

Supplementary Materials:

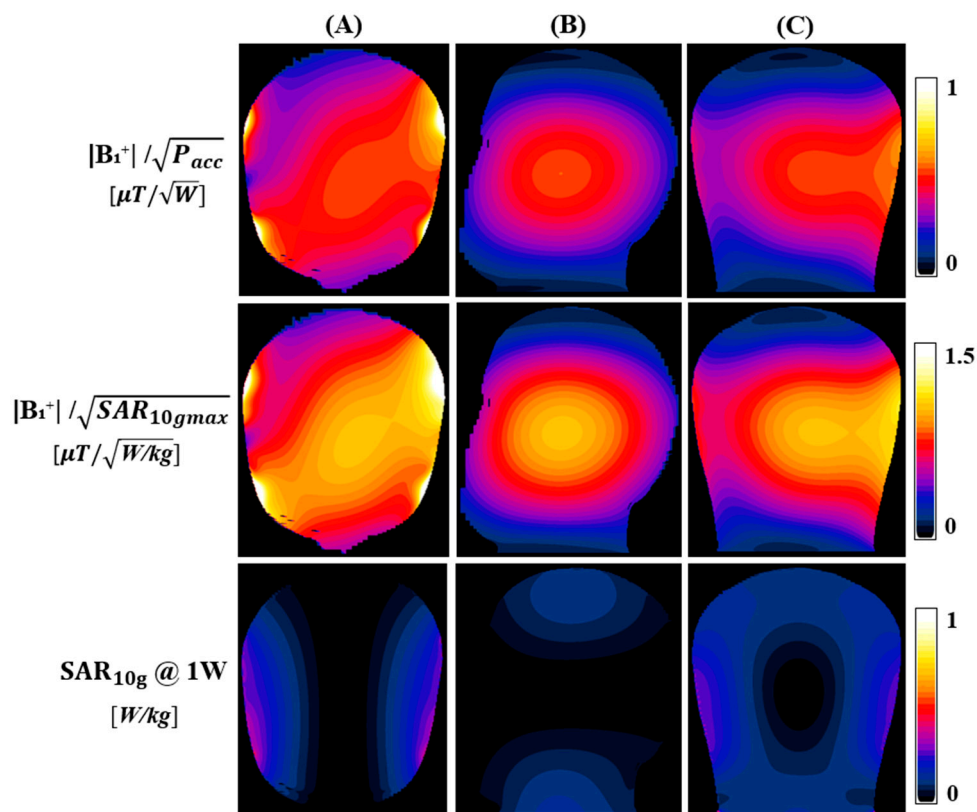
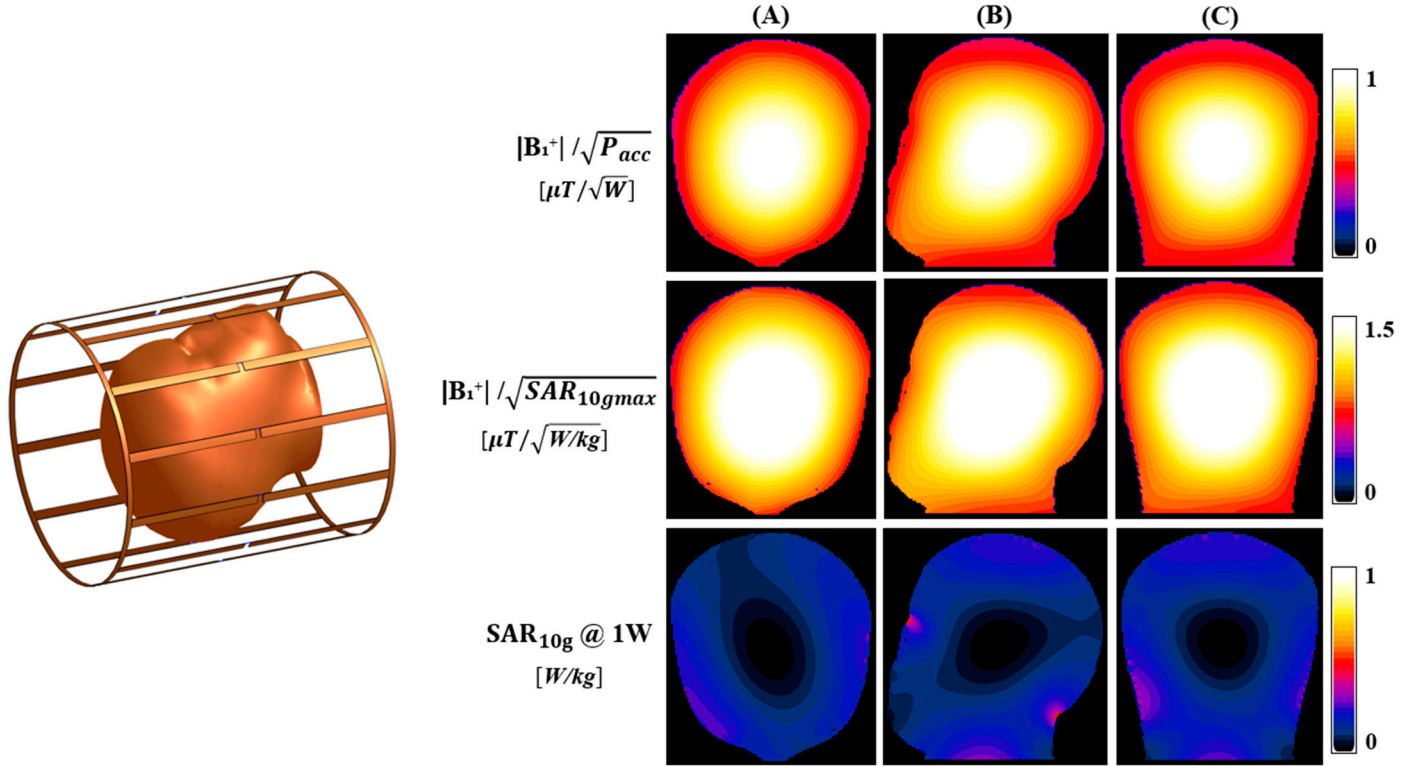


Figure S1: Simulated $|B_1^+|$ efficiency, SAR efficiency, and SAR_{10g} maps at 1 W P_{acc} in the (A) axial, (B) sagittal, and (C) coronal sections at isocenter, for the four-channel TMD array driven with CP-mode phase settings ($\varphi_1 = 0^\circ$, $\varphi_2 = 0^\circ$, $\varphi_3 = 180^\circ$, $\varphi_4 = 180^\circ$), shown for comparison with the RF-shimmed results in Figures 9A–C.



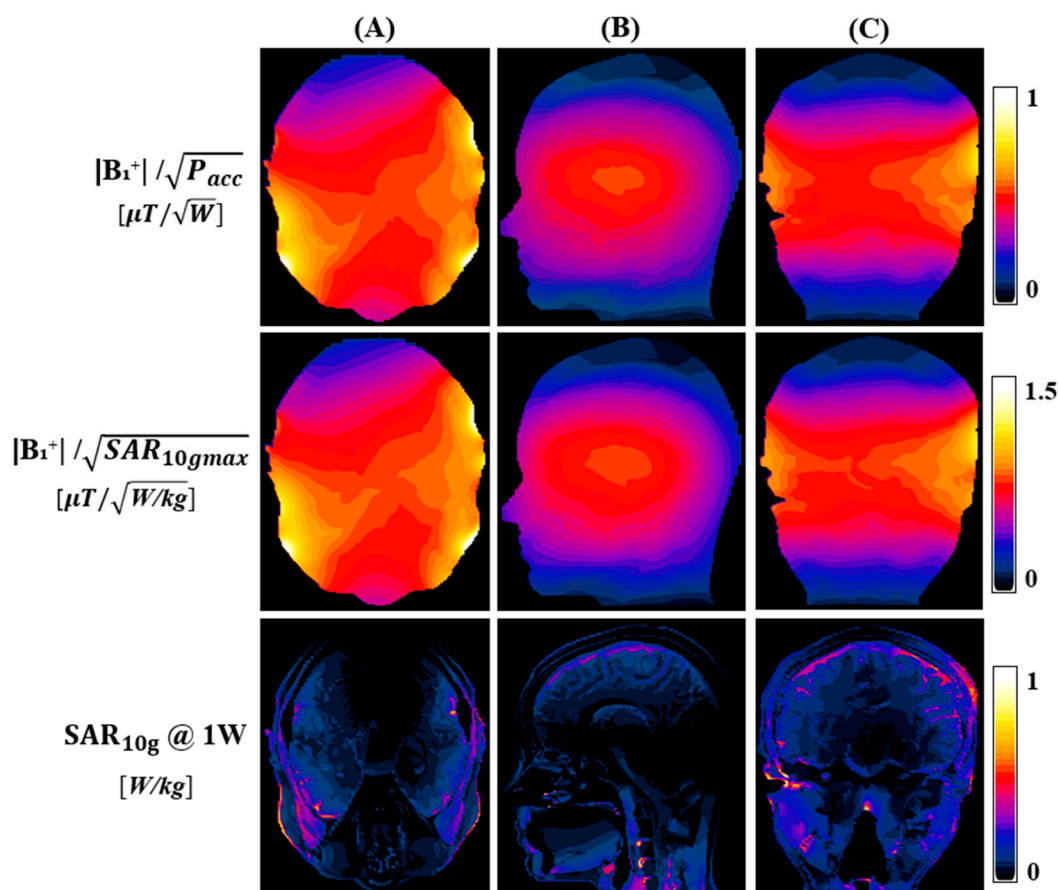


Figure S3: Simulated RF-shimmed $|B_1^+|$ efficiency, SAR efficiency, and SAR_{10g} maps at 1W P_{acc} in the (A) axial, (B) sagittal, and (C) coronal sections at isocenter, for the four-channel TMD array simulated with the MIDA (Multimodal Imaging-Based Detailed Anatomical) head model. The array configuration, optimized phase settings, and normalization procedure are identical to those used in Figure 3B and Figure 9. The simulated S-parameters for the MIDA-loaded four-channel TMD array are: $|S_{11}| = -9$ dB, $|S_{22}| = -11$ dB, $|S_{33}| = -11$ dB, $|S_{44}| = -11$ dB; $|S_{12}| = |S_{21}| = -4$ dB, $|S_{13}| = |S_{31}| = -19$ dB, $|S_{14}| = |S_{41}| = -18$ dB, $|S_{23}| = |S_{32}| = -18$ dB, $|S_{24}| = |S_{42}| = -16$ dB, $|S_{34}| = |S_{43}| = -4$ dB. The results show good agreement with the corresponding four-channel results presented in Figure 9.

Table S1. Measured -3 dB bandwidth (BW_{-3dB}) in the loaded and unloaded conditions, and the corresponding BW_{-3dB} ratio (loaded/unloaded), for each channel of the two-, four-, and six-channel TMD and loop-coil configurations shown in Figure 3. Values for the 2-CH TMD configuration could not be reliably determined due to insufficient $|S_{11}|$ depth at the fundamental resonance.

TMD				Loop Coil		
Channel Number	Loaded BW_{-3dB} [MHz]	Unloaded BW_{-3dB} [MHz]	BW_{-3dB} ratio (Loaded/ Un-loaded)	Loaded BW_{-3dB} [MHz]	Unloaded BW_{-3dB} [MHz]	BW_{-3dB} Ratio (Loaded/ Un-loaded)
2-CH						
1	Not reliably determined			10.25	1	10.25
2	Not reliably determined			8.6	2.0	4.3
4-CH						
1	6.8	19	0.36	3.5	1.5	2.3
2	6.8	19	0.36	3.5	1.5	2.3
3	2.1	10	0.21	3.4	1.8	1.9
4	2.2	11	0.20	2.7	1.2	2.3
6-CH						

1	6.9	20	0.34	5.8	3.8	1.5
2	7.0	20	0.35	3.0	1.5	2.0
3	3.0	12	0.25	4.2	2.8	1.5
4	2.9	11	0.26	2.6	1.4	1.9
5	4.0	10	0.40	2.7	1.5	1.8
6	3.9	10	0.39	2.9	1.3	2.2