We demonstrate a rapidly frequency-tunable radio frequency (RF) filter using microwave photonics technology for ultrawideband RF spread spectrum applications. A pair of electro-optic frequency combs is arranged as a dispersive tapped delay line in a differential detection configuration to implement a programmable finite impulse response RF filter. Our photonic scheme enables both fast frequency tuning on the order of tens of nanoseconds and wide tuning range (7.5 GHz) with minimal variation of RF gain and passband shape. The low control voltage (ca. 1 V) and the linear relationship between control voltage and passband frequency facilitate agile frequency tuning for processing of signals with time-varying frequency content, while differential detection increases the photocurrent by a factor of two and suppresses common mode intensity noise. We exploit the rapid tunability of the implemented filter to demonstrate dynamic tracking of frequency-hopped and chirped RF signals. An experiment that performs dynamic filtering of an input chirp signal (3.92-GHz center frequency, up-chirped by >2 GHz within 100 ns) obscured by strong broadband noise achieves ~11-dB signal-to-noise ratio (SNR) improvement. The SNR obtained is in addition to that available from standard matched filtering or pulse compression processing, suggesting strong potential for enhanced resistance against broadband noise jamming.