

The peculiarities of power terrestrial ELF emission in the Earth's ionosphere

Valery Korepanov, Fedir Dudkin, Vira Pronenko, and Valery Chvach
Lviv Center of Institute for Space Research, Lviv, Ukraine (vakor@isr.lviv.ua)

The near-Earth space is saturated with electromagnetic (EM) waves of terrestrial origin in a wide frequency range. The most powerful natural sources of EM emission are thunderstorms and triggered by them Schumann resonance (SR) radiation which is the narrowband EM noise that occurs due to the global thunderstorm activity in the Earth-ionosphere cavity in frequency range about 7-100 Hz. The considerable part of the terrestrial EM emission belongs to everyday human activity which increases year by year with unpredictable consequences. At the beginning of space exploration era it was considered that high frequency EM waves freely penetrate through the Earth's ionosphere, but the terrestrial EM emission below very low frequency range is limited by ionospheric F2 layer boundary due to great EM losses in plasma. About 40 years ago the power lines harmonic radiation (multiple of 50/60 Hz) was found at satellite observations in a few kilohertz range, nevertheless the ionosphere was considered fully opaque for extremely low frequency (ELF) EM emission. However recently, in spite of theoretical estimations, the SR harmonics and power line emission (PLE) 50/60 Hz were discovered during flights of low Earth orbiting satellites C/NOFS (Simões et al., 2011) and Chibis-M (Dudkin et al., 2015) at heights 400-800 km, i.e. over F2-layer.

Last results are a great challenge to the theory of ELF EM emission propagation in the Earth's ionosphere as well as for study of long-term influence of constantly increasing electric energy consumption by human civilization in the Earth's environment. We present the analysis of the space and time distribution for observed PLE and SR harmonics, their connection with power terrestrial sources of ELF emission and possible relation between measured values and ionosphere conditions. Also some electromagnetic parameters have been estimated.

Simões, F. A., R. F. Pfaff, and H. T. Freudenreich (2011), Satellite observations of Schumann resonances in the Earth's ionosphere, *Geophys. Res. Lett.*, 38, L22101, doi:10.1029/2011GL049668.

Dudkin, F., V. Korepanov, D. Dudkin, V. Pilipenko, V. Pronenko, and S. Klimov (2015), Electric [U+FB01] eld of the power terrestrial sources observed by microsatellite Chibis-M in the Earth ' s ionosphere in frequency range 1 – 60 Hz, *Geophys. Res. Lett.*, 42, doi:10.1002/2015GL064595.