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LOWER RADIO FREQUENCY SIGNALS' EXISTENCE AND POTENTIAL USEFULNESS IN SPACE

Abstract

Radio frequencies below 300 kHz (long waves, myriametric waves and other) have been used in various radio transmissions since the creation of the radio itself. Despite the mostly low efficiencies of the antennas and other radiating structures, lower frequency signals have permitted the successful establishment of long-range communication, underground remote sensing, submarine and mines communication, frequency standard transmissions and broadcasting of various time signals with global range. An usual approach towards the emission and propagation of lower frequency radio signals - from the perspective of broadcasting - concentrates either on the two main terrestrial components of the emitted radio wave (i.e. ground wave and ionospheric wave), or the modal propagation in the natural Earth-ionosphere waveguide (below 30 kHz). Since 1970s it has been found that the man-made (or artificial) lower frequency signals constitute a detectable and important part of the space surrounding Earth. As numerous research shows, these emissions are not only carrying potentially useful information in space operations (like the atomic clock's time standards), but also actively influence the form of the magnetic environment of the planet and, due to low attenuation and wide angular dimensions of its beams registered by spacecraft instruments above the ionosphere, potentially penetrate further the heliosphere. As the beam form and signal intensity above the ionosphere is directly dependent on the frequency (the lower, the less attenuated), the form of the antenna system and the radiated power, technical measures can be undertaken on Earth to develop these transmitting systems as potentially useful in space - with the modulation less susceptible for the loss of sidebands above the ionosphere (and, therefore, carried information), antenna systems with radiation characteristics more adapted for space propagation (including e.g. near-space antenna positioning) and further research on the existence and properties of the lower frequency signals in near-Earth space and the heliosphere, as well as their environmental influence.