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Universal high-performance LO and CLK generation module for LLRF system receivers

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Several accelerator facilities exist worldwide and many new projects are under construction or planned to be realized in near future. They have different specifications that depend on their concepts and applications. This variety of systems leads to development of standardized equipment and universal system platforms. In this article a universal high-performance Local Oscillator (LO) and Clock (CLK) generation module for Low-Level RF (LLRF) front-end receiver is presented. The LO signal is used in superheterodyne receiver of LLRF field detector. The CLK signal is used as a low jitter sampling clock for analog-to-digital converters (ADC) of the LLRF digitizer. These high performance signals allow precise control of electromagnetic field in accelerating RF cavities. The presented module offers flexibility and wide selection of generated LO and CLK frequencies in range from several MHz up to 6 GHz while maintaining low noise performance. This is achieved thanks to modular PCB design and already proven concept of low-noise signal generation. Module reconfiguration can be done by assembly options on two levels, on the level of PCB components and on the level of submodules. System layout ensures signal integrity in wide bandwidth. Number of outputs and signal power levels can be easily modified as well. Mains supply as well as DC supply can be used. The module is equipped with remote diagnostics what helps maintaining LLRF system high reliability. The module is packaged in compact 1 unit high standard 19" crate what makes it easy to integrate with any LLRF system. The article describes the concept of the universal LO and CLK generation module and its realizations in variety of configurations. Performance measurements for 700 MHz, 1300 MHz, 3000 MHz, 3900 MHz and 5700 MHz modules are presented showing excellent results.

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