Measurement of Radiation Power from an Aircraft FMCW Radar Altimeter for Investigating Spectrum-Sharing Conditions with Wireless Avionics Intra-Communication Systems

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Wireless avionics intra-communication (WAIC) devices facilitate wireless communication among sensors in an aircraft for monitoring and telemetry applications (International Telecommunication Union, Report M.2197-0, Nov. 2011). The usage and standardization of WAIC systems have been widely studied in recent years. However, for further implementation of these devices, the electromagnetic compatibility (EMC) between WAIC systems and existing avionics systems should be investigated. The frequency band of 4,200–4,400 MHz is allocated for WAIC systems; however, aircraft radio altimeters are operated in the same frequency band. To investigate the EMC issues of WAIC systems, we developed an electromagnetic field estimation method based on large-scale finite-difference time-domain analysis (S. Futatsumori et al., 34th International Review of Progress in Applied Computational Electromagnetics, pp.1-2, Mar. 2018).

In this paper, the electric field (E-field) strength radiated from the radio altimeter of the Beechcraft B300 aircraft is measured for future investigation of the spectrum-sharing condition of WAIC systems. The radio altimeter radiation characteristics are measured using a Beechcraft B300 experimental aircraft. The functioning of the radar altimeter is based on the frequency-modulated continuous-wave (FMCW) ranging method. The central frequency and bandwidth are 4.3 GHz and 100 MHz, respectively. In addition, the transmitting power is 27 dBm. Fig. 1 (a) shows the measurement points for radio altimeter radiation characteristics. Measurements are performed on a circular trajectory, wherein the trajectory's center as considered the geometrical center of the aircraft. The trajectory's radius is 26.5 m, which is 1.5 times the maximum dimensions of the aircraft. The E-field strength is measured at a height of 2.35 m, i.e., the window height of the aircraft. The measurement antenna is both vertical and horizontal polarization. Fig. 1 (b) shows the typical measured E-field strength of the radio altimeter on the ground. The maximum E-field strengths with horizontal and vertical polarizations are 90.5 and 94.8 dBμV/m, respectively.

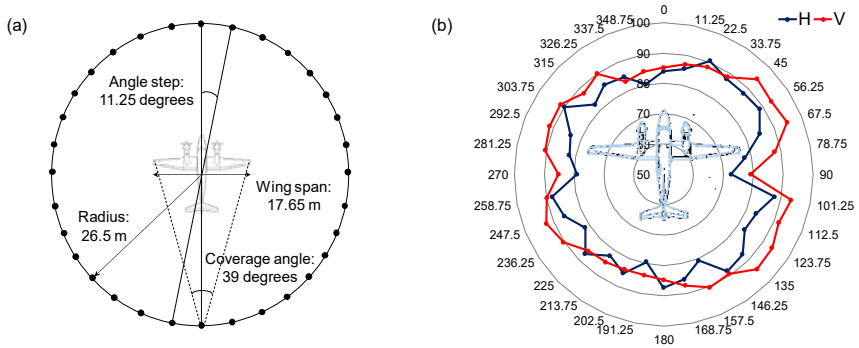

Figure 1. (a) Measurement points of the Beechcraft B300 aircraft radio altimeter radiation characteristics. (b) Typical measured E-field strength of the radio altimeter on the ground.