High-Resolution Ground-level Observations of AKR-like Emissions

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Although theory suggests that Auroral Kilometric Radiation (AKR) is beamed outward from sources in the auroral acceleration region and cannot penetrate the ionosphere, there have been a number of observations over the years of AKR-like radio signals detected from sounding rockets, low-earth-orbit satellites, and ground-level. If these are associated with AKR, they probably do not represent penetration of X- or O-mode signals but rather mode-converted signals, possibly in the whistler mode, as proposed for example by Oya et al. (*J. Geomagn. Geoelectr., 37*, 237262, 1985, doi:10.5636/jgg.37.237). Recently, the connection of these low-altitude phenomena with AKR has been supported by simultaneous observations at ground-level and with the GEOTAIL satellite (LaBelle and Anderson, *Geophys. Res. Lett., 38*, L04104, 2011, doi:10.1029/2010GL046411), and by recent DEMETER satellite observations suggesting that these emissions are a relatively common phenomenon at low altitudes during periods of sustained magnetic activity (Parrot and Berthelier, *J. Geophys. Res., 117*, A10314, 2012, doi:10.1029/2012JA017937). In 2012 Dartmouth College installed a digital software defined radio receiver at South Pole Station, Antarctica, together with a pair of large magnetic loop antennas oriented perpendicular to each other and optimized to measure EM waves in the frequency range 350-700 kHz. The resulting measurements complement lower-resolution, larger bandwidth measurements, covering 0.1-5000 kHz, from the stepped-frequency receiver operated at South Pole by Dartmouth. Despite relatively high noise level in this band at South Pole due to station activities, numerous auroral hiss events and one example of AKR-like emissions were recorded with both receivers. The AKR-like emissions occurred 0215–0230 UT on August 2, 2013. The stepped frequency receiver data show that they are restricted to the AKR band, and the two-channel digital receiver data allow polarization and presence or absence of AKR-like frequency fine-structure to be determined for the first time from ground-level observations of this phenomenon.