

# Supplemental Material

## Determining the humidity-dependent *ortho-to-para* ratio of water vapor at room temperature by terahertz spectroscopy

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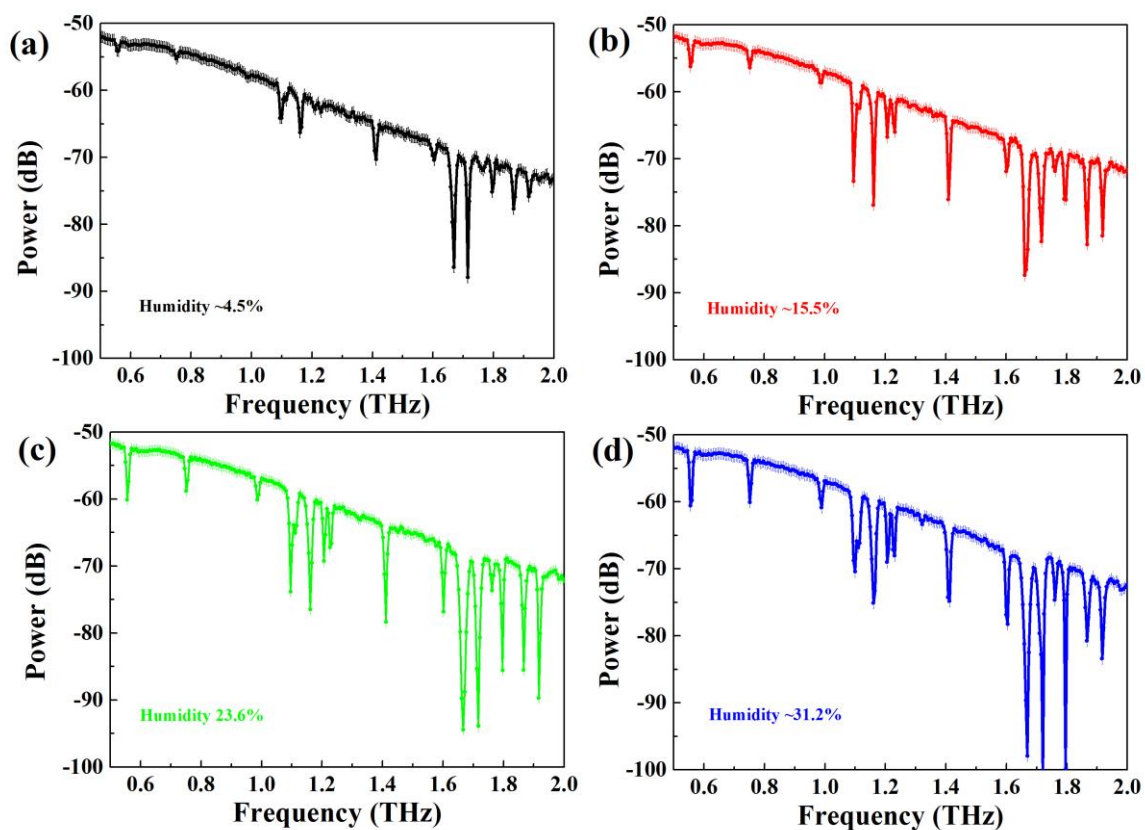


Fig. S1. Frequency-domain spectroscopy results of time after time tests for water vapor at the humidity (a) ~4.5%, (b) 15%, (c) ~23.6%, and (d) ~31.0%. The measurements were performed in replicates of four under ambient atmospheric pressure. The reproducibility of the measurements was examined by obtaining the spectra of H<sub>2</sub>O vapor at various humidity values. The results from different experiments were represented by means of error bars, with the standard deviation no more than 0.05. Besides, the unit, Decibel (dB), is used to describe the intensity of THz field. The value of power in dB is governed by formula: Power (dB) = 20×log (electric field intensity (V)). To meet this expression, the electric field in Voltage should be positive, indicating that the sensor is a load instead of a source, which absorbs the energy of THz wave. In the case that electric field is between 0 V and 1 V, a negative value in dB is obtained.