

# Recent Improvements of the Wireless Link of the CorTec Brain Interchange Implanted BCI

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**Introduction:** The CorTec Brain Interchange is a brain-computer interface system consisting of a head-implanted electronic unit (IEU) and body-external components. The IEU is implanted behind the ear and wirelessly powered by a magnetically suspended headpiece placed on the skin, similar to that used in cochlear implant systems. The IEU communicate via a radio-frequency link with the body-external components. The location of the antenna outside the body is known to be critical. Here, we investigate potential improvements of the robustness of the wireless data link by moving the antenna from the traditional location at the upper arm to the headpiece.

**Material, Methods and Results:** Two szenarios (see Figure 1) are compared with respect to their wireless data link robustness: RF communication between the implant and the antenna located (A) in the communication unit, 30cm away from the implant and (B) in the headpiece, opposite to the implant. The data link performance is quantified as data packets lost in percent. Moving the antenna to the headpiece reduced packet loss as shown in Table 1, in the szenarios investigated here.

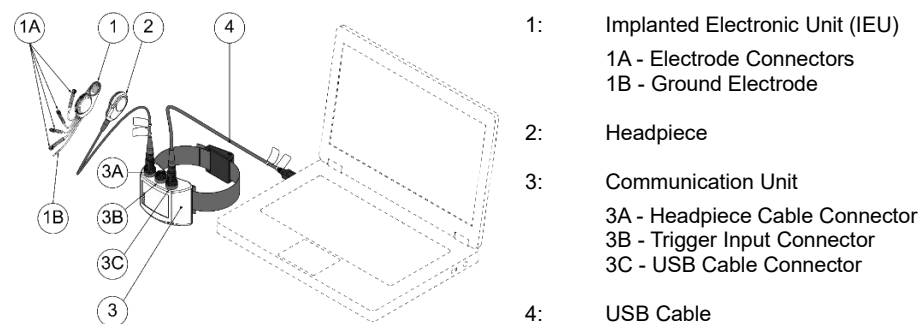


Figure 2: Components of the Brain Interchange System. The two locations for the data-transmission antenna outside the body are: Inside the communication unit (3) and inside the headpiece (2).

**Conclusion:** Change of antenna position from communication unit to headpiece improved the wireless link quality. Note: as shown in [1], a reduced wireless communication packaet loss results in a lower noise level of the signals received by the computer.

Table 1: Packets lost in two szenarios  
(Communication Unit 1 and 2 refer to the same szenario but two different systems)

Metric	Communication Direction	Antenna in Com-Unit 1	Antenna in Com-Unit 2	Antenna in Headpiece
Packets Lost	External to Implant	0.07%	0.02%	0.0%
	Implant to External	8.08%	4.43%	0.9%

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## References:

- [1] Ayyoubi AH, Fazli Besheli B, Quach MM, Gavvala JR, Goldman AM, Swamy CP, Bartoli E, Curry DJ, Sheth SA, Francis DJ, Ince NF. Benchmarking signal quality and spatiotemporal distribution of interictal spikes in prolonged human iEEG recordings using CorTec wireless brain interchange. *Scientific Reports*. 14(1): 2652, 2024