{2\pi} A(\varphi) F(\alpha) d\varphi \quad (1)$$

We have developed algorithm for the reconstruction of AP, based on the methodology of CCPW. The main results obtained are reflected in the following publications: Yu.I. Choni, S.A. Pirozhenko, Radio Electr., vol. 35, 1992, no. 2, pp. 45–50 (in Russian); Yu.I.Choni, L.K.T. Abuhadma, I.Yu. Danilov, 2018 Systems of Signals Generating and Processing in the Field on Board Communications, Moscow, Russia, 14-15 March, 2018. pp. 376-382.

As a result, our findings showed that the objective one in Fig. 1. was achieved with high accuracy of CCPW and in the same time the radiation pattern reconstruction in non-anechoic chamber with using different algorithms has been increased. These results are consistent with the objective one that indicated three times tolerance accuracy was significantly better than others algorithms as showed in (2). according to measure the similarity, and/or the differences i.e. (integral correlation) between the ideal value and the approximations ones as this formally.

$$\mathcal{E} = \sqrt{1 - \frac{|F(\alpha)_0 - F(\alpha)_{re}|^2}{|F(\alpha)_0|^2}} \quad (2)$$

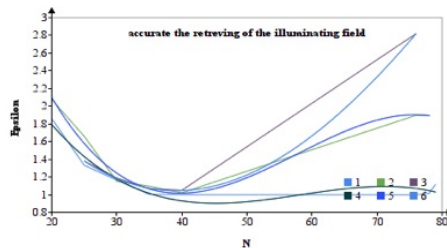


Figure 1. The accuracy retrieval of the CCPW and the ARP depends upon the numbers of clusters N and the algorithms' parameters