Analog-to-Digital Converters

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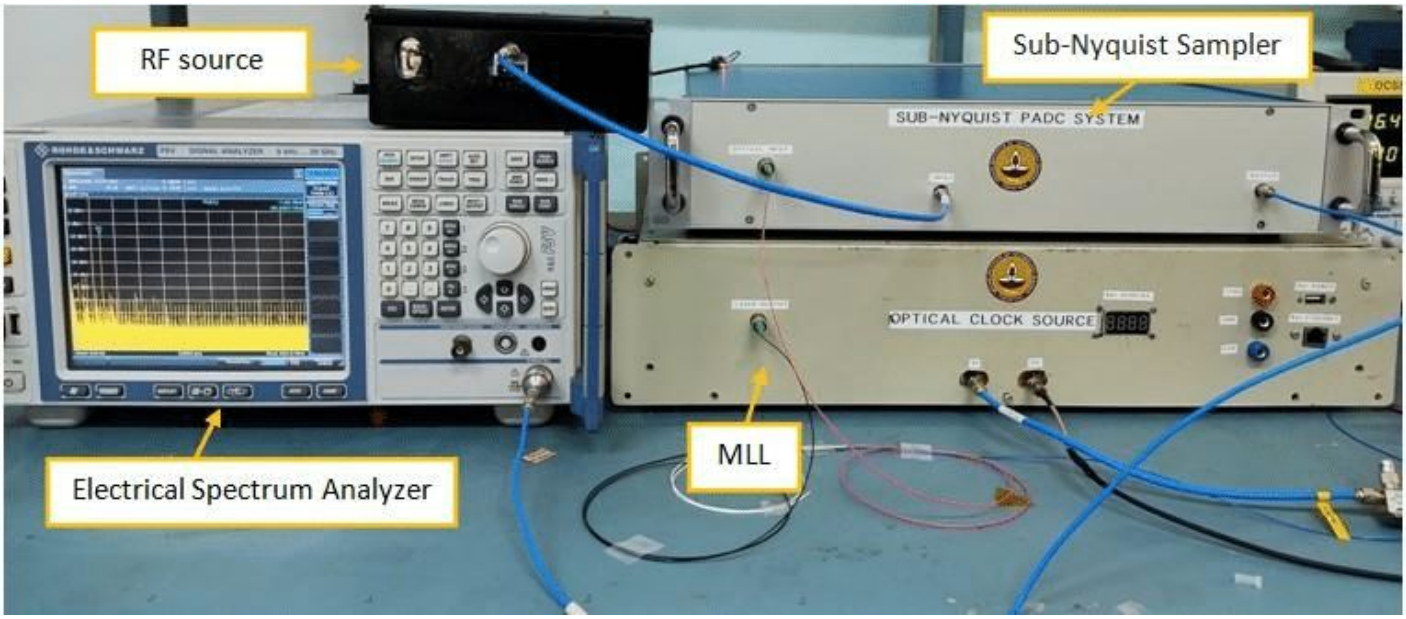

Key points:

- Analog-to-digital converters (ADCs) are **critical components for developing** the next generation of **advanced digital receivers.**
- The limitation of electronic ADCs (EADCs) is that their vertical resolution is compromised at high bandwidths.
- There are **two possible approaches** to solve this problem through Photonics.
    - **Radio frequency**, when modulated on a **spectrally rich optical pulsed source**, can be stretched in the optical domain through a dispersive medium, thus converting high-frequency RF signals into effectively low-frequency signals.
    - This **reduces the input bandwidth requirements** of the back-end ADC as many times as the stretch factor of the optical pulse.
    - The other Photonic approach is to use an **optical clock whose fluctuations** in timing (timing jitter) is much smaller than an electronic clock; which is possible with a short pulsed laser.
    - High bandwidth RF signals, when sampled with stable optical clocks, can provide a much higher effective number of bits (ENOB) compared to electronic clocks.
    - It has time-stretched photonic ADC with effective bandwidth 12 times higher than EADC, which enables digitisation of signals with a much larger precision.
- A newly designed prototypes in the Next-Generation Photonic Analog-to-Digital Converters (NG-PADC) project which can carry out instantaneous frequency measurement, generation and transport of Radio Frequency

(RF) through optical methods.

- Its effective bandwidth is 12 times higher than a corresponding EADC
- This could revolutionize various sectors, enabling **faster digital communication, improved satellite communication, better medical imaging**, and Photonic radars.

Q1) What is Photonic radar?

Photonic radars, also known as photonic-based radar systems are advanced radar systems that utilize photonic (light-based) technologies to enhance radar performance and capabilities. Traditional radar systems use radio frequency (RF) waves for detection and ranging, while photonic radars employ optical signals to achieve similar objectives.

Source: New technology developed to transport radio frequency (RF) through optical methods could improve digital & satellite communication.