

FOURIER TRANSFORM MILLIMETER-WAVE SPECTROMETER WITH ORIGINAL DESIGN

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Direct digital synthesizers (DDS) have a number of advantages, especially such as the high precision and rate of frequency adjustment. In addition, these synthesizers possess a unique property to allow changing the frequency from one value to another with continuous phase. Few years ago, we built fast-scan absorption spectrometer with Schottky diode frequency multiplication chains as a radiation source.^a The rapid frequency scan in the spectrometer is provided by RF synthesizer based on up-conversion of the DDS signal. Owing to the capability of fast frequency switching, the same up-converted RF synthesizer may generate short pulses to polarize molecules and subsequently may be used as a local oscillator in the heterodyne detection of free induction decay. This feature simplifies the spectrometer design, as it allows using only one radiation source to polarize molecular sample, and to detect molecular signal. Using this principle, we built a Fourier transform spectrometer in the millimeter wave range. The spectrometer covers the frequency range between 150 and 220 GHz. In the current design, the RF synthesizer allows generation of frequency pulses with a bandwidth inverse proportional to pulse duration, as well as chirped pulses with a bandwidth of about 350 MHz. The performances of the spectrometer will be presented and discussed.

^aA. Pienkina, R.A. Motiyenko, L. Margulès et al. ISMS, 71st symposium (2016), FB05