AVANCE NEO Technology

True NMR Channel System

The AVANCE NEO NMR acquisition system is based on a fully modular, highly integrated RF transmit and receive concept. Each NMR channel (a TRX1200 transceiver) consists of a fully autonomous and independent pulse programmer, transmitter and receiver. All transceivers can be synchronized with each other within a 12.5ns timescale at pulse program level, which is 4 times faster than before. RF pulses are generated with the simultaneous amplitude, phase and frequency setting, within 12.5ns.

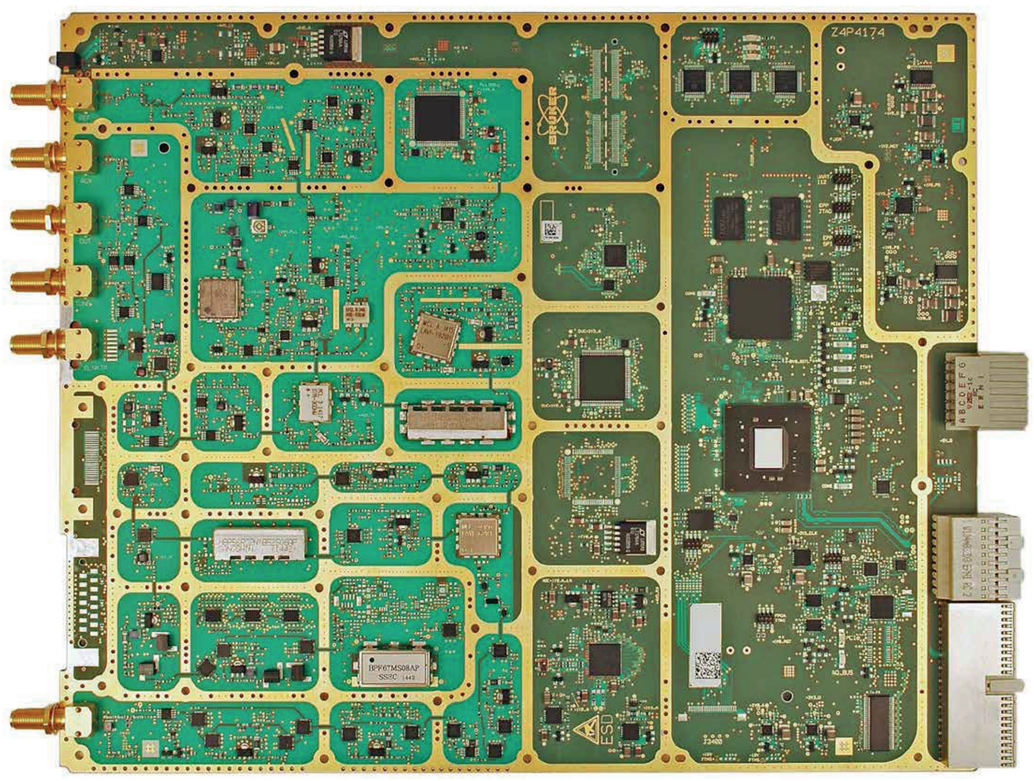

Fig. 1: TRX1200 transceiver.

Each channel has a dedicated pulse program execution engine (system on chip) with an onboard high speed 1GB waveform memory. The highly digital implementation incorporates a 960 MSPS digital up-converter (DUC) for transmit, and a high speed 240 MSPS ADC with a high speed digital down converter (DDC). This provides ultra stable and precise RF pulse generation, as well as high dynamic, spurious free NMR detection with further enhanced dynamic range. A state of the art and well-designed heterodyne receiver results in approximately 50% less noise than previous technology. This delivers full sensitivity even at very low receiver gains.

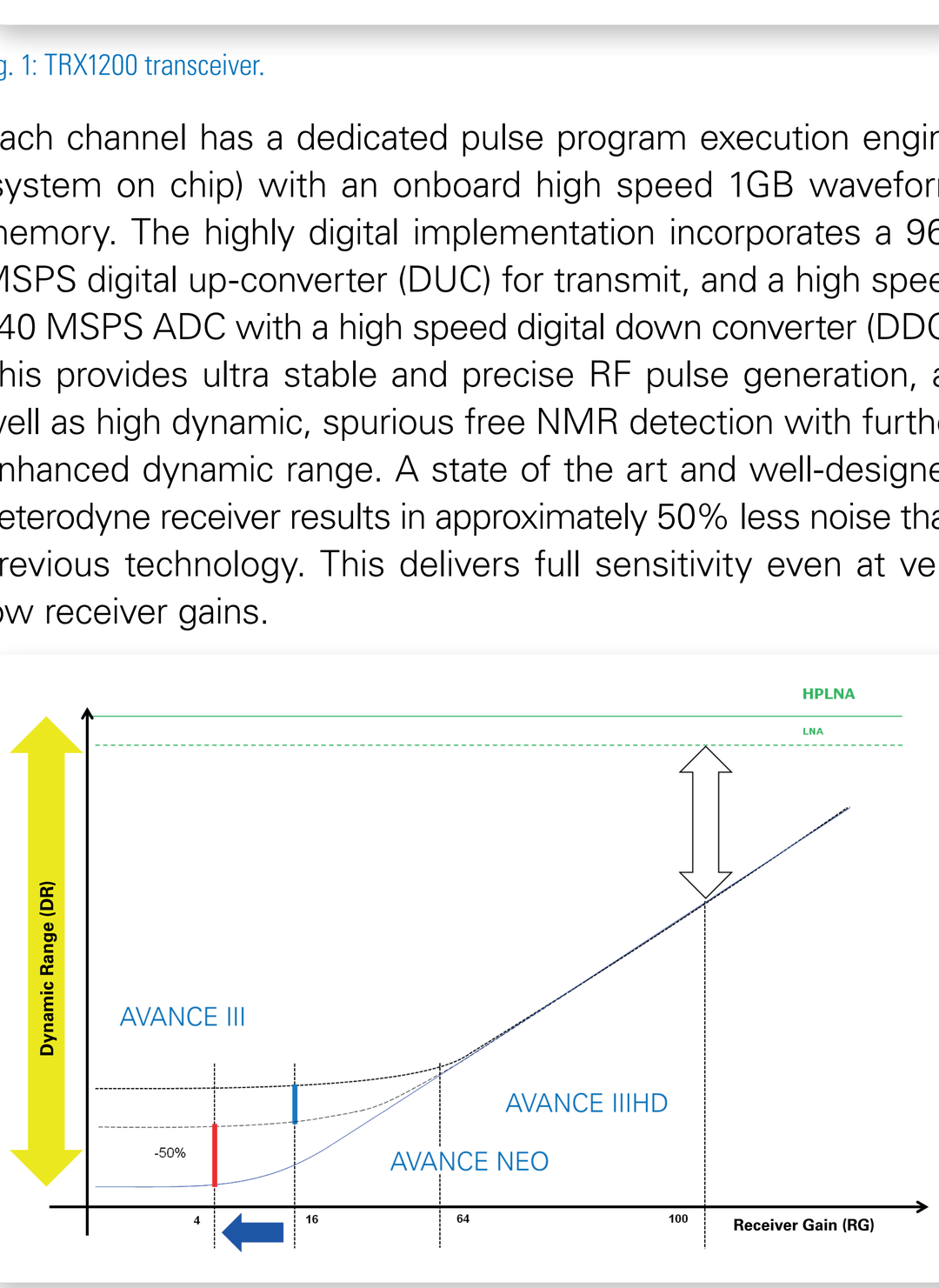

Fig. 2: Comparison showing higher dynamic range (DR), especially when NMR experiments have to be carried out at very low RG

High IF Technology

The receiver within the TRX1200 uses a very high intermediate frequency (IF) of 1.852 GHz for NMR signal generation and detection. This avoids any compromise with local oscillator (LO) windows, regarding noise and decoupling leakage.

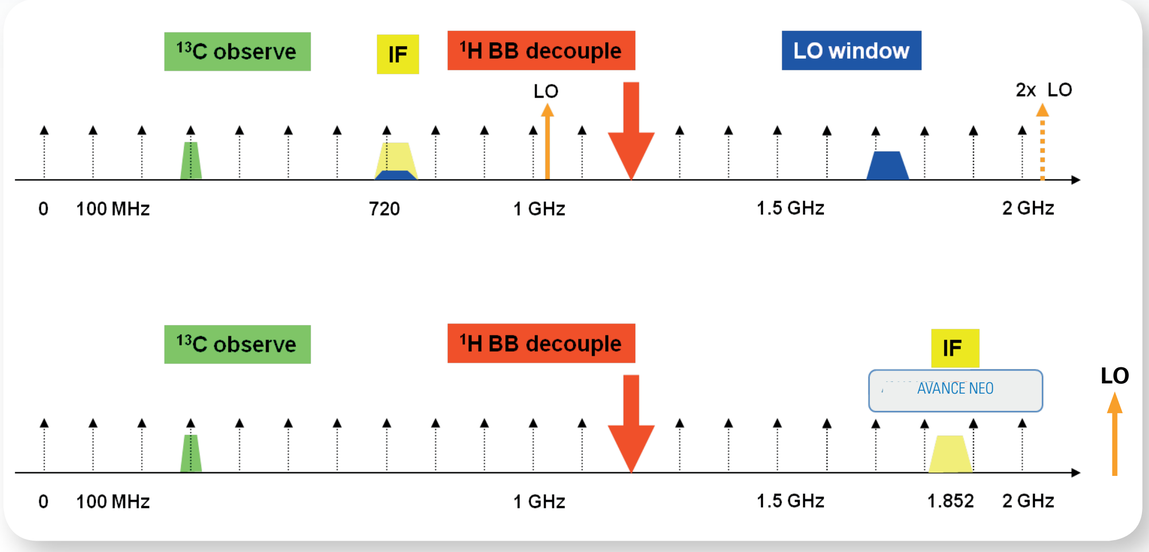

Fig. 3: A high IF avoids unwanted folding of noise and leakage from unintended LO windows (blue, upper) into the IF. With a high IF the unwanted LO window can be avoided by design.

With this architecture, there is no possible conflict between any observed and decoupled nuclei within the full range of NMR at any NMR field (eg 1.2 GHz).

Enhanced Sensitivity for X-Nuclei

GaAs transistor technology has been used with ^{1}H preamplifiers for decades. Its superior performance provides maximum sensitivity on ^{1}H.

Preamplifiers for low γ nuclei such as ^{13}C, ^{2}H, ^{15}N, etc are now also using GaAs transistor technology, benefiting from a sensitivity increase of 6 - 8% together with RT probes. This corresponds to about 15% higher throughput, for example with a SmartProbe™.

With the enhanced sensitivity of the ^{2}H preamplifier, field stability can be increased under experimental conditions with a low amount of deuterated solvent and labs exposed to external field perturbations (trams, elevator, etc).

Full Broadband RF Amplifiers

Latest RF power transistor technology used within the new and fully broad banded RF amplifiers (BLABB) provides high RF power from 15 MHz up to 600 MHz. Together with the ^{1}H RF amplifier this larger bandwidth allows any combination of ^{1}H / ^{19}F or low γ-nucleus but as well ^{1}H and ^{19}F experiments run in parallel and with independent RF channels even on two channel systems being equipped with broad banded probes (e.g. SmartProbe™).

Summary

- True 12.5ns RF pulse generation.
- All channel synchronicity within 12.5ns.
- True NMR channel, each transmit and receive.
- State-of-the-art design and latest technology for synthesizer, receiver, RF amplifier and preamplifier.