

Multi-phase transmission for B₁+ shimming at 3T

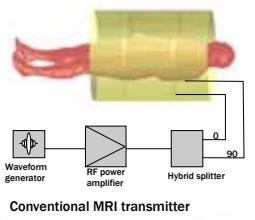
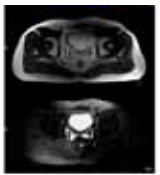
Vad har företagen på gång vad gäller parallell RF transmission?

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Conventional MRI transmitter

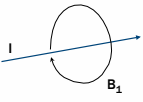
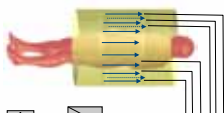
- > One amplitude/phase control
- > Same amplitude, fixed phase (90 degree)
- > Two feeding ports
- > 16 rung birdcage coil

Conventional MRI transmitter 3T torso images with a conventional transmitter

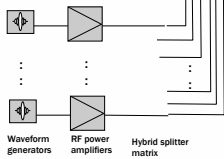



B₁ shimming parameters

B₁ field is created by current on rungs


- > B₁ field can be more uniform by adjusting RF current on each rung
 1. Number of feeding ports
 2. Number of independent controls
 3. Preset or prescan to determine the parameters

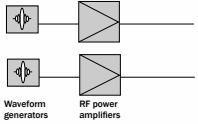





Number of transmit channels

- > Most expensive part of the transmitter
- > Minimum two channels for B₁ shimming
- > Started testing with two channels



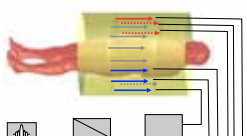


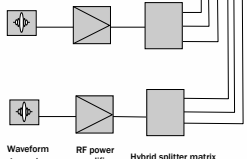
MRI transmitter




Number of feeding ports

- > 16 elements birdcage coil for transmit
- > Number of ports can be two to sixteen

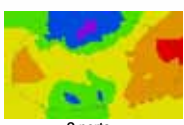
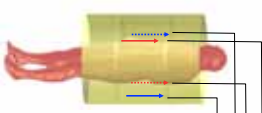




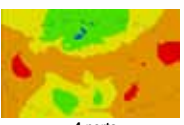
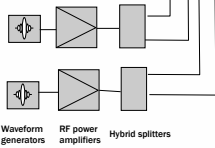
MRI transmitter




Number of feeding ports

2 ports

4 ports
Simulated B₁ field



Shimming parameter determination

Custom parameters by prescan or preset parameter sets?

- > Patient Body geometry dependence
- > Imaging Body region dependence

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Body geometry dependence

Relative Amplitude

Broad optimum area

Relative Phase

Male 120kg

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Body geometry dependence

Relative Amplitude

Broad optimum area

Relative Phase

Male 50kg

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Body region dependence

Relative Amplitude

Relative Phase

Head

Abdomen

Shoulder

C-Spine

Knee

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The B1 shimming solution

- > Two channels
- > Four ports
- > Preset parameter sets for each body region

Waveform generators RF power amplifiers Hybrid splitters

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Overall performance of B1 shimming

w/o B1 shimming

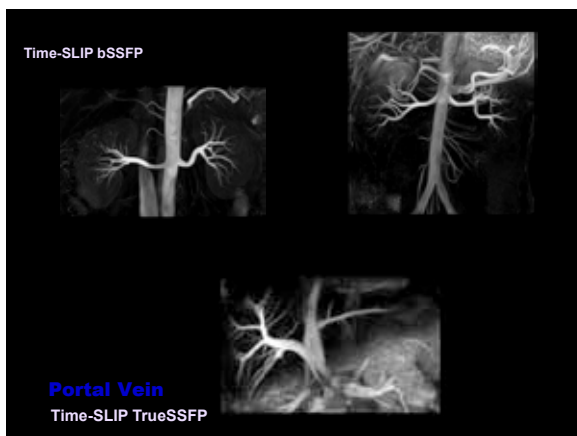
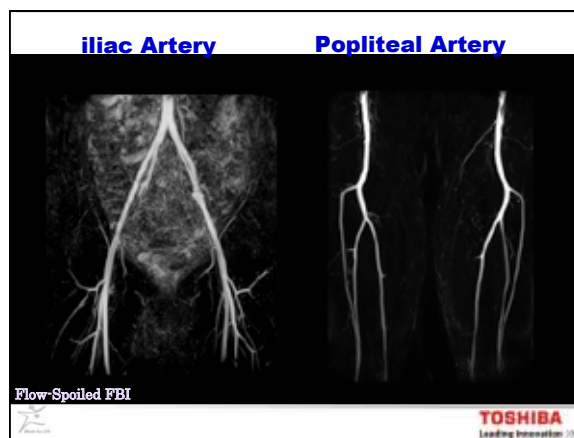
w/ B1 shimming

RF Map

T2WI

T2WI Fsat

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Additional effects

- > Low SAR
 - > Up to 30% lower local SAR hot spot
- > Accurate RF level measurement
 - > Uniform B1 field increased accuracy of RF level measurement and provides stable image uniformity, contrast, fat sat etc.

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Conclusions

- > Various controls, parameters and configurations were evaluated by experiments and simulations to optimize B1 shimming for clinical MRI systems.
- > Four-port Two-channel shimming with preset parameters was considered the best solution
- > B1 shimming significantly improves uniformity of 3T images

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