

Achieva 3.0T TX overcomes high field challenges

MultiTransmit technology at University of Bonn helps to improve quality of 3.0T MR imaging



Winfried A. Willinek, MD

MR imaging at 3T has always been subject to challenges such as dielectric shading and local SAR limiting speed. Now, the Achieva 3.0T TX scanner has fundamentally addressed those challenges by using multiple RF sources. The first Achieva 3.0T TX was installed at University of Bonn in October.

Unlike conventional 3T imaging systems, the Achieva 3.0T TX uses Philips' proprietary MultiTransmit parallel transmission technology to project multiple independent RF transmit signals, thereby addressing dielectric shading at the source to enhance image uniformity and consistency. Additionally, local RF deposition can be reduced, which enables a gain in scanning speed.

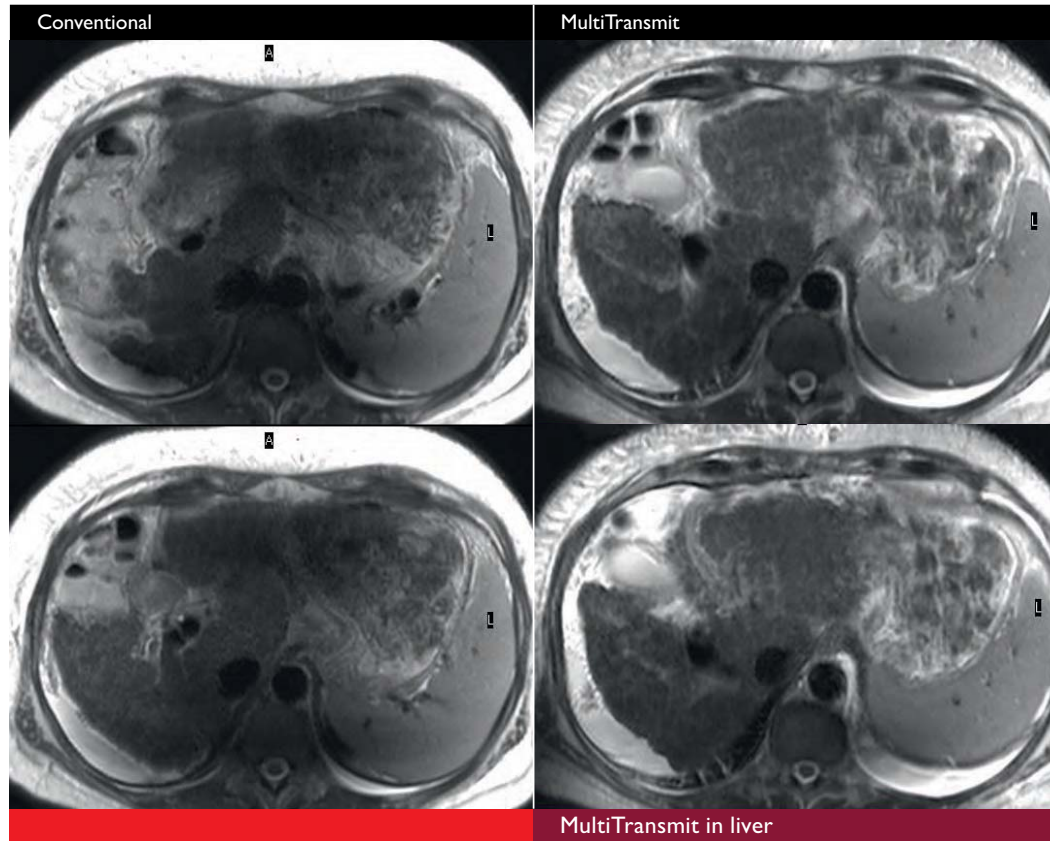
“MultiTransmit provides more uniform excitation. In turn, that improves image homogeneity and consistency of MR imaging.”

Winfried A. Willinek, MD, is Associate Professor of Radiology at the University of Bonn (Bonn, Germany), where more than 200 patients have been scanned on the new Achieva 3.0T TX since October 2008. He says that although imaging at 3T was already quite mature, patient-adaptive MultiTransmit technology offers several distinct advantages over conventional 3T imaging.

“The main advantage, of course, is the improved RF field homogeneity and consistency. MultiTransmit provides multiple independent RF signals adjusted to each individual patient, therefore yielding more uniform excitation. In turn, that improves B1 homogeneity and consistency of MR imaging in all patients. This is required in daily clinical practice in order to enhance diagnostic confidence. The better RF distribution control at 3T enables us to accelerate imaging by 30-40% in many applications.”

The Achieva 3.0T TX features the illuminated Ambient Ring for an enhanced patient experience, as well as dual-sided controls and wireless physiology for ease of use.





“In liver cirrhosis patients, MultiTransmit with patient-adaptive RF shimming improves the image quality significantly.”

52-year-old patient with liver cirrhosis and ascites. MRI of ascites patients is often challenging due to the shielding effect of fluids. Intraindividual comparison of axial T2-weighted TSE imaging acquired with single (left column) and parallel transmission (right column). Note the dielectric shading artifacts with single transmission and the improved homogeneity with MultiTransmit.

MultiTransmit benefits liver imaging

Achieva 3.0T TX is helping to improve imaging in some of the most difficult MR exams. “Liver imaging at 3T, particularly in patients with cirrhosis and ascites, used to be very challenging due to dielectric shading,” says Dr. Willinek. “In patients with liver cirrhosis we see fluid collections in the abdomen quite regularly. In these cases, the Achieva 3.0T TX system with multiple RF transmission and patient-adaptive RF shimming improved the image quality significantly.”

This is particularly important in patients for whom an MR exam is vital, such as those who are anticipating a liver transplant and need to exclude the possibility of a tumor before surgery can be performed. If tumors are indeed present, says Dr. Willinek, the surgeon needs information on the lesions. “Surgery is one treatment option, but not if too many lesions are present or the tumor is too big. Alternatively, image-guided interventional techniques like embolization or RF ablation can be selected, but exact knowledge of the tumor size, number of lesions and the localization is pivotal.”

“In spine examinations MultiTransmit yields an effective gain of time.”

Guido Kukuk, MD, who is collaborating with Dr. Willinek and Philips' Jürgen Gieseke, PhD, in a liver project on the MultiTransmit system, adds, “Using MultiTransmit technology, B1-inhomogeneity clearly decreases and lesion detectability significantly improves. This is especially true in the most critical areas, which are the left liver lobe, the peripancreatic and paravertebral region and the posterior parts of the right liver lobe.”

Increased speed aids spine exams

In spine imaging, the increased speed of Achieva 3.0T TX is a boon to patients with severe back pain. “We encountered SAR limitations with conventional 3T spine imaging, and acquisition time could be quite long – up to 30 minutes,” says Dr. Willinek. “The time consumed with imaging often resulted in patient discomfort and deteriorated image quality due to patient movement and motion, necessitating re-scanning for good diagnostic image quality.”



MultiTransmit in lumbar spine

Intraindividual comparison of lumbar spine MRI at 3.0T. With MultiTransmit a total scan time reduction of 40% was achieved in combined T1- and T2-weighted TSE imaging as opposed to conventional imaging at 3.0T (4:35 vs. 7:39 min.).



The University of Bonn MR team. From left to right: S. Shwehdy, G. Kukuk, E. Muschler, M. Nelles, M. Andersson, A. Müller, R. Semrau, W.A. Willinek, C.P. Nähle, N. Morakkabati-Spitz, B. Brecher, A.M. Jah-Kabba, R. König, F. Träber, D. Thomas.

Michael Nelles, MD, who is collaborating in the Achieva 3.0T TX spine project in Bonn summarizes, “MultiTransmit in spine examinations yields an effective gain of time (on average 30-40%) with diagnostic image quality readily comparable to that of standard single transmission sequences.”

Versatility of MultiTransmit will step up the future of 3.0T imaging

Torso and body imaging at 3T have been traditionally very challenging, says Dr. Willinek. “Because of the high image quality and consistency with the Achieva 3.0T TX, the high field system can now be used for the first time without diagnostic impairment even in patients with ascites.” Dr. Willinek adds, “In our hospital, for instance, we have a kind of triage system, where we schedule patients by their clinical need for a scan. Therefore, we need maximum flexibility of the MR system to deal with every patient – no exceptions. A patient-adaptive system like the Achieva 3.0T TX with MultiTransmit and parallel RF transmission helps to make this a reality.”

Dr. Willinek says the results at University of Bonn are also very promising for future development and even higher field strengths such as 7T. “In body imaging especially, the higher the field strength, the more pronounced are the challenges. Therefore, for higher field strengths it is very beneficial to have a MultiTransmit system such as Achieva 3.0T TX.”

“We need maximum flexibility of the MR system to deal with every patient. A patient-adaptive system like the Achieva 3.0T TX with MultiTransmit helps to make this a reality.”