

AURORA EXPERIMENT WITH JT65A

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Dx station W7IXZ Oregon (USA)

Frequency: 18.102 Mhz (JT65A digital mode)

Date: April 3rd, 2010 utc time: 19.00

Abstract

This report summarizes research on the Effects of the Aurora on Radio Wave Propagation using the wsjt software (JT65A mode for HF communication). Experiments were conducted to detect the effect of ionospheric irregularities such as those associated with the aurora. I analyze ionospheric fluctuations of HF radio waves and the variance of the signal amplitude and amplitude fluctuation spectra under Aurora activity. Radio-wave fluctuations are related to the Aurora manifestations. During very intense solar activity, irregularities are excited in the polar ionospheric region.

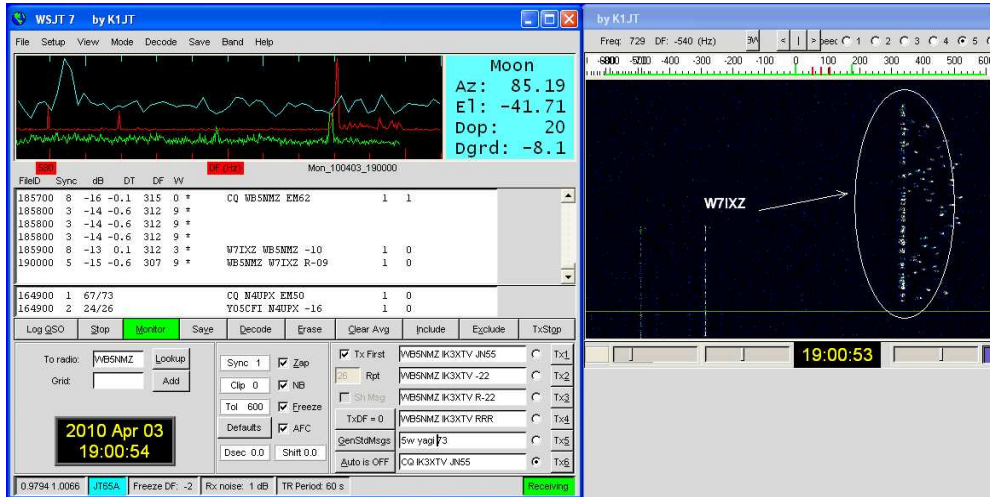


Fig.1 WSJT screen shoot with auroral signal about W7IXZ from Oregon USA in the HF 17 meters band (18.102 Mhz).

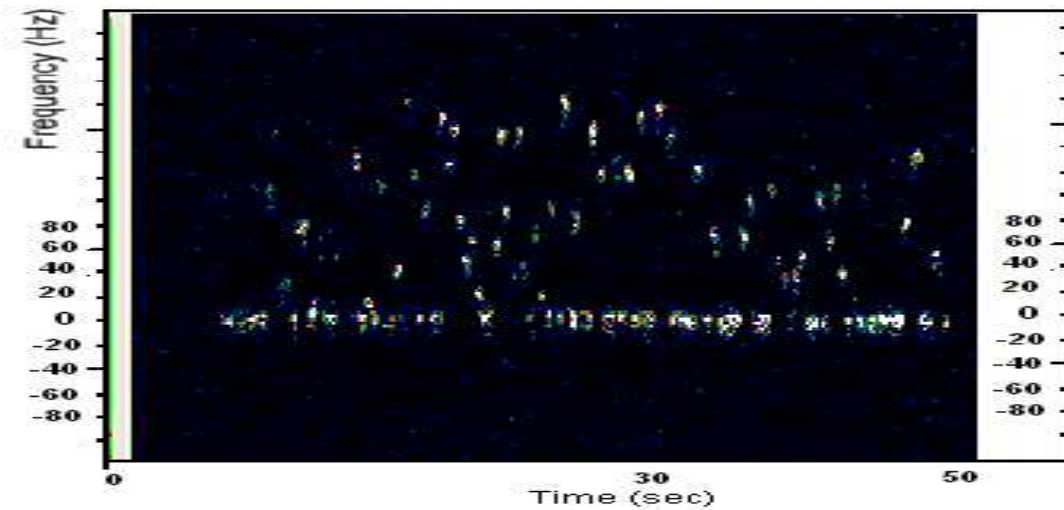


Fig.2 Spectra plot of the JT65A W7IXZ signal.

Irregularly structured ionospheric regions can cause diffraction and scattering of trans-ionospheric radio signals. When received at an antenna, these signals present random temporal fluctuations in both amplitude and phase. This is known as ionospheric scintillation. Ionospheric scintillation may cause problems such as signal power fading, phase cycle slips, receiver loss of lock, etc., and degrade the quality of communication.

The ionospheric irregularities

The ionosphere can deviate from the expected behaviour, as for instance modelled by the Klobuchar model. This is the case when the ionosphere includes irregularities in which the electron density differs significantly from the "ambient" plasma. These irregularities can cause diffraction effects, i.e. scintillations, on the signals passing through them. The formation, evolution and dynamics of such irregularities are ruled by the interplay between the geomagnetic field, the Interplanetary Magnetic Field (IMF) and the solar wind (that is the emission of energetic particles coming from the Sun)

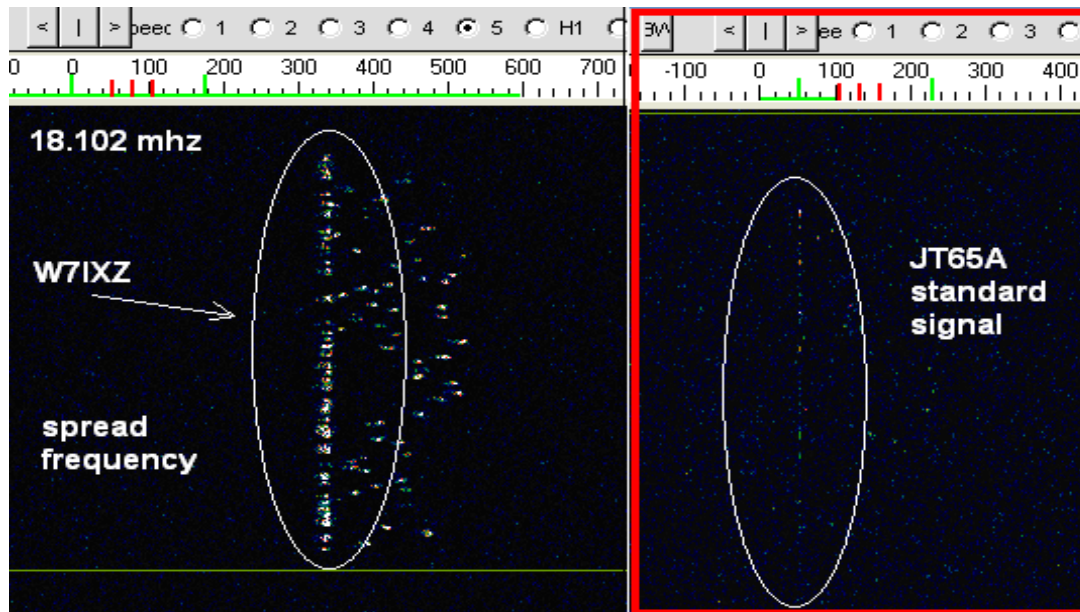


Fig 3. Flutter fading signal of W7IXZ compared with a normal JT65A signal. The ionospheric irregularities over the Aurora carry out a modulation action through the signal spectrum. There is an interaction over the signal, as the experiment shows: there is a spread action increasing the signal bandwidth, this doppler-spread dispersing the signal's spectrum. (compare with JT65A standard signal in the red lines display).

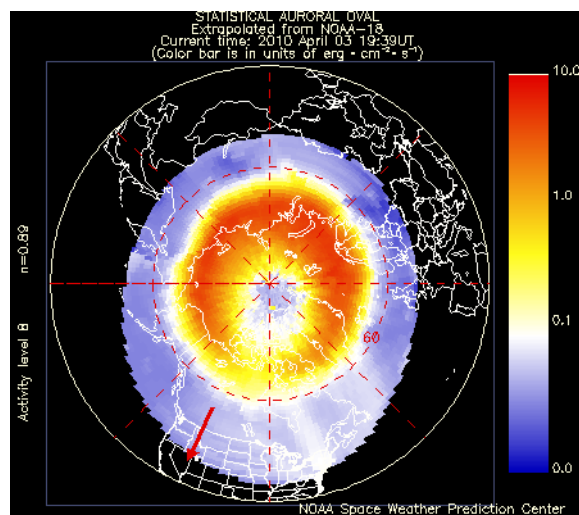


Fig.4 The Aurora during the reception of W7IXZ from NOAA statistical auroral oval activity level

References:

Wsjt by Joe Taylor, K1JT
wikipedia