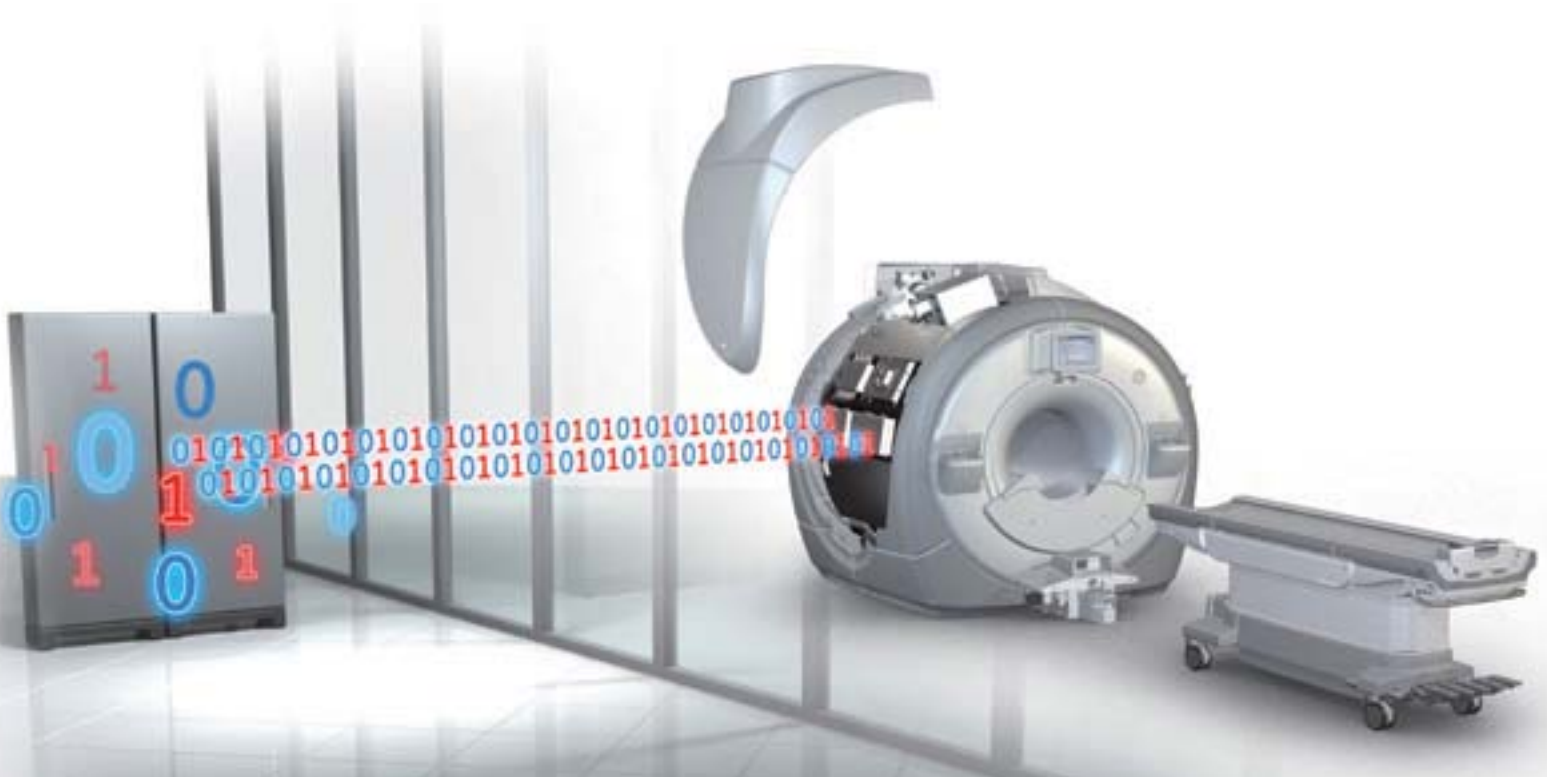




Introducing Optics to RF So You Can Sharpen Your Focus on Quality and Performance

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Applications for whole-body imaging, real-time cardiac, high resolution contrast kinetic imaging and functional MRI increase the necessary rate and quality of data acquisition. Each of these applications can generate large volumes of images in a short period of time and require a high signal-to-noise ratio (SNR) to best monitor physiologic and/or anatomic changes. Combining this increased demand for greater data management with the need for efficient patient and technologist workflow makes the radio frequency (RF) receiver system of an MR scanner a critical component in system design.



The RF Receiver controls the entire chain of events from connection of the surface coils through the digitization and transmission of data to the reconstruction engine for processing and analysis. The Signa® MR750 3.0T Optical RF system was designed to enhance all of these critical aspects of MR image acquisition – image SNR, acquisition speed and patient and technologist workflow – while also providing a platform for advanced research and development.

SNR and data acquisition speed

The Optical RF system improves SNR by up to 27 percent over conventional, non-optical MR receivers by reducing electrical noise and improving signal detection. Conventional MR scanners have the RF receivers in the electronics room where the MR signal is subject to significant electrical noise prior to being digitized. The Signa MR750 Optical RF receivers are located on the magnet system inside the shielded scan room,

completely isolated from external noise sources. The MR signal is digitized within the scan room and then optically transmitted to the reconstruction engine in the electronics room. This design significantly improves image quality. Also, since the intensity of an analog MR signal decreases as it travels along a wire, the close proximity of the receivers to the patient further improves image quality.

The use of optical transmission in the telecommunication industry provides a robust method of data transfer that is immune to external noise. The Optical RF system in the Signa MR750 uses a similar method to ensure high speed and high quality imaging. The receive electronics are scaleable in 16-channel increments up to 128 simultaneous acquisition channels. Each receive channel operates an independent 80Mhz digitizer inside the scan room. This high sampling rate provides a very low noise floor, better dynamic range and thus, higher SNR. The volume of data created during this phase of image acquisition is significant; therefore, 2 GB/sec



optical transmission is used to transfer the data to the volume reconstruction engine (VRE) for processing and image generation in the electronics room.

Ultra high-density 32-channel coils with parallel imaging enable imaging frame rates that were not previously attainable in the clinical environment. The fast switching capability and high-speed interface technology of the Optical RF system facilitates real time image acquisition and display from 32-channel independent receivers. The Signa® MR750 3.0T eXtreme gradient system generates shorter TR/TEs to further increase the rate of data throughput.

The combination of noise immunity and improved signal detection with the Signa MR750 Optical RF system results in an SNR improvement relative to conventional RF receivers.



Simplified exam preparation

The Signa MR750 coil interfaces are augmented with four new high-density coil connectors. These new 32-channel connectors in the Optical RF system are distributed on the magnet system and foot of the Signa MR750 patient table, the industry's only fully detachable MR table with a coil interface for simplified exam preparation. Each connector provides mechanical assistance for simple insertion and extraction for high-density, multi-station scanning of the entire body. The connectors on the detachable table allow the technologist to fully prepare a patient outside of the exam room to dramatically improve scanner efficiency, reducing patient prep time by as much as 71 percent. The high-density connections also simplify the placement and use of surface coils and accelerates parallel imaging speed to reduce exam duration. For systems with a fixed patient table, patient preparation time may approach the length of the data acquisition time.

Advanced research and development

The Optical RF architecture on the Signa MR750 is scalable for both proton and broadband frequencies. The system will support up to 128 independently controlled receivers with independent bias lines for advanced surface coil designs and signal routing. For non-proton imaging, the Optical RF system and architecture can simultaneously acquire eight channels of multinuclear (broadband) data. Given the excellent dynamic range and noise immunity of the Optical RF system, the Signa MR750 is an ideal platform for advancing clinical applications and research and development.

Conclusion

The Signa MR750 Optical RF system offers excellent dynamic range and noise immunity, patient workflow improvements and greater signal detection with faster data transmission. By addressing critical design aspects, the Signa MR750 is the ideal platform for advanced clinical use and research and development. ■