High-resolution comb-assisted microwave frequency identification and Down-conversion system

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With the modern communication, radar, electronic warfare systems continue to develop in the direction of high speed rate, wide bandwidth, it is of great significance to effectively identify the signal frequency. Spectrum analysis based on frequency or wavelength scanning is a powerful tool in signal measurement in either the electrical or the optical domain. However, this method is difficult to achieve high frequency detection accuracy and wide frequency detection range at the same time. We propose a new method that can maintain a high precision in the frequency detection process while having a wide frequency sweep range. In this method, We lock the frequency of a single-frequency laser on an optical mode of an Optical Frequency Comb(OFC), and then modulate it with the signal to be measured. Another single-frequency laser is used to sweep the modulated signal, and finally the frequency of the signal to be measured is obtained. Due to the small frequency of the optical comb spacing used in the frequency locking process, the frequency can be accurately positioned during the detection process, which makes the frequency detection result of the method more accurate. In addition, due to the wide frequency range of the optical comb used in the frequency locking process, it can be measured in the range of laser scanning, so the frequency detection range of this method is wide. Therefore, the frequency detection accuracy of this method is below 1.3 MHz, and the frequency detection range can theoretically reach hundreds of GHz within the allowable range of wavelength coordination. During the sweeping process, the detector laser is synchronized with the OFC to achieve down-conversion by switching the control loop, and the stability of the frequency conversion signal is 1-hour STD < 1.4 Hz.

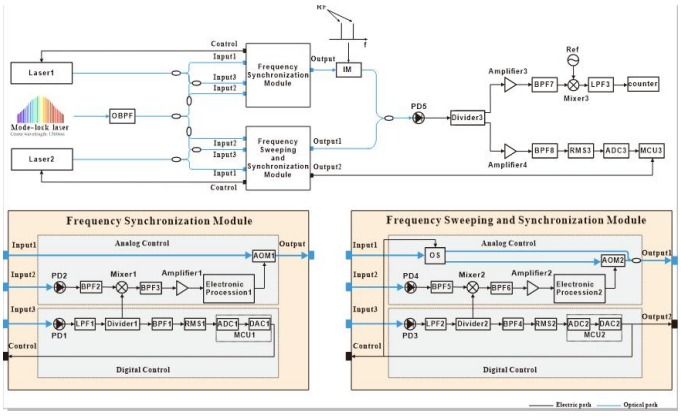

Fig. 1: The Schematic diagram of spectrum detection and signal down-conversion system.